NAVFAC
Naval Facilities Engineering Systems Command
NAVFAC PACIFIC
WORK ORDER NO: 1665555

SPECIFICATIONS

For

FY24 AJJY183012 (P-012),
PDI: North Aircraft Parking Ramp

At the

North Aircraft Parking Ramp, Joint Region Marianas,
Andersen Air Force Base (AAFB), Guam

PREPARED BY:

Jacobs / BURNS McDONNELL

Jacobs Government Services Company
777 Main Street
Fort Worth, Texas 76102 USA
A/E Contract No. N62742-20-D-0002

Architectural:	Chris Alfstad, AIA	Fire Protection:	Alicea Fitzpatrick, PE
Civil Airfield:	Andrew McCoy, PE	Fuels Civil:	William Battey, PE
Civil Utilities:	Jennifer Haynes, PE	Fuels Electrical:	Tim Renshaw, PE
Civil:	Andrew McCoy, PE	Fuels Mechanical:	Gaurav Singh Sehra, PE
Civil:	Jennifer Haynes, PE	Fuels Structural:	Hassan Sahudin, PE
Electrical:	Steven Stratton, PE	Cathodic Protection:	Craig K. Meier
Environmental:	Eunjin Kotkovetz, PE	Geotechnical:	Tony Stein, PE
Telecommunications:	Tyson Q. Banks	Structural:	Alex Bannerot, PE

Submitted By: _____ Date: 2 Feb 2026
Ms. Lara Schoenenberger, PE

APPROVED BY:

Specification: _____

For Commander,
NAVFAC Pacific: _____
EVAN MIZUE

Date: 02/02/2026

This page intentionally left blank

PROJECT TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 15	02/24	LIST OF DRAWINGS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	02/24, CHG 1: 05/25	SUMMARY OF WORK
01 14 00	11/22, CHG 5: 05/25	WORK RESTRICTIONS
01 20 00	11/20, CHG 5: 02/25	PRICE AND PAYMENT PROCEDURES
01 30 00	11/20, CHG 5: 02/25	ADMINISTRATIVE REQUIREMENTS
01 31 23.13 20	08/23, CHG 1: 02/24	ELECTRONIC CONSTRUCTION AND FACILITY SUPPORT CONTRACT MANAGEMENT SYSTEM (eCMS)
01 32 17.00 20	05/25	COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS)
01 33 00	08/18, CHG 4: 02/21	SUBMITTAL PROCEDURES
01 33 29	02/21, CHG 1: 08/25	SUSTAINABILITY REQUIREMENTS AND REPORTING
01 35 13.04 30	CES 01/25	FACILITY-RELATED CONTROL SYSTEMS (FRCS) PROCUREMENT FOR AIR FORCE CONTROL SYSTEMS
01 35 26	05/24, CHG 1: 05/25	GOVERNMENTAL SAFETY REQUIREMENTS
01 35 29.13	11/15, CHG 1: 08/22	HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES
01 42 00	05/24	SOURCES FOR REFERENCE PUBLICATIONS
01 45 00	08/23, CHG 3: 08/25	QUALITY CONTROL
01 45 35	05/24	SPECIAL INSPECTIONS
01 50 00	11/20, CHG 3: 08/24	TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
01 57 19	08/22, CHG 2: 08/25	TEMPORARY ENVIRONMENTAL CONTROLS
01 57 19.03 21	07/25	SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS SECRETARY OF THE NAVY (SECNAV) EXPLOSIVE SAFETY RISK ACCEPTANCE WITHIN JOINT REGION MARIANAS
01 58 00	08/19, CHG 5: 08/22	PROJECT IDENTIFICATION
01 74 19	02/19, CHG 3: 11/21	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 78 00	05/19, CHG 1: 08/21	CLOSEOUT SUBMITTALS
01 78 23	05/23, CHG 1: 05/25	OPERATION AND MAINTENANCE DATA
01 78 23.33	08/18, CHG 1: 02/21	OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS
01 78 24.00 20	05/23, CHG 1: 11/23	FACILITY DATA WORKBOOK (FDW)

DIVISION 02 - EXISTING CONDITIONS

02 41 00	08/22	DEMOLITION
02 61 13	02/25	EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL
02 81 00	08/25	TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS
02 82 00	08/25	ASBESTOS REMEDIATION
02 83 00	11/18	LEAD REMEDIATION
02 84 16	11/22	HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY
02 84 33	11/22	REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs)

DIVISION 03 - CONCRETE

03 30 00	02/19, CHG 10: 08/25	CAST-IN-PLACE CONCRETE

DIVISION 04 - MASONRY

04 20 00	05/25	UNIT MASONRY

DIVISION 05 - METALS

05 05 20	05/22, CHG 1: 08/24	POST-INSTALLED CONCRETE AND MASONRY ANCHORS
05 50 13	08/24, CHG 1: 08/25	MISCELLANEOUS METAL FABRICATIONS
05 59 10	11/22	ROLLING COVER FOR AVIATION REFUELING VAULTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 11 13	08/23	BITUMINOUS DAMPPROOFING
07 84 00	05/10, CHG 1: 08/13	FIRESTOPPING

DIVISION 09 - FINISHES

09 90 00	02/21	PAINTS AND COATINGS
09 96 00	11/14	HIGH-PERFORMANCE COATINGS
09 96 53.13	11/25	SILICONE ELASTOMERIC COATINGS
09 97 13.27	02/21, CHG 1: 08/22	HIGH PERFORMANCE COATING FOR STEEL STRUCTURES

DIVISION 25 - INTEGRATED AUTOMATION

25 05 11.26	08/24	CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI)

DIVISION 26 - ELECTRICAL

26 05 48	11/23	SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
26 05 73	08/23	POWER SYSTEM STUDIES
26 08 00	11/22	APPARATUS INSPECTION AND TESTING
26 12 19	05/24	PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS
26 13 00	05/21, CHG 1: 05/22	HIGH-FIREPOINT FLUIDS INSULATED PAD-MOUNTED SWITCHGEAR
26 20 00	05/25	INTERIOR DISTRIBUTION SYSTEM
26 27 14.00 20	02/21, CHG 1: 05/21	ELECTRICITY METERING
26 42 13	05/21	GALVANIC (SACRIFICIAL) ANODE CATHODIC PROTECTION (GACP) SYSTEM
26 56 00	08/21	EXTERIOR LIGHTING
26 56 20	02/19	AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS

DIVISION 31 - EARTHWORK

31 00 00	08/23	EARTHWORK
31 11 00	11/18	CLEARING AND GRUBBING
31 32 19.16	02/21	GEOTEXTILE SOIL STABILIZATION

31 33 10	05/25	FOUNDATION DRILLING AND GROUTING IN ROCK

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 01 19.61	11/19, CHG 1: 11/24	SEALING OF JOINTS IN RIGID PAVEMENT
32 05 33	08/17	LANDSCAPE ESTABLISHMENT
32 11 20	05/22	BASE COURSE FOR RIGID PAVING
32 11 23	05/22	GRADED CRUSHED AGGREGATE BASE COURSES
32 11 23.23	08/22	BASE COURSE DRAINAGE LAYERS
32 12 13	05/24	BITUMINOUS TACK AND PRIME COATS
32 12 15.13	11/20, CHG 1: 05/22	ASPHALT PAVING FOR AIRFIELDS
32 12 16.16	11/20	ROAD-MIX ASPHALT PAVING
32 13 14.13	11/22, CHG 1: 05/24	CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS
32 13 73.19	11/19	COMPRESSION CONCRETE PAVING JOINT SEALANT
32 16 19	05/18	SIDEWALKS
32 17 23.16	11/24	ROAD AND PARKING LOT PAVEMENT MARKINGS
32 17 23.19	11/24	AIRFIELD PAVEMENT MARKINGS
32 31 13.53	11/21	HIGH-SECURITY FENCES (CHAIN LINK) AND GATES
32 84 24	08/11, CHG 1: 05/17	TEMPORARY IRRIGATION SPRINKLER SYSTEMS
32 92 19	08/17, CHG 1: 08/21	SEEDING
32 93 00	08/17, CHG 1: 08/21	EXTERIOR PLANTS

DIVISION 33 - UTILITIES

33 08 53	08/18	AVIATION FUEL DISTRIBUTION SYSTEM START-UP
33 09 53	02/21	AVIATION FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (TYPE III)
33 11 00	08/24	WATER UTILITY DISTRIBUTION PIPING
33 40 00	11/21	STORMWATER UTILITIES
33 46 16	05/18	SUBDRAINAGE PIPING
33 52 23.15	05/25	POL SERVICE PIPING WELDING
33 52 43.11	08/18	AVIATION FUEL MECHANICAL EQUIPMENT
33 52 43.13	08/18, CHG 1: 02/21	AVIATION FUEL PIPING
33 52 80	08/22	LIQUID FUELS PIPELINE COATING SYSTEMS
33 71 02	08/21	UNDERGROUND ELECTRICAL DISTRIBUTION
33 82 00	04/06	TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

DIVISION 34 - TRANSPORTATION

34 73 16	11/19	AIRFIELD GROUNDING

-- End of Project Table of Contents --

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00 01 15

LIST OF DRAWINGS
02/24

PART 1 GENERAL

1.1 SUMMARY

This section lists the drawings for the project pursuant to contract clause "DFARS 252.236-7001, Contract Drawings and Specifications."

1.2 CONTRACT DRAWINGS

Contract drawings are as follows:

DWG NO.	NAVFAC DWG NO.	TITLE
G-001	17361624	COVER SHEET
G-002	17361625	SHEET INDEX
G-003	17361626	SHEET INDEX
GI001	17361627	LOCATION MAP AND HAUL ROUTE
GI002	17361628	TYPICAL SYMBOLS AND ABBREVIATIONS
GI003	17361629	ABBREVIATIONS CONTINUED
GI108	17361630	PHASING PLAN
GI109	17361631	AIRFIELD PHASING PLAN
V-101	17361632	OVERALL EXISTING CONDITIONS
V-102	17361633	EXISTING CONDITIONS - AREA 1
V-103	17361634	EXISTING CONDITIONS - AREA 2
V-104	17361635	EXISTING CONDITIONS - AREA 3
V-105	17361636	EXISTING CONDITIONS - AREA 4
V-106	17361637	EXISTING CONDITIONS - AREA 5
V-107	17361638	EXISTING CONDITIONS - AREA 6
V-108	17361639	EXISTING CONDITIONS - AREA 7
V-109	17361640	EXISTING CONDITIONS - AREA 8
V-110	17361641	EXISTING CONDITIONS - AREA 9
V-111	17361642	EXISTING CONDITIONS - AREA 10
V-112	17361643	EXISTING CONDITIONS - AREA 11
V-113	17361644	EXISTING CONDITIONS - AREA 12
V-114	17361645	EXISTING CONDITIONS - AREA 13
V-115	17361646	EXISTING CONDITIONS - AREA 14
V-116	17361647	EXISTING CONDITIONS - AREA 15
V-117	17361648	EXISTING CONDITIONS - AREA 16
V-118	17361649	EXISTING CONDITIONS - AREA 17
V-119	17361650	EXISTING CONDITIONS - AREA 18
V-120	17361651	EXISTING CONDITIONS - AREA 19

V-121	17361652	EXISTING CONDITIONS - AREA 20
V-122	17361653	EXISTING CONDITIONS - AREA 21
V-123	17361654	EXISTING CONDITIONS - AREA 22
V-124	17361655	EXISTING CONDITIONS - AREA 23
V-125	17361656	EXISTING CONDITIONS - AREA 24
V-126	17361657	EXISTING CONDITIONS - AREA 25
V-127	17361658	EXISTING CONDITIONS - AREA 26
V-128	17361659	SURVEY CONTROL PLAN
BB101	17361660	LIMITED GEOTECHNICAL FIELD WORK PLAN
BB102	17361661	PHASE 2 GEOTECHNICAL FIELD WORK
BB103	17361662	BORING LOGS
BB104	17361663	BORING LOGS
BB105	17361664	BORING LOGS
BB106	17361665	BORING LOGS
BB107	17361666	BORING LOGS
BB108	17361667	BORING LOGS
BB109	17361668	BORING LOGS
BB110	17361669	BORING LOGS
BB111	17361670	BORING LOGS
BB112	17361671	BORING LOGS
BB113	17361672	BORING LOGS
BB114	17361673	BORING LOGS
BB115	17361674	BORING LOGS
BB116	17361675	BORING LOGS
BB117	17361676	BORING LOGS
BB118	17361677	BORING LOGS
BB119	17361678	BORING LOGS
BB120	17361679	BORING LOGS
C-001	17361680	GENERAL NOTES
CD101	17361681	OVERALL DEMOLITION PLAN
CD102	17361682	DEMOLITION PLAN - AREA 1
CD103	17361683	DEMOLITION PLAN - AREA 2
CD104	17361684	DEMOLITION PLAN - AREA 3
CD105	17361685	DEMOLITION PLAN - AREA 4
CD106	17361686	DEMOLITION PLAN - AREA 5
CD107	17361687	DEMOLITION PLAN - AREA 6
CD108	17361688	DEMOLITION PLAN - AREA 7
CD109	17361689	DEMOLITION PLAN - AREA 8
CD110	17361690	DEMOLITION PLAN - AREA 9
CD112	17361691	DEMOLITION PLAN - AREA 11
CD113	17361692	DEMOLITION PLAN - AREA 12
CD114	17361693	DEMOLITION PLAN - AREA 13
CD115	17361694	DEMOLITION PLAN - AREA 14

CD116	17361695	DEMOLITION PLAN - AREA 15
CD117	17361696	DEMOLITION PLAN - AREA 16
CD118	17361697	DEMOLITION PLAN - AREA 17
CD119	17361698	DEMOLITION PLAN - AREA 18
CD120	17361699	DEMOLITION PLAN - AREA 19
CD121	17361700	DEMOLITION PLAN - AREA 20
CD122	17361701	DEMOLITION PLAN - AREA 21
CD123	17361702	DEMOLITION PLAN - AREA 22
CD124	17361703	DEMOLITION PLAN - AREA 23
CD125	17361704	DEMOLITION PLAN - AREA 24
CD126	17361705	DEMOLITION PLAN - AREA 25
CD127	17361706	DEMOLITION PLAN - AREA 26
CD130	17361707	NOT USED
CD131	17361708	NOT USED
CD132	17361709	NOT USED
CD134	17361710	NOT USED
CD135	17361711	NOT USED
CD136	17361712	NOT USED
CD137	17361713	NOT USED
CD138	17361714	NOT USED
CD139	17361715	NOT USED
CS101	17361716	OVERALL SITE & PAVING PLAN
CS102	17361717	SITE & PAVING PLAN - AREA 1
CS103	17361718	SITE & PAVING PLAN - AREA 2
CS104	17361719	SITE & PAVING PLAN - AREA 3
CS105	17361720	SITE & PAVING PLAN - AREA 4
CS106	17361721	SITE & PAVING PLAN - AREA 5
CS107	17361722	SITE & PAVING PLAN - AREA 6
CS108	17361723	SITE & PAVING PLAN - AREA 7
CS109	17361724	SITE & PAVING PLAN - AREA 8
CS110	17361725	SITE & PAVING PLAN - AREA 9
CS111	17361726	SITE & PAVING PLAN - AREA 10
CS112	17361727	SITE & PAVING PLAN - AREA 11
CS113	17361728	SITE & PAVING PLAN - AREA 12
CS114	17361729	SITE & PAVING PLAN - AREA 13
CS115	17361730	SITE & PAVING PLAN - AREA 14
CS120	17361731	SITE & PAVING PLAN - AREA 20
CS121	17361732	SITE & PAVING PLAN - AREA 21
CS122	17361733	SITE & PAVING PLAN - AREA 22
CS123	17361734	SITE & PAVING PLAN - AREA 23
CS124	17361735	SITE & PAVING PLAN - AREA 24
CS125	17361736	SITE & PAVING PLAN - AREA 25
CS126	17361737	SITE & PAVING PLAN - AREA 26

CS130	17361738	OVERALL PAVEMENT MARKING PLAN
CS131	17361739	PAVEMENT MARKING PLAN - AREA 1
CS132	17361740	PAVEMENT MARKING PLAN - AREA 2
CS133	17361741	PAVEMENT MARKING PLAN - AREA 3
CS134	17361742	PAVEMENT MARKING PLAN - AREA 5
CS135	17361743	PAVEMENT MARKING PLAN - AREA 6
CS136	17361744	PAVEMENT MARKING PLAN - AREA 7
CS137	17361745	PAVEMENT MARKING PLAN - AREA 11
CS138	17361746	PAVEMENT MARKING PLAN - AREA 12
CS139	17361747	PAVEMENT MARKING PLAN - AREA 13
CS140	17361748	PAVEMENT MARKING PLAN - AREA 20
CS141	17361749	PAVEMENT MARKING PLAN - AREA 21
CS142	17361750	PAVEMENT MARKING PLAN - AREA 22
CS143	17361751	PAVEMENT MARKING PLAN - AREA 23
CS144	17361752	PAVEMENT MARKING PLAN - AREA 24
CS145	17361753	PAVEMENT MARKING PLAN - AREA 25
CS146	17361754	PAVEMENT MARKING PLAN - AREA 26
CS201	17361755	ROADWAY PLAN & PROFILE RW01 STA 0+00-6+25 - AREA 22
CS202	17361756	ROADWAY PLAN & PROFILE RW01 STA 6+25-12+50 - AREA 22 & 23
CS203	17361757	ROADWAY PLAN & PROFILE RW01 STA 12+50-18+75 - AREA 23 & 24
CS204	17361758	ROADWAY PLAN & PROFILE RW01 STA 18+75-25+00 - AREA 24 & 25
CS205	17361759	ROADWAY PLAN & PROFILE RW01 STA 25+00-31+25 - AREA 25 & 26
CS206	17361760	ROADWAY PLAN & PROFILE RW01 STA 31+25-37+50 - AREA 21 & 26
CS207	17361761	ROADWAY PLAN & PROFILE RW01 STA 37+50-44+00 - AREA 21
CS212	17361762	TAXILANE PLAN & PROFILE L2 STA 00+00-06+50
CS213	17361763	TAXILANE PLAN & PROFILE L2 STA 06+50-13+00
CS215	17361764	TAXILANE PLAN & PROFILE L3 STA 00+00-06+50
CS216	17361765	TAXILANE PLAN & PROFILE L3 STA 06+50-13+00
CS301	17361766	ROADWAY SECTIONS - SAMPLE LINE PLAN
CS302	17361767	ROADWAY SECTIONS - RW01
CS303	17361768	ROADWAY SECTIONS - RW01
CS304	17361769	ROADWAY SECTIONS - RW01
CS305	17361770	ROADWAY SECTIONS - RW01
CS306	17361771	ROADWAY SECTIONS - RW01
CS307	17361772	ROADWAY SECTIONS - RW01
CS308	17361773	ROADWAY SECTIONS - RW01
CS309	17361774	ROADWAY SECTIONS - RW01
CS310	17361775	APRON SECTIONS - A01
CS311	17361776	APRON SECTIONS - A02

CS312	17361777	APRON SECTIONS - A03
CS501	17361778	SITE DETAILS
CS502	17361779	SITE DETAILS
CS503	17361780	SITE DETAILS
CS504	17361781	SITE DETAILS
CS505	17361782	SITE DETAILS
CS506	17361783	SITE DETAILS
CS507	17361784	SITE DETAILS
CT101	17361785	OVERALL JOINTING PLAN
CT102	17361786	JOINTING PLAN - AREA 1
CT103	17361787	JOINT ELEVATION PLAN - AREA 1
CT104	17361788	JOINTING PLAN - AREA 2
CT105	17361789	JOINT ELEVATION PLAN - AREA 2
CT106	17361790	JOINTING PLAN - AREA 3
CT107	17361791	JOINT ELEVATION PLAN - AREA 3
CT108	17361792	JOINTING PLAN - AREA 6
CT109	17361793	JOINT ELEVATION PLAN - AREA 6
CT110	17361794	JOINTING PLAN - AREA 7
CT111	17361795	JOINT ELEVATION PLAN - AREA 7
CT112	17361796	JOINTING PLAN - AREA 12
CT113	17361797	JOINT ELEVATION PLAN - AREA 12
CT114	17361798	JOINTING PLAN - AREA 13
CT115	17361799	JOINT ELEVATION PLAN - AREA 13
CG101	17361800	OVERALL GRADING AND DRAINAGE PLAN
CG102	17361801	GRADING AND DRAINAGE PLAN - AREA 1
CG103	17361802	GRADING AND DRAINAGE PLAN - AREA 2
CG104	17361803	GRADING AND DRAINAGE PLAN - AREA 3
CG105	17361804	GRADING AND DRAINAGE PLAN - AREA 4
CG106	17361805	GRADING AND DRAINAGE PLAN - AREA 5
CG107	17361806	GRADING AND DRAINAGE PLAN - AREA 6
CG108	17361807	GRADING AND DRAINAGE PLAN - AREA 7
CG109	17361808	GRADING AND DRAINAGE PLAN - AREA 8
CG110	17361809	GRADING AND DRAINAGE PLAN - AREA 9
CG112	17361810	GRADING AND DRAINAGE PLAN - AREA 11
CG113	17361811	GRADING AND DRAINAGE PLAN - AREA 12
CG114	17361812	GRADING AND DRAINAGE PLAN - AREA 13
CG115	17361813	GRADING AND DRAINAGE PLAN - AREA 14
CG116	17361814	GRADING AND DRAINAGE PLAN - AREA15
CG117	17361815	GRADING AND DRAINAGE PLAN - AREA 16
CG118	17361816	GRADING AND DRAINAGE PLAN - AREA 17
CG119	17361817	GRADING AND DRAINAGE PLAN - AREA 18
CG120	17361818	GRADING AND DRAINAGE PLAN - AREA 19
CG121	17361819	GRADING AND DRAINAGE PLAN - AREA 20

CG122	17361820	GRADING AND DRAINAGE PLAN - AREA 21
CG123	17361821	GRADING AND DRAINAGE PLAN - AREA 22
CG124	17361822	GRADING AND DRAINAGE PLAN - AREA 23
CG125	17361823	GRADING AND DRAINAGE PLAN - AREA 24
CG126	17361824	GRADING AND DRAINAGE PLAN - AREA 25
CG127	17361825	GRADING AND DRAINAGE PLAN - AREA 26
CG130	17361826	NOT USED
CG131	17361827	NOT USED
CG132	17361828	NOT USED
CG134	17361829	NOT USED
CG135	17361830	NOT USED
CG136	17361831	NOT USED
CG137	17361832	NOT USED
CG138	17361833	NOT USED
CG139	17361834	NOT USED
CG140	17361835	LIMITS OF GEOSYNTHETIC CLAY LINER
CG141	17361836	LIMITS OF GEOSYNTHETIC CLAY LINER
CG142	17361837	LAWN RESTORATION PLAN
CG143	17361838	NOT USED
CG144	17361839	KARST FEATURES PLAN
CG145	17361840	NOT USED
CG146	17361841	KARST FEATURES DETAIL
CG147	17361842	TURF REINFORCEMENT PLAN
CG148	17361843	NOT USED
CG201	17361844	DRAINAGE PROFILES
CG202	17361845	DRAINAGE PROFILES
CG203	17361846	DRAINAGE PROFILES
CG204	17361847	DRAINAGE PROFILES
CG205	17361848	DRAINAGE PROFILES
CG206	17361849	DRAINAGE PROFILES
CG207	17361850	DRAINAGE PROFILES
CG208	17361851	DRAINAGE PROFILES
CG209	17361852	DRAINAGE PROFILES
CG210	17361853	DRAINAGE PROFILES
CG211	17361854	DRAINAGE PROFILES
CG212	17361855	DRAINAGE PROFILES
CG501	17361856	DRAINAGE DETAILS
CG502	17361857	DRAINAGE DETAILS
CG503	17361858	DRAINAGE DETAILS
CG504	17361859	DRAINAGE DETAILS
CG505	17361860	DRAINAGE DETAILS
CG506	17361861	DRAINAGE DETAILS
CG507	17361862	SAND FILTER DETAILS

CU101	17361863	OVERALL UTILITY PLAN
CU102	17361864	UTILITY PLAN - AREA 1
CU103	17361865	UTILITY PLAN - AREA 6
CU104	17361866	UTILITY PLAN - AREA 7
CU105	17361867	UTILITY PLAN - AREA 8
CU106	17361868	UTILITY PLAN - AREA 23
CU107	17361869	UTILITY PLAN - AREA 24
CU108	17361870	UTILITY PLAN - AREA 25
CU109	17361871	UTILITY PLAN - AREA 26
CU201	17361872	UTILITY PROFILES
CU202	17361873	UTILITY PROFILES
CU203	17361874	UTILITY PROFILES
CU501	17361875	UTILITY DETAILS
CU502	17361876	UTILITY DETAILS
S-001	17361877	STRUCTURAL GENERAL NOTES
S-002	17361878	STRUCTURAL GENERAL NOTES
S-101	17361879	FOUNDATION PLANS
S-501	17361880	TYPICAL CONCRETE DETAILS
S-502	17361881	TYPICAL CONCRETE DETAILS
S-503	17361882	CONCRETE SECTIONS AND DETAILS
A-001	17361883	GENERAL NOTES, SYMBOLS, AND EXTERIOR PERSPECTIVE VIEWS
A-406	17361884	DETACHED EQUIPMENT YARD
E-001	17361885	ELECTRICAL LEGEND 1 OF 2
E-002	17361886	ELECTRICAL LEGEND 2 OF 2
ED101	17361887	ELECTRICAL DEMOLITION PLAN 1
ED102	17361888	ELECTRICAL DEMOLITION PLAN 2
ED601	17361889	EXISTING DISTRIBUTION ONE LINE DIAGRAM - DEMOLITION PLAN
ES101	17361890	ELECTRICAL SITE PLAN 1
ES102	17361891	ELECTRICAL SITE PLAN 2
ES103	17361892	ELECTRICAL SITE PLAN 3
ES104	17361893	ELECTRICAL SITE PLAN 4
ES105	17361894	ENLARGED ELECTRICAL SITE PLAN
ES201	17361895	EXISTING SWITCHING STATION - 13.8KV SWITCHGEAR ARRANGEMENT ELEV
ES501	17361896	ELECTRICAL SITE DETAILS
ES502	17361897	ELECTRICAL SITE DETAILS
ES503	17361898	ELECTRICAL SITE DETAILS
ES504	17361899	ELECTRICAL SITE DETAILS
ES505	17361900	ELECTRICAL SITE DETAILS
ES506	17361901	ELECTRICAL SITE DETAILS
ES701	17361902	HIGH MAST LIGHT POLE LOCATIONS
EP601	17361903	EXISTING DISTRUBUTION ONE LINE DIAGRAM - NEW WORK
EP602	17361904	ONE-LINE DIAGRAMS
EP701	17361905	PANELBOARD SCHEDULES

EA101	17361906	AIRFIELD ELECTRICAL PLAN 1
EA102	17361907	AIRFIELD ELECTRICAL PLAN 2
EA501	17361908	AIRFIELD LIGHTING DETAILS
EA502	17361909	AIRFIELD LIGHTING DETAILS
EA503	17361910	AIRFIELD LIGHTING DETAILS
EA504	17361911	AIRFIELD LIGHTING DETAILS
EA701	17361912	AIRFIELD LIGHTING POINTS SCHEDULE
EA702	17361913	AIRFIELD LIGHTING ONE-LINE DIAGRAMS
TS001	17361914	TELECOMMUNICATIONS SITE LEGEND
TD101	17361915	TELECOMMUNICATIONS SITE DEMOLITION PLAN 1
TD102	17361916	TELECOMMUNICATIONS SITE DEMOLITION PLAN 2
TS101	17361917	TELECOMMUNICATIONS SITE PLAN 1
TS102	17361918	TELECOMMUNICATIONS SITE PLAN 2
TS103	17361919	TELECOMMUNICATIONS SITE PLAN 3
TS104	17361920	TELECOMMUNICATIONS SITE PLAN 4
TS105	17361921	TELECOMMUNICATIONS SITE PLAN 5
TS501	17361922	TELECOMMUNICATIONS SITE DETAILS
TS502	17361923	TELECOMMUNICATIONS SITE DETAILS
TS701	17361924	TELECOMMUNICATIONS INTERBUILDING BACKBONE RISER
CF101	17361925	OVERALL FUELING PLAN
CF102	17361926	OVERALL COMM PLAN
CF201	17361927	FUEL PLAN AND PROFILE - AREA 1
CF202	17361928	FUEL PLAN AND PROFILE - AREA 2
CF203	17361929	FUEL PLAN AND PROFILE - AREA 3
CF204	17361930	FUEL PLAN AND PROFILE - AREA 4
CF205	17361931	FUEL PLAN AND PROFILE - AREA 5
CF206	17361932	FUEL PLAN AND PROFILE - AREA 6
CF207	17361933	FUEL PLAN AND PROFILE - AREA 7
CF208	17361934	FUEL PLAN AND PROFILE - AREA 8
CF209	17361935	FUEL PLAN AND PROFILE - AREA 9
CF210	17361936	FUEL PLAN AND PROFILE - AREA 10
CF211	17361937	FUEL PLAN AND PROFILE - AREA 11
CF212	17361938	FUEL PLAN AND PROFILE - AREA 12
CF221	17361939	COMM PLAN - AREA 1
CF222	17361940	COMM PLAN - AREA 2
CF223	17361941	COMM PLAN - AREA 3
CF224	17361942	COMM PLAN - AREA 4
CF225	17361943	COMM PLAN - AREA 5
CF226	17361944	COMM PLAN - AREA 6
CF227	17361945	COMM PLAN - AREA 7
CF228	17361946	COMM PLAN - AREA 8
CF229	17361947	COMM PLAN - AREA 9
CF230	17361948	COMM PLAN - AREA 10

CF231	17361949	COMM PLAN - AREA 11
CF232	17361950	COMM PLAN - AREA 12
CF233	17361951	COMM PLAN - AREA 13
CF234	17361952	COMM PLAN - AREA 14
CF501	17361953	FUELING DETAILS
CF502	17361954	FUELING DETAILS
SF001	17361955	STRUCTURAL GENERAL NOTES - SHEET 1
SF002	17361956	STRUCTURAL GENERAL NOTES - SHEET 2
SF003	17361957	LEGENDS AND ABBREVIATIONS
SF101	17361958	OVERALL STRUCTURAL LAYOUT
SF111	17361959	ISOLATION VALVE VAULT 1 - PLANS
SF112	17361960	ISOLATION VALVE VAULT 2 - PLANS - SHEET 1
SF113	17361961	ISOLATION VALVE VAULT 2 - PLAN - SHEET 2
SF114	17361962	HYDRANT PIT - PLANS AND SECTIONS
SF115	17361963	HPV PITS - PLANS AND SECTIONS
SF501	17361964	STANDARD STRUCTURAL DETAILS - SHEET 1
SF502	17361965	STANDARD STRUCTURAL DETAILS - SHEET 2
SF511	17361966	ISOLATION VALVE VAULT - SECTIONS - SHEET 1
SF512	17361967	ISOLATION VALVE VAULT - SECTIONS - SHEET 2
SF513	17361968	ISOLATION VALVE VAULT - SECTIONS AND DETAILS
SF521	17361969	ROLLING COVER - SHEET 1
SF522	17361970	ROLLING COVER - SHEET 2
SF523	17361971	ROLLING COVER - SHEET 3
SF524	17361972	ROLLING COVER - SHEET 4
SF525	17361973	ROLLING COVER - SHEET 5
SF551	17361974	PIPE SUPPORT DETAILS
MF001	17361975	FUELING MECHANICAL LEGEND
MF002	17361976	FUELING MECHANICAL GENERAL NOTES
MF011	17361977	FUELING MECHANICAL FLOW DIAGRAM - OVERALL
MF101	17361978	FUELING MECHANICAL OVERALL SITE PLAN
MF501	17361979	FUELING MECHANICAL DETAILS - ISOLATION VALVE VAULT (IVV-1)
MF502	17361980	FUELING MECHANICAL DETAILS - ISOLATION VALVE VAULT (IVV-2)
MF503	17361981	FUELING MECHANICAL DETAILS
MF504	17361982	FUELING MECHANICAL DETAILS
MF505	17361983	FUELING MECHANICAL DETAILS
MF506	17361984	FUELING MECHANICAL DETAILS
MF601	17361985	FUELING MECHANICAL P&ID
EF001	17361986	ELECTRICAL FUELING LEGEND - 1
EF002	17361987	ELECTRICAL FUELING LEGEND - 2
EF011	17361988	OVERALL FUELING HAZARDOUS AREA PLAN
EF101	17361989	OVERALL FUELING ELECTRICAL SITE PLAN
EF401	17361990	ENLARGED PLAN - PUMPHOUSE
EF501	17361991	ELECTRICAL DETAILS - EPDS

EF502	17361992	ELECTRICAL DETAILS - GROUNDING
EF503	17361993	ELECTRICAL SITE DETAILS - HANDHOLES
EF504	17361994	ELECTRICAL SITE DETIALS - DUCT BANKS
EF511	17361995	ELEVATION - PUMP CONTROL PANEL
EF611	17361996	PCP - CONTROL DIAGRAM
EF621	17361997	NORTH APRON EPDS - FRONT LAYOUT
EF622	17361998	NORTH ARON EPDS WIRING - 1
EK501	17361999	CATHODIC PROTECTION DETAILS
EK502	17362000	CATHODIC PROTECTION DETAILS

-- End of Document --

SECTION 01 11 00

SUMMARY OF WORK
02/24, CHG 1: 05/25

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The project is to construct an aircraft parking apron with associated taxiways and shoulders, utility yards, airfield fence, and hydrant fueling pits and piping required to accommodate bombers, tankers, and other aircraft. Work should include all subgrade and subbase work, drainage, airfield lighting, grounding, mooring, markings, fencing, ramp area lighting, and other necessary airfield support. New utilities including a fuel hydrant loop, fuel hydrant pits at each parking position, and fire hydrants located around the perimeter, as well as site improvements and communications. The project will include the necessary infrastructure to support the operational requirements. Work also includes environmental mitigations for the project site to be disturbed or impacted. The environmental mitigations will be implemented at the project site and two natural resources mitigation/transplanting sites, Tarague Forest Enhancement Area (FEA) and the Habitat Management Unit (HMU).

1.1.2 Location

The work is located at the Andersen Air Force Base, Guam, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.2 EXISTING WORK

Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

1.3 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. Verify existing utility locations indicated on Contract drawings, within area of work.

Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with dual frequency Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities are discovered. Verify the elevations of existing piping, utilities,and any type of underground or encased obstruction not indicated, or specified to be removed, that is indicated or discovered during scanning, in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing

new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.3.1 Notification Prior to Excavation

Notify the Contracting Officer at least 15 calendar days prior to starting excavation work.

1.3.2 Utility Locations

Provide a third party, independent, private utility locating company to positively identify underground utilities in the work area in addition to any station locating service and coordinated with the station utility department.

1.4 NCTS/TELECOMM/ACCESS CONTROL/IDS COORDINATION REQUIREMENTS

1.4.1 NCTS/Telecomm/Access Control/IDS Contractor Access

Allow the NCTS/telecomm/access control/IDS Contractor access to the facility towards the end of construction (finishes 90 percent complete, rough-in 100 percent complete, Inside Plant (ISP)/Outside Plant (OSP) infrastructure in place) to provide equipment in the telecommunications rooms and make final connections. Coordinate efforts with the NCTS/telecomm/access control/IDS Contractor to facilitate joint use of building spaces during the final phases of construction. After the Contracting Officer has facilitated coordination meetings between the two contractors, within one week, incorporate the effort of additional coordination with the NCTS/telecomm/access control/IDS Contractor into the construction schedule to demonstrate a plan for maintaining the contract duration.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 14 00

WORK RESTRICTIONS
11/22, CHG 5: 05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

1.2 DEFINITIONS

"State" when used in reference to states of the United States also include the Territory of Guam.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel

Personnel List

Free-Zone Request; G

Vehicle List; G

Statement Of Acknowledgement; G

1.4 SPECIAL SCHEDULING REQUIREMENTS

a. Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work.

b. The B2616, B2619, the Giant Voice, the airfield, and Marianas Boulevard will remain in operation during the entire construction period. Conduct operations so as to cause the least possible interference with normal operations of the activity.

c. Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

1.5 CONTRACTOR ACCESS AND USE OF PREMISES

1.5.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear appropriate personal protective equipment (PPE) in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Ensure all Contractor equipment, including delivery vehicles, are clearly identified with their company name.

1.5.1.1 Subcontractors and Personnel Contacts

Provide a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.5.1.2 Contractor Requirements for Access to Andersen Air Force Base

a. All Contractors shall have a sponsor to the installation on Andersen Air Force Base (AFB). Coordinate access to Andersen Air Force Base with the Contracting Officer.

b. A Contractor Affidavit is required for each person requesting access to Andersen AFB. Complete the "USAF Contractor/Sub-Contractor Access Affidavit" form, https://www.andersen.af.mil/Contact-Us/Visitor-Center/.

c. Contractors are required to submit a paper pass/Base Pass Request with approval from their sponsor/Contracting Officer to the Visitors control Center. Submit free-zone request.

d. Contractor must submit affidavits within 45 days of contract award and plan for 30 days of Government review.

1.5.1.3 Installation Access

Obtain access to Air Force installations through participation in the Defense Biometrics Identification System (DBIDS). Requirements for Contractor employee registration, and transition for employees currently under Navy Commercial Access Control System (NCACS), are available at https://www.cnic.navy.mil/Operations-and-Management/Base-Support/DBIDS/. No fees are associated with obtaining a DBIDS credential.

Participation in the DBIDS is not mandatory, and Contractor personnel may apply for One-Day Passes at the Base Visitor Control Office to access an installation.

1.5.1.3.1 Registration for DBIDS

Registration for DBIDS is available at https://www.cnic.navy.mil/Operations-and-Management/Base-Support/DBIDS/. Procedure includes:

a. Present a letter or official award document from the Contracting Officer, that provides the purpose for access, to the base Visitor Control Center representative.

b. Present valid identification, such as a passport or Real ID Act-compliant state driver's license.

c. Provide completed SECNAV FORM 5512/1 to the base Visitor Control Center representative to obtain a background check. This form is available for download at https://www.cnic.navy.mil/Operations-and-Management/Base-Support/DBIDS/.

d. Upon successful completion of the background check, the Government will complete the DBIDS enrollment process, which includes Contractor employee photo, fingerprints, base restriction and several other assessments.

e. Upon successful completion of the enrollment process, the Contractor employee will be issued a DBIDS credential, and will be allowed to proceed to worksite.

1.5.1.3.2 DBIDS Eligibility Requirements

Throughout the year, the Contractor employee must continue to meet background screen standards. Periodic background screenings are conducted to verify continued DBIDS participation and installation access privileges. DBIDS access privileges will be immediately suspended or revoked if at any time a Contractor employee becomes ineligible.

An adjudication process may be initiated when a background screen failure results in disqualification from participation in the DBIDS, and Contractor employee does not agree with the reason for disqualification. The Government is the final authority.

1.5.1.3.3 DBIDS Notification Requirements

a. Immediately report instances of lost or stolen badges to the Contracting Officer.

b. Immediately collect DBIDS credentials and notify the Contracting Officer in writing under the following circumstances:

(1) An employee has departed the company without having properly returned or surrendered their DBIDS credentials.

(2) There is a reasonable basis to conclude that an employee, or former employee, might pose a risk, compromise, or threat to the safety or security of the Installation or anyone therein.

1.5.1.3.4 One-Day Passes

Personnel applying for One-Day passes at the Base Visitor Control Office are subject to daily mandatory vehicle inspection, and will have limited access to the installation. The Government is not responsible for any cost or lost time associated with obtaining daily passes or added vehicle inspections incurred by non-participants in the DBIDS.

1.5.1.4 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installation, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under

renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.5.2 Working Hours

Regular working hours will consist of an 8 hour period , between 6:00 a.m. and 6:00 p.m., Monday through Friday, excluding Government holidays.

1.5.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 30 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in accordance with requirements of EM 385-1-1. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.

1.5.4 Exclusionary Period

Work inside the existing airfield fence line along Taxiway D loop could be affected by exercises occurring between February and July every year and require removal and re-establishment of the free zone fence. Taxiway tie-in work must not occur during the February-July exercises without prior approval of the Contracting Officer. Notify the Contracting Officer 60 days prior if work inside the free zone along Taxiway D loop is anticipated during the exercise period.

1.5.5 Occupied Buildings

Work will be around existing buildings which are occupied. Do not enter the buildings without prior approval of the Contracting Officer.

1.5.6 Utility Cutovers and Interruptions

a. Approval from the 36th CES is required in advance of any temporary or permanent work that impacts a utility system. Examples of work that requires advance approval from the 36th CES are a temporary or permanent connection to a utility, a request to energize a new facility, or work to repair, install, enlarge, demolish or modernize existing utility infrastructure. Depending on the work one or more of the following approvals is required prior to any work being conducted. These forms and instructions are available at the Requirements Section Building 18001 or send an email to CSU Org Box: 36ces.service@us.af.mil.
(1) Project Coordination and Approval Checklist

Andersen Air Base Utility Connection Permit

Record Meter Change

Andersen Air Base Utility Outage Request

b. Fees: Electrical distribution services are provided by a private contractor, DZSP, hired by Andersen Air Force Base. DZSP charges for

some services. Applicants should contact DZSP Customer Service in advance to determine what fees may be required.

c. Time Lines: Applicants are strongly encourage to contact 36th CES early in the process to discuss the required approvals and estimated timeline for approval. Each of the approvals listed above has established review timelines (noted in the form instructions). However, the length of time to receive all approvals varies from case to case. Some applications are delayed because applicants do not follow instructions carefully. Sometimes additional supporting studies or tests require further review and approval by 36th CES, all of which takes additional time after the application has been submitted. Point of Contact is the Requirements and Optimization Chief who can be reached by sending an email to CSU Org Box: 36ces.service@us.af.mil.

d. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in paragraph WORK OUTSIDE REGULAR HOURS.

e. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

f. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS. Such interruptions are further limited to four hours. This time limit includes time for deactivation and reactivation.

g. Operation of Station Utilities: Do not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. Notify the Contracting Officer giving reasonable advance notice when such operation is required.

1.5.7 Restrictions on Use of Yellow, Orange-Yellow, Red, and Magenta Materials

The use of yellow, yellow-orange, red and magenta materials for the following purposes is prohibited: sheeting, tarpaulins, polyethylene bottles or other containers, tapes, bags, banding of identification marks on tools, and boundary markers such as ribbons. Obtain Contracting Officer's prior approval for use of such colored materials for other purposes, such as buried vapor barrier membranes.

1.6 SECURITY REQUIREMENTS

1.6.1 Personnel List

Submit for approval, at least 15 days prior to the desired date of entry, an original alphabetical list of personnel who require entry into Government property to perform work on the project. Furnish for each person:

a. Name

b. Date and place of birth

c. Citizenship

d. Home address

e. Social Security number

f. Current pass expiration date

g. Naturalization or Alien Registration number

h. Passport number, place of issue, and expiration date

i. Guam Police clearance report for last six months

The request for personnel passes must be accompanied with the following certification:

"I hereby certify that all personnel on this list are either born U.S. citizens, naturalized U.S. citizens with the naturalization number shown, or legal aliens with the alien registration number indicated."

Signature/Firm Name

1.6.1.1 Citizenship Requirements

Aliens will not be admitted to the work site without approval.Clearance for aliens may require approximately 20 workdays for approval.

1.6.2 Vehicle List

Submit an original list of vehicles to be utilized at the work site with the following information for each vehicle:

a. Make

b. Year

c. Model

d. License number

e. Registered owner

1.6.3 Passess

Submit request for personnel and vehicle passes together. Include the Certificate of Insurance for Contractor and Subcontractor(s) and the Statement of Acknowledgement with the submittal. Passes will normally be issued within 21 calendar days.

1.6.3.1 Control

Maintain strict accountability over passes. Immediately report to the source of issue, passes missing or lost and the circumstances. If the Contractor has another active contract or one commencing immediately, employees' names may be transferred from one contract to the other. Final payment will not be effected until employees are transferred to another contract or the records are cleared. Furnish a signed letter, countersigned by the source of issue, stating that passes have been turned

in.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES
11/20, CHG 5: 02/25

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Earned Value Report; G

1.2 EARNED VALUE REPORT

1.2.1 Data Required

This Contract requires the use of a cost-loaded Network Analysis Schedule (NAS). Schedule of Prices must not be used with cost-loaded Network Analysis Schedule (NAS). Use Earned Value Report derived from cost-loaded NAS. Within30 calendar days of Contract Award, prepare and deliver to the Contracting Officer a Earned Value Report (construction Contract) as directed by the Contracting Officer. Schedule of Prices must have cost summarized and totals provided for each construction category. Provide a detailed breakdown of the Contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices. Indirect activities (e.g., meetings, presentations, submittals, surveys, haul road or storage yard maintenance, dust control, security) will not be cost loaded. Evenly distribute the costs across the associated construction activities. Costs shall be summarized and totals provided for each construction category. Contractor overhead and profit including salaries for field office personnel, if applicable, must be proportionately spread over all pay items and not included as individual pay items.

1.2.2 Payment Schedule Instructions

Payments will not be made until the Earned Value Report from the cost-loaded NAS has been submitted to and accepted by the Contracting Officer.

Additionally, the Earned Value Report must be separated as follows:

a. Primary Facilities Cost Breakdown:

Defined as work on the primary facilities out to the 5 foot line. Work out to the 5 foot line includes construction encompassed within a theoretical line 5 foot from the face of exterior walls and includes attendant construction, such as pad mounted HVAC cooling equipment, cooling towers, and transformers placed beyond the 5 foot line.

b. Supporting Facilities Cost Breakdown:

Defined as site work, including incidental work, outside the 5 foot

line.

1.2.3 Schedule Requirements for HVAC TAB

The field work requirements must be broken down in the Earned Value Report from the cost-loaded NAS by separate line items which reflect measurable deliverables. The value for each pay item listed below will be established on a case by case basis for each Contract. The line items are as follows:

a. Approval of Design Review Report: The TABS Agency is required to conduct a review of the project plans and specifications to identify any feature, or the lack thereof, that would preclude successful testing and balancing of the project HVAC systems. Submit the resulting findings to the Government to allow correction of the design. The progress payment will not be issued until the report is reviewed and approved.

b. Approval of the pre-field engineering report: The TABS Agency submits a report which outlines the scope of field work. The report must contain details of what systems will be tested, procedures to be used, sample report forms for reporting test results and a quality control checklist of work items that must be completed before TABS field work commences.

c. Season I field work: Incremental payments are issued as the TABS field work progresses. The TABS Agency mobilizes to the project site and executes the field work as outlined in the pre-field engineering report. The HVAC water and air systems are balanced and operational data must be collected for one seasonal condition (either summer or winter depending on project timing).

d. Approval of Season I report: On completion of the Season I field work, the data is compiled into a report and submitted to the Government. The report is reviewed, and approved, after ensuring compliance with the pre-field engineering report scope of work.

e. Completion of Season I field QA check: Contract QC and Government representatives meet the TABS Agency at the jobsite to retest portions of the systems reported in the Season I report. The purpose of these tests are to validate the accuracy and completeness of the previously submitted Season I report.

1.3 CONTRACT MODIFICATIONS

In conjunction with the Contract Clause DFARS 252.236-7000 Modification Proposals-Price Breakdown, and where actual ownership and operating costs of construction equipment cannot be determined from Contractor accounting records, base equipment use rates upon the applicable provisions of the USACE EP 1110-1-8 Region XII Equipment Rates or acceptable guidance specific to Guam to establish a set cost for equipment and equipment operations cost,as approved by Contracting Officer.

1.4 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

1.4.1 Content of Invoice

Requests for payment will be processed in accordance with the Contract Clause FAR 52.232-27 Prompt Payment for Construction Contracts and FAR

52.232-5 Payments Under Fixed-Price Construction Contracts. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies. Include the documents listed below in the requests for payment.

a. The Contractor's invoice, on NAVFAC Form 7300/30 furnished by the Government, showing in summary form, the basis for arriving at the amount of the invoice. Form 7300/30 must include certification by Quality Control (QC) Manager as required by the Contract.

b. The Earned Value Report from the cost-loaded NAS.

c. Contractor's Monthly Estimate for Voucher and Contractors Certification (NAVFAC Form 4330) with Subcontractor and supplier payment certification. Other documents, including but not limited to, that need to be received prior to processing payment include the following submittals as required. These items are still required monthly even when a pay voucher is not submitted.

d. Monthly Work-hour report.

e. Updated Construction Progress Schedule and tabular reports required by the contract.

f. Contractor Safety Self Evaluation Checklist.

g. Updated submittal register.

h. Solid Waste Disposal Report.

i. Certified payrolls.

j. Updated testing logs.

k. Other supporting documents as requested.

l. The following environmental mitigation costs are to be specifically included in the invoice:

(1) Processing, Staging, and Delivery of High Value Trees (Natural Resources of Cultural Importance

(2) HACCP Plan

(3) HACCP Plan Implementation

1.4.2 Submission of Invoices

If DFARS Clause 252.232-7006 Wide Area WorkFlow Payment Instructions is included in the Contract, provide the documents listed in above paragraph CONTENT OF INVOICE in their entirety as attachments in Wide Area Work Flow (WAWF) for each invoice submitted. The maximum size of each WAWF attachment is two megabytes, but there are no limits on the number of attachments. If a document cannot be attached in WAWF due to system or size restriction, provide it as instructed by the Contracting Officer.

Monthly invoices and supporting forms for work performed through the anniversary award date of the Contract must be submitted to the Contracting Officer within 5 calendar days of the date of invoice. For

example, if Contract award date is the 7th of the month, the date of each monthly invoice must be the 7th and the invoice must be submitted by the 12th of the month.

1.4.3 Final Invoice

a. A final invoice must be accompanied by the certification required by DFARS 252.247.7023 Transportation of Supplies by Sea, and the Contractor's Final Release. If the Contractor is incorporated, the Final Release must contain the corporate seal. An officer of the corporation must sign and the corporate secretary must certify the Final Release.

b. For final invoices being submitted via WAWF, the original Contractor's Final Release Form and required certification of Transportation of Supplies by Sea must be provided directly to the respective Contracting Officer prior to submission of the final invoice. Once receipt of the original Final Release Form and required certification of Transportation of Supplies by Sea has been confirmed by the Contracting Officer, the Contractor must then submit final invoice and attach a copy of the Final Release Form and required certification of Transportation of Supplies by Sea in WAWF.

c. Final invoices not accompanied by the Contractor's Final Release and required certification of Transportation of Supplies by Sea will be considered incomplete and will be returned to the Contractor.

1.5 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of itemized requests by the Contractor which comply with the requirements of this section, and will be subject to reduction for overpayments or increase for underpayments made on previous payments to the Contractor.

1.5.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this Contract will, at the discretion of the Contracting Officer, be subject to reductions and suspensions permitted under the FAR and agency regulations including the following in accordance with FAR 32.103 Progress Payments Under Construction Contracts:

a. Reasonable deductions due to defects in material or workmanship;

b. Claims which the Government may have against the Contractor under or in connection with this Contract;

c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and

d. Failure to maintain accurate "as-built" or record drawings in accordance with FAR 52.236.21 and the contract.

e. Failure to submit accurate monthly schedule updates in accordance with the contract.

1.5.2 Payment for Onsite and Offsite Materials

Progress payments may be made to the Contractor for materials delivered on

the site, for materials stored off construction sites, or materials that are in transit to the construction sites under the following conditions:

a. FAR 52.232-5(b) Payments Under Fixed Price Construction Contracts.

b. Materials delivered on the site, but not installed, and off-site materials to be considered for progress payment must be major high cost, long lead, special order, or specialty items, not susceptible to deterioration or physical damage in storage or in transit to the construction site. Examples of materials acceptable for payment consideration include, but are not limited to, structural steel, non-magnetic steel, non-magnetic aggregate, equipment, machinery, large pipe and fittings, precast/prestressed concrete products, plastic lumber (e.g., fender piles/curbs), and high-voltage electrical cable. Materials not acceptable for payment include consumable materials such as nails, fasteners, conduits, gypsum board, glass, insulation, and wall coverings.

c. Provide the Contracting Officer with documentation (e.g., Purchase Orders or Material Contracts) to justify payment for materials in advance of installation. When appropriate, include the Defense Priorities and Allocations System (DFAS) ratings (e.g., DX or DO) on purchase orders or material contracts to ensure timely delivery.

d. Materials to be considered for progress payment prior to installation must be specifically and separately identified in the Contractor's estimates of work submitted for the Contracting Officer's approval in accordance with Earned Value Report requirement of this Contract. Requests for progress payment consideration for such items must be supported by documents establishing their value (e.g., paid invoices) and that the title requirements of the clause at FAR 52.232-5 Payments Under Fixed-Price Construction Contracts have been met.

e. Ensure materials are adequately insured and protected from theft and exposure. Provide insurance documentation (e.g., Builder's Risk Insurance) which covers the overall value of the materials to be paid in advance of installation.

f. Provide a written consent from the surety company with each payment request for offsite materials.

g. Materials to be considered for progress payments prior to installation must be stored in Guam. Other locations are subject to written approval by the Contracting Officer.

h. Materials in transit to the job site or storage site are not acceptable for payment.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS
11/20, CHG 5: 02/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

15 CFR 772	Definition of Terms
15 CFR 773	Special Licensing Procedures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

View Location Map

Progress and Completion Pictures

1.3 VIEW LOCATION MAP

Submit, prior to or with the first digital photograph submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.4 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 20 digital photographs each week throughout the entire project from a minimum of ten different viewpoints selected by the Contractor unless otherwise directed by the Contracting Officer. Submit with the monthly invoice one set of digital photographs in the agency construction management system of record, cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Provide photographs for each month in a separate monthly directory and name each file to indicate its location on the view location sketch. Also provide the view location sketch with the submission in the agency construction management

system of record as a digital file. Include a date designator in file names. Photographs provided are for unrestricted use by the Government.

1.5 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by FAR 28.307-2 Liability, during the entire period of performance under this contract. Provide other insurance coverage as required by Guamlaw.

1.6 SUPERVISION

1.6.1 Superintendent Qualifications

Provide project superintendent with a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

1.6.2 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

1.6.3 Duties

The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend Red Zone meetings, partnering meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

1.6.4 Non-Compliance Actions

The Project Superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time or excess costs or damages by the Contractor.

1.7 PRECONSTRUCTION MEETING

Immediately after award, prior to commencing any work at the site, coordinate with the Contracting Officer a time and place to meet for the Preconstruction Meeting. The meeting must take place within 35 calendar

days after award of the contract, but prior to commencement of any work at the site. The purpose of this meeting is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, invoicing, value engineering, safety, base-access, outage requests, hot work permits, schedule requirements, quality control, schedule of prices or earned value report, shop drawings, submittals, cybersecurity, prosecution of the work, government acceptance, final inspections and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and any required phasing.

1.7.1 Attendees

Contractor attendees must include the Project Manager, Superintendent, Site Safety and Health Officer (SSHO), Quality Control Manager and major subcontractors.

1.8 CYBERSECURITY OF CONTROL SYSTEMS

Discuss Cybersecurity of building control system requirements and submittals.

1.9 FACILITY TURNOVER PLANNING MEETINGS (Red Zone Meetings)

Meet with the Government to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start planning the turnover process at the Pre-Construction Conference meeting with a discussion of the Red Zone process and convene at regularly scheduled Red Zone Meetings beginning at approximately 75 percent of project completion. Include the following in the facility Turnover effort:

1.9.1 Red Zone Checklist

a. Contracting Officer's Technical Representative (COTR) will provide the Contractor a copy of the Red Zone Checklist template.

b. Prior to 75 percent completion, modify the Red Zone Checklist template by adding or deleting critical activities applicable to the project and assign planned completion dates for each activity. Submit the modified Red Zone Checklist to the Contracting Officer. The Contracting Officer may request additional activities be added to the Red Zone Checklist at any time as necessary.

1.9.2 Meetings

a. Conduct regular Red Zone Meetings beginning at approximately 75 percent project completion, or three to six months prior to Beneficial Occupancy Date (BOD), whichever comes first.

b. The Contracting Officer will establish the frequency of the meetings, which is expected to increase as the project completion draws nearer. At the beginning, Red Zone meetings may be every two weeks then increase to weekly towards the final month of the project.

c. Using the Red Zone Checklist as a Plan of Action and Milestones (POAM) and basis for discussion, review upcoming critical activities and strategies to ensure work is completed on time.

d. During the Red Zone Meetings discuss with the COTR any upcoming

activities that require Government involvement.

e. Maintain the Red Zone Checklist by documenting the actual completion dates as work is completed and update the Red Zone Checklist with revised planned completion dates as necessary to match progress. Distribute copies of the current Red Zone Checklist to attendees at each Red Zone Meeting.

1.10 EXPORT LICENSES FOR OVERSEAS PROJECTS

Obtain individual export licenses and project export licenses required by the Department of Commerce regulations (15 CFR 772 and 15 CFR 773) so that no delays are experienced in shipping from the United States of America to a foreign country. For additional information, the Contractor may contact one of the U.S. and Foreign Commercial Service District Offices of the Department of Commerce which are located in almost every State.

1.11 WAIVER FOR WORKER'S COMPENSATION

In addition to FAR 52.228-4 Workers' Compensation and War-Hazard Insurance Overseas, the Secretary of Labor has granted a waiver. The waiver does not apply to employees who are hired in the United States, or who are residents, or citizens of the United States.

1.12 PARTNERING

Host the partnering session within 45 calendar days of contract award. To most effectively accomplish this Contract, the Contractor and Government must form a cohesive partnership with the common goal of drawing on the strength of each organization in an effort to achieve a successful project without safety mishaps, conforming to the Contract, within budget and on schedule. The partnering team must consist of personnel from both the Government and Contractor including project level and corporate level leadership positions. Key Personnel from the supported command, end user, NAVFAC, PWD, FEAD/ROICC, Contractor, key subcontractors and the Designer of Record (DOR) (regardless of whether the contract is a design-build or a design-bid-build) are required to participate in the Partnering process.

1.12.1 Facilitated (Formal) Partnering

a. Within 35 calendar days after award and prior to the start of work, host a Formal Partnering session with key personnel from the project team including both Contractor and Government personnel. All costs associated with the Partnering session including the third-party independent Facilitator Consultant, meeting room and other incidental items are the responsibility of the Contractor.

b. Before the Facilitated (Formal) Partnering session, coordinate with the Facilitator all requirements for incidental items (such as audio-visual equipment, easels, flipchart paper, colored markers, note pads, pens/pencils, colored flash cards) and have these items available at the Partnering session. Provide copies of any documents required for distribution to all attendees. Participants will bear their own costs for meals, lodging and transportation associated with Partnering.

c. The Initial Partnering Session must be a duration of one day and be held at a location off base as agreed to by the Contracting Officer. Partnering session may take place concurrently with the

Pre-Construction Meeting.

d. Facilitator must be experienced in conducting corporate Partnering sessions and must be a third-party independent facilitating consultant - not an employee of the Contractor. The Facilitator is responsible for leading all aspects of the Partnering session necessary to achieve the Partnering goal.

e. An outcome of the Partnering session must be an escalation matrix agreed upon by both the Government and Contractor, which identifies key Government and Contractor decision makers by name and anticipated decision durations.

f. Host follow-on Partnering Sessions at three- to six-month intervals or more frequently if needed and lasting generally a half day or less. Attendees need only be those required to resolve current issues. The same Facilitator used in the Initial Partnering session must lead the follow-on sessions unless an alternative is permitted by the Contractor Officer. All costs associated with follow-on Partnering sessions are the responsibility of the Contractor.

1.13 MOBILIZATION

Mobilize to the jobsite within 60 calendar days after contract award. Mobilize is defined as having equipment AND having a physical presence of at least one person from the contractor's team on the jobsite.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 31 23.13 20

ELECTRONIC CONSTRUCTION AND FACILITY SUPPORT CONTRACT MANAGEMENT SYSTEM (eCMS)
08/23, CHG 1: 02/24

PART 1 GENERAL

1.1 CONTRACT ADMINISTRATION

Utilize the Naval Facilities Engineering Systems Command's (NAVFAC's) Electronic Construction and Facility Support Contract Management System (eCMS) for the transfer, sharing, and management of electronic technical submittals and documents. The web-based eCMS is the designated means of transferring technical documents between the Contractor and the Government. Paper media or email submission, including originals or copies, of the documents are not permitted unless identified within the contract.

All government contracting specialist/officer, legal, and command communications will remain the same.

1.2 USER PRIVILEGES

The Contractor's key staff may be provided access to eCMS. Contact the COR for eCMS account access. Project roles and system roles will be established to control each user's menu, application, and software privileges, including the ability to create, edit, or delete objects. Additional project roles may be assigned for workflow. The COR makes the final decision on roles for the project. User's ability to view, edit documents may be lowered at the discretion of the COR.

Only one eCMS user account is required regardless of the number of user's projects. Notify the COR within seven calendar days if a contractor user is no longer associated with company or project so they can remove them from any open record and inactivate them from the project.

1.2.1 eCMS Subcontractor Users

If the contractor's user is a subcontractor, the subcontractor must be registered under the name of their company and email. For example it is common for contractors to contract Quality Control Managers. The QC Manager's account should be under their company's name and email reducing the number of eCMS accounts required.

1.2.2 Users with Multiple Roles

Users may have multiple roles associated with their account within eCMS. Roles are used in workflow. When a user is added to the project, they will be assigned the default role when the user was created. Contact the COR to change or add roles to the user for the project.

1.2.3 Loss of Privilege

Users may lose privilege to access eCMS at the discretion of the Contracting Officer. The eCMS is a collaborative system that allows flexibility of use and does not restrict all inappropriate user actions. User activities are logged into eCMS in visible and background data

collection. Users found to use eCMS in an inappropriate action may have their eCMS access revoked. Examples include, but not limited to, fraudulent representations, sharing user accounts with others, and changing approved records without the consent of the COR. Depending on the severity of the infraction, the users can lose eCMS access for a period of time, permanently for the project, or lose eCMS access for any project. The contractor may appeal the suspension in writing to the contracting officer within 14 calendar days of notice. The appeal must identify the infraction, supporting information, and steps to ensure the infraction will not happen in the future.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contractor's Personnel

For Division 1 government approved Pre-Construction submittals, combine into a single Pre-Construction Submittal Package. Annotated with SD Type of SD-01. Pre-Construction submittal package approval date will be used as a KPI.

1.4 SYSTEM REQUIREMENTS AND CONNECTIVITY

1.4.1 General

NAVFAC eCMS requires a web-browser (platform-neutral) and Internet connection. For best results, recommend using browser in InPrivate/Incognito mode; Internet speeds greater than 40mbps when uploading files, computers with high RAM and Solid State Drives, "White List" eCMS website, Zip or Split files for better uploading. Non-NAVFAC Users are not to use VPN when using eCMS per NAVFAC IT.

The use of eCMS is required by the Contractor and all associated costs and time necessary to utilize eCMS will be borne by the Contractor with no allowance for time extensions and at no additional cost to the government.

1.4.2 Contractor Personnel List

Within twenty calendar days of contract award, provide to the Contracting Officer a list of Contractor's personnel who will have the responsibility for the transfer, sharing and management of electronic submittals, RFIs, daily reports, and other files and will require access to the eCMS. Project personnel roles which must be filled as applicable in the eCMS, include, at a minimum, the Contractor's Project Manager (KTR-PM), Superintendent (KTSUPT), Quality Control (QC) Manager (KTR-QC), Principal (KTR-PRIN), and Site Safety and Health Officer (KTR-SSHO). Notify the COR immediately of any personnel changes to the project. The Contracting Officer reserves the right to perform a security check on all potential users.

Provide the following information:

Company Name

Name (First, Last)

Email Address

Project Role (CQM, SSHO, Superintendent, CM, PM, Principal)

Existing or New eCMS User

1.5 SECURITY CLASSIFICATION

In accordance with Department of Navy guidance, all military construction contract data are unclassified, unless specified otherwise by a properly designated Original Classification Authority (OCA) and in accordance with an established Security Classification Guide (SCG). Refer to the project's OCA when questions arise about the proper classification of information.

In conformance with the Freedom of Information Act (FOIA), DoD INSTRUCTION 5200.48 CONTROLLED UNCLASSIFIED INFORMATION (CUI), and DoD requirements, any unclassified project documentation uploaded into the eCMS must be designated either "U - UNCLASSIFIED" (U) or "CUI - CONTROLLED UNCLASSIFIED INFORMATION" (CUI).NAVFAC eCMS must only be used for the transaction of unclassified information associated with construction projects. Controlled Unclassified Identification (CUI) documents may be loaded into eCMS with the appropriate markings.

1.5.1 Markings on CUI Documents

Contractor's proprietary information, or documents determined by the originator in accordance with CUI guidance, should be marked CUI. Proprietary information not marked CUI can be released under the Freedom of Information Act (FOIA). Apply the appropriate markings before any document is uploaded into eCMS. Markings are not required on Unclassified U documents.

1.6 eCMS UTILIZATION

Establish, maintain, and update data and documentation in the eCMS throughout the duration of the contract. Utilize eCMS to transfer all submittals, RFIs, daily reports, and other files required by contract to be forwarded to the government.

Full eCMS use is required. All Submittals/Information to use eCMS Modules including, but not limited to, RFIs, Daily Reports, Meeting Minutes, Communications, Issues, Punch Lists, Checklists, and Flysheets, unless otherwise directed by the COR or Contracting Officer.

1.6.1 Restricted Information

Personally Identifiable Information (PII) transmittal such as credit card, driver's license, passport, social security, and payroll number are not permitted in eCMS. Name, address, and email are permitted. Pre-negotiation information such as cost estimates that require formal negotiations are not allowed. For example, proposed changes over the SAP level of $250k require formal negotiations. Cost estimates for LEAN, ULTRA LEAN, and Design Changes under the SAP level are at the discretion of the COR's or Contract Specialist/Officer's direction. The eCMS must only be used for the transaction of unclassified information associated

with construction projects. Controlled Unclassified Identification (CUI) documents may be loaded into eCMS with the appropriate markings. Uploading of files directly into the Documents folder is not allowed. All documents must be uploaded using an eCMS module.

1.6.2 Naming Convention for Files

Titles of files uploaded are to be descriptive of the purpose and content of the file. For example RFI_ROOF_Leak.doc or for submittals, SUB_LIGHT_FIXTURE.pdf. Titles of file to be uploaded must only contain uppercase letters, lowercase letters, numbers, hyphens (-), underscores (_) and periods (.). Use of any other characters is not allowed and may create an error. When practicable, adding the record number to the title is desired. For example RFI_XYZ12345_ROOF_Leak.doc. Uploading files with the same title will create a new revision in eCMS. Original revision is Rev 0, the first revision is Rev 1. Uploaded files are to use the default file location regardless of the module used unless directed by the COR.

Table 1 also identifies which eCMS application is to be used in the transmittal of data (these are subject to change based on the latest software configuration).

Table 1 - Project Documentation Types

SUBJECT/NAME	REMARKS	eCMS APPLICATION
As-Built Drawings	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals
Building Information Modeling (BIM)	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals
Construction Permits	Refer to rules of the issuing activity, state or jurisdiction	Submittals
Construction Schedules (Activities and Milestones)		Submittals
Construction Schedules		Submittals
Construction Schedules (3-Week Look ahead)	Import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Meeting Minutes

SUBJECT/NAME	REMARKS	eCMS APPLICATION
DD 1354 Transfer of Real Property	When applicable, required for final billing.	Submittals
Daily Production Reports	Provide weather conditions, crew size, man-hours, equipment, and materials information	Daily Report
Daily Quality Control (QC) Reports	Provide QC Phase, Definable Features of Work Identify visitors	Daily Report
Designs and Specifications	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals
Environmental Notice of Violation (NOV), Corrective Action Plan	Refer to rules of the issuing activity, state or jurisdiction	Submittals
Environmental Protection Plan (EPP)		Submittals
Invoice (Supporting Documentation)	Applies to supporting documentation only. Invoices are submitted in Wide-Area Workflow (WAWF)	Submittals
Jobsite Documentation, Bulletin Board, Labor Laws, SDS	Redact any PII information when loaded into eCMS	Submittals
Meeting Minutes		Meeting Minutes
Modification Documents	Provide final modification documents for the project. Upload into Modifications RFPs folder	Communications
Operations & Maintenance Support Information (OMSI/eOMSI), Facility Data Worksheet	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals

SUBJECT/NAME	REMARKS	eCMS APPLICATION
Photographs	Subject to base/installation restrictions	Submittals
QCM Initial Phase Checklists		Meeting Minutes or Checklists
QCM Preparatory Phase Checklists		Meeting Minutes or Checklists
Quality Control Plans		Submittals
QC Certifications		Submittals
QC Punch List		Punch Lists
Red-Zone Checklist		Punch List or Checklists
Rework Items List		Punch Lists
Request for Information (RFI) Post-Award		RFIs
Safety Plan		Submittals
Safety - Activity Hazard Analyses (AHA)		Submittals
Safety - Mishap Reports		Daily Report
Shop Drawings	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals
Storm Water Pollution Prevention (Notice of Intent - Notice of Termination)	Refer to rules of the issuing activity, state or jurisdiction	Submittals
Submittals and Submittal Register		Submittals

SUBJECT/NAME	REMARKS	eCMS APPLICATION
Testing Plans, Logs, and Reports		Submittals
Training/Reference Materials		Submittals
Training Records (Personnel)	Redact any PII information if storing in eCMS	Submittals
Utility Outage/Tie-In Request/Approval		Submittals
Warranties/BOD Letter		Submittals
Quality Assurance Reports		Checklists (Government initiated)
Non-Compliance Notices		Non-Compliance Notices (Government initiated)
Other Government-prepared documents		GOV ONLY
Letters to government contracting, claims, REAs, and other contracting officer communications	eCMS is not the primary tool to use in contracting officer communications. eCMS can only store documents or letters after the submission to the contracting officer is made.	Communications
All Othere Documents	Refer to FOIA guidelines and contact the FOIA official to determine whether exemptions exist	As applicable

1.6.3 RFIs Module

Create contractor RFIs using eCMS RFIs module. The contractor must confirm the numbering convention with the COR if different than eCMS default.

If the government (GOV) Response has "No" Cost or Schedule Impact, this reply is given with the expressed understanding that it does not constitute a basis for any change in the amount or time of subject contract. Information provided in this response does not authorize work not currently included in the contract. If GOV Response is "Yes" or "Potentially" then this response may require a change to the contract. If the contractor disagrees with either the government's No Cost

determination or No Schedule impact determination, or both, the contractor has 14 calendar days to notify the COR and Contracting Officer in writing.

1.6.4 Submittals Module

Create contractor submittals using eCMS Submittals module. The contractor must confirm the numbering convention with the COR if different than eCMS default.

1.6.5 Submittal Packages Module

Create submittal packages using the eCMS Submittal Packages module in lieu of or in addition to Related Objects. Submittal Packages track completion of the packaged submittals and is used in NAVFAC HQ's KPIs.

1.6.6 Communications Module

Create communications using the eCMS Communications module. The Communications module is used to create or document communications that are not a part of other eCMS modules. Use of Communications module will memorialize information into an eCMS record file. The following are Types of Communications:

Email

Memo to File

Face to Face

Telephone

Web Collaboration

Photos

Other Documents

Other

Unless directed by the COR, upload documents or files that do not have a corresponding eCMS module. Choose "Photos" Type for Photos and "Other Documents" for all other documents.

1.6.7 Issues Module

Create or respond to issues using the eCMS Issues module. Respond to CPARS issues using the Issues module.

1.6.8 Meeting Minutes Module

Create or respond to Meeting Minutes using the eCMS Meetings module.

Document required contractual meetings. Dates of meetings are used in NAVFAC KPIs. Minimum meetings in eCMS include the following:

Post Award Kickoff (PAK)

Pre-construction (Pre Con)

Initial and Preparatory Three Phases of Control

Quality Control (QC)

1.6.9 Potential Change Items Module

Not used.

1.6.10 Daily Report Module

Create Daily Reports using the eCMS Daily Report Module. The contractor must confirm the numbering convention with the COR if different than eCMS default.

1.6.11 Punchlists Testing Logs (Legacy)

Punchlist Testing Logs is a legacy program that is being replaced by the Punch Lists Module. This module is to be used for reference of past projects. Use the Punch Lists Module for all future work.

1.6.12 Punch Lists Module

The eCMS Punch Lists module is useful more than just for Punchlists. The module includes the capability of batch editing, create items from Optical Character Recognition (OCR) plans, assign tasks and track completion of individual items.

Create the following using the Punch Lists module:

Rework Items List

DFOW List

Punch-Out Inspection

Pre-Final Punchlist Inspection

Final Punchlist Inspection

Testing Logs

1.6.13 FWD UltraLean COAR RFP Module

Not Used.

1.6.14 Non-Compliance Notices (NCN) Module

Respond to Non-Compliance Notices listed in the Non-Compliance Notices module.

1.6.15 Checklists

Use Checklist listed in the contractor's eCMS menu and as directed by the COR. Checklists capture data and is used in dashboards and KPIs.

1.6.15.1 Partnering Team Health Survey Checklist

Contractor must use the eCMS checklist to document the partnering team health survey. Partnering Team Health Survey is in accordance with the

Partnering Specification of this contract.

1.6.16 Flysheets

Use Flysheets listed in the contractor's eCMS menu, if available, and as directed by the COR. Flysheets allow the contractor to print out information from other systems and upload into eCMS. The eCMS will use OCR to capture the information as data. Flysheets capture data and used in dashboards and KPIs.

1.6.17 eCMS Outage

In the case where eCMS is unavailable for 8 hours or more, paper or email may be used in the interim to maintain project schedule.

Once the system is operational, all final records are required to be recreated using the appropriate module. Subject/title of the record to include the type of record i.e., RFI/Submittal/Daily Report/Communication/Other, the identification number(s), and the statement "Processed Outside of eCMS". Example, "RFI 001 Processed Outside of eCMS".

1.6.18 User Account Activity

NAVFAC eCMS captures user data and activities that are directly related to the user's account. The user agrees through the use of eCMS, their account activities will be captured and can be displayed on eCMS printed reports.

1.7 QUALITY ASSURANCE

Requested Government response dates on Submittals must be in accordance with the terms and conditions of the Contract unless previously agreed by the COR. Requesting response dates earlier than the required review and response time, without concurrence by the Government COR, may be cause for rejection.

Incomplete submittals will be rejected without further review and must be resubmitted. Required Government response dates for resubmittals must reflect the date of resubmittal, not the original submittal date.

All submittals and associated attachments must be transmitted to the Government via the COR. Transmittals are no longer required when using eCMS since approval status is tracked on the submittal. Transmittal forms can be attached to submittals if approved by the COR. Submittals requiring government approval are "Transmitted For" "Approval". Submittals requiring contractor approved submittals, including those designated for Contractor Quality Control approval or Information Only, are "*Transmitted For" "Information Only" in the Submittal Module. Provide and sign the QC certification or approving statement on the attachment per submittal specification section. When Submittal Packages are required, use eCMS Submittal Packages after creating individual submittals. Importing Submittals from the Submittal Register is optional. Contact the COR for the data conversion requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 32 17.00 20

COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS)
05/25

PART 1 GENERAL

1.1 DEFINITIONS

The cost-loaded Network Analysis Schedule (NAS) is a tool to manage the project, both for Contractor and Government activities. The NAS is also used to report progress, evaluate time extensions, and provide the basis for progress payments.

For consistency, when scheduling software terminology is used in this section, the terms in Oracle Primavera's scheduling programs are used.

1.2 NAS REQUIREMENTS PRIOR TO THE START OF WORK

1.2.1 Preliminary Scheduling Meeting

Before preparation of the Baseline NAS, and prior to the start of work, meet with the Contracting Officer to discuss the proposed NAS and the requirements of this section. Propose projected data dates for monthly update NAS for the project and incorporate each monthly update submittal into the submittal register. Discuss required forms, terminology, and submittal requirements of this section and other requirements related to schedule management for this contract. Use the NAVFAC-provided Preliminary Scheduling Meeting Guideline in the completion of the intended mutual understanding.

1.2.2 Baseline NAS

Submit the Baseline NAS within 30 calendar days after contract award. Data date must be set to contract award date and no progress recorded for any activity. Only bonds and the required Preliminary Scheduling Meeting may be recorded as complete prior to acceptance of the Baseline NAS. The acceptance of a Baseline NAS is a condition precedent to:

a. The Contractor starting demolition work or construction stage(s) of the contract.

b. Processing Contractor's invoices(s) for any items other than bonds.

c. Review of any NAS updates. The contractor is still required to submit monthly NAS updates. Without an accepted baseline NAS, the Government may return Monthly NAS update as received for record.

Submittal of the Baseline NAS is the Contractor's certification that the submitted NAS meets the requirements of the Contract Documents and represents the Contractor's plan on how the work will be accomplished. Provide all items listed in paragraph REQUIRED TABULAR REPORTS AND NATIVE P6 XER FILES with baseline NAS submittal.

1.3 WEEKLY LOOK AHEAD SCHEDULE

1.3.1 Quality Control and Production Integration with NAS

Submit the first Look Ahead Schedule 30 days after contract award and continue to submit weekly until contract completion.

Transmit the Weekly Look Ahead Schedule Submittal to the Contracting Officer on the first day of the current week that the Look Ahead Schedule covers and at least one working day prior to any Quality Control meetings. Contractor is required to provide all attendees at meetings with a copy of the Look Ahead Schedule. A Look Ahead Schedule is required to be submitted weekly regardless of whether a meeting is held or not.

1.3.2 Weekly Look Ahead Schedule Requirements

Prepare and issue a Four-Week Look Ahead Schedule to provide a more detailed day-to-day plan of upcoming work identified on the current Network Analysis Schedule. Requirements include:

a. For each Look Ahead Schedule activity, identify parent NAS activity number(s). The parent NAS activity is the activity in the NAS that would incorporate the Look Ahead Schedule activity requirement and scope of work.

b. Update schedule each week to show the planned work for the following four-week period. Also include previous week, as-built work, showing actual start and finish dates.

c. Include upcoming outages, closures, preparatory meetings, and initial meetings, testing and inspections.

d. Identify any offsite fabrication and production activities.

e. Clearly identify Longest Path activities on the Weekly Look Ahead Schedule. Include a key or legend that distinguishes longest path activities. Include all Longest Path activity NAS start/finish dates exceeded and occurring during this period.

f. Identify responsibility for each activity.

g. The detail work plans are to be bar chart type schedules, derived from but maintained separately from the Project NAS on an electronic spreadsheet program and printed on 11 by 17 inch sheets as directed by the Contracting Officer.

h. Activities must not exceed 5 working days in duration and have sufficient level of detail to assign crews, tools and equipment required to complete the work.

i. Look Ahead activities are not limited to only onsite work. Include submittal, offsite fabrication, and procurement activities. Include design activities, meetings, and coordination when part of scope.

j. Upload the Weekly Look Ahead Schedules to eCMS as a submittal by the date and time required.

1.4 MONTHLY NETWORK ANALYSIS

Submittal of Monthly NAS is the Contractor's certification that the submitted NAS meets the requirements of the Contract Documents and represents the Contractor's plan on how the work will be accomplished. Provide all items listed in paragraph REQUIRED TABULAR REPORTS AND NATIVE P6 XER FILES with the monthly NAS submittal.

1.4.1 Monthly Update Meeting

Meet with Government representative(s) at monthly intervals to review and agree on the information presented in the Monthly NAS Update. The Monthly Update Meeting must be a separate and distinct meeting from other meetings required of the contract. As a minimum, accomplish the following with each meeting held monthly:

a. Prior to the meeting, provide an agenda of proposed topics to be discussed to include but not limited to narrative report and items listed in paragraph REQUIRED TABULAR REPORTS. Document agenda and minutes with Meeting Minutes object in eCMS for each monthly update meeting.

b. The Approved Designated Project Scheduler must present the NAS data using Oracle Primavera P6 software and have baseline NAS, monthly update NAS, and Time Impact Analysis native files available to review as necessary.

c. Review Time Impact Analysis.

d. Document action items in eCMS Meeting Minutes for necessary revisions to Monthly NAS Update and to address any delays and or problem areas in a timely manner.

1.4.2 Monthly NAS Updates

a. The submission of an accepted, updated NAS to the Government is a condition precedent to the processing of the Contractor's invoice.

b. Regardless of whether an invoice is being submitted monthly, or no project progress occurred, an updated NAS (or with new data date) must be submitted monthly to the Government. The Monthly NAS update must be submitted within 5 calendar days of the data date.

c. Regardless of whether a baseline or other NAS is submitted and accepted, an updated NAS must be submitted monthly to the Government. Monthly updates submitted before the baseline being accepted may be returned as received for record.

d. Provide all items listed in paragraph REQUIRED TABULAR REPORTS AND NATIVE P6 XER FILES, with each monthly NAS update submittal.

e. Activity progress must incorporate as-built events as they occurred and correspond to records including but not limited to submittals and daily production and quality control reports.

f. Software Settings: Handle NAS calculations through Retained Logic, not Progress Override. Out of Sequence progress is not allowed. Relationships must be changed to reflect as-built relationships. Show all activity durations and float values in days. Show activity

progress using Remaining Duration. Set default activity type to "Task Dependent".

g. Updated NAS must reflect current Contract Completion Date and contract value in accordance with all conformed contract modifications issued prior to data date of NAS update.

1.4.3 As-Built NAS

As a condition precedent to the release of retention and making final payment, submit an "As-Built NAS," as the last NAS update showing all activities at 100 percent completion. This NAS must reflect the exact manner in which the project was actually constructed.

1.5 CORRESPONDENCE AND TEST REPORTS

Reference NAS Activity IDs that are being addressed in each correspondence (e.g., letters, Submittals, Requests for Information (RFIs), e-mails, meeting minute items, Production and QC Daily Reports, material delivery tickets, photographs) and test report (e.g., concrete, soil compaction, weld, pressure).

1.6 ADDITIONAL NETWORK ANALYSIS SCHEDULE REQUIREMENTS

Other specification sections may include additional NAS related requirements, including systems to be inspected, tested and commissioned, and submittal procedures. Those requirements must be incorporated into the NAS.

1.7 SUBMITTALS

Government approval/acceptance is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Baseline NAS; G

Designated Project Scheduler; G

SD-07 Certificates

Weekly Look Ahead Schedule

Monthly NAS Updates; G

SD-11 Closeout Submittals

As-Built NAS; G

1.8 SOFTWARE

Prepare and maintain project NAS using Oracle Primavera P6 software in a version compatible with Government's current version. Submit XER files exported as version 17 or earlier. Importing data into P6 using data conversion techniques or third party software is cause for rejection of the submitted NAS. NAS with Performing Organizational Breakdown Structure

(POBS) data in any form other than column is cause for rejection. NAS must be scheduled by using the Schedule command after last entry in Oracle Primavera P6 prior to export for submission to the Government.

1.9 DESIGNATED PROJECT SCHEDULER

Within 30 calendar days of contract award, submit to the Contracting Officer for approval an individual who will serve as the Designated Project Scheduler. Include a copy of the candidate's resume with qualifications. The Designated Project Scheduler is subject to removal by the Contracting Officer for non-compliance with the requirements specified in the Contract. Payment request will not be processed without an approved Designated Project Scheduler.

1.9.1 Qualifications

The Designated Project Scheduler must have served as a scheduler and prepared and maintained at least three previous NAS for projects, at least one within the last 5 years of similar size and complexity to this contract, using Oracle Primavera P6.

1.9.2 Duties

Duties of the Designated Project Scheduler include to be actively involved and be responsible for the following:

a. Prepare Baseline NAS.

b. Prepare monthly NAS updates.

c. Prepare tabular reports.

d. Prepare Time Impact Analysis (TIA) as necessary.

e. Provide certification of contract compliance for each NAS and TIA submittal transmitted to government for review.

f. Participate with the Prime Contractor and Government Representative in a monthly teleconference call, or meeting at the job site in-person, and scheduled with sufficient time to support the Monthly Network Analysis Updates process, to discuss project status, NAS updates, critical activities, potential delays, and contract modifications impacting any project progress. Have a computer with P6 software available during the meeting.

g. Be present on the project site full-time during working hours.

1.10 NETWORK SYSTEM FORMAT

Prepare the NAS in accordance with the following Primavera P6 settings and parameters. Deviation from these settings and parameters, without prior consent of the Contracting Officer, is cause for rejection of NAS submittal.

1.10.1 NAS Activity Properties and Level of Detail

1.10.1.1 Activity Identification and Organization

a. Identify construction activities planned for the project and other

activities that could impact project completion if delayed in the NAS.

b. Each activity must have a unique name.

c. Identify administrative type activity/milestones, including all pre-construction submittal and permit requirements prior to demolition or construction stage.

d. Include durations for procurement, Contractor quality control, acceptance testing and training in the NAS.

e. Include the Government approval time required for the submittals that require Government Approval prior to construction, as indicated in Section 01 33 00 SUBMITTAL PROCEDURES.

f. Create separate activities for each Phase, Area, Floor Level and Location the activity is occurring.

g. Do not use activities to represent non-work type reference (e.g., Serial Letter, Request for Information) in NAS. When RFIs need to be included in NAS, identify Non-work reference with use of added Activity codes (e.g, RFI code, Serial Letter Code). Document use of added activity codes in narrative report.

Activity categories included in the NAS are specified below.

1.10.1.2 Activity Logic

a. With the exception of the Contract Award and Contract Completion Date (CCD) milestone activities, activity must not be open-ended; each activity must have at least one predecessor and at least one successor.

b. Activities must not have open start or open finish (dangling) logic.

c. Do not use lead or lag logic without Contracting Officer prior approval. Request for approval must be submitted at the required Preliminary Scheduling Meeting for use in the Baseline NAS and at the required Monthly Network Analysis Update Meeting for use in a monthly updated NAS.

d. Minimize redundant logic ties.

e. Once an activity exists on the NAS it must not be deleted or renamed to change the scope of the activity and must not be removed from the NAS logic without approval from the Contracting Officer. Request for approval must be submitted with the required Monthly NAS Update Narrative.

f. While an activity cannot be deleted, where said activity is no longer applicable to the NAS, but must remain within the logic stream for historical record, change the activity original and remaining duration to zero and clearly label "(NO LONGER REQUIRED)" after the Activity Name.

(1) Document any such change in the activities' "Notebook," including a date and explanation for the change.

(2) The ID number for a "NO LONGER REQUIRED" activity must not be re-used for another activity.

g. No activity can be added to the NAS without the prior approval from the Contracting Officer. Request for approval must be submitted at the required Monthly Network Analysis Update Narrative for use in a monthly updated NAS.

h. Activity Type for all activities except for milestones must be set to "Task Dependent". "Level of Effort" Activity Type is not allowed.

i. Duration Type for all activities except for milestones must be set to "Fixed Duration & Units".

j. Percent Complete Type for all activities including milestones must be set to "Physical".

1.10.1.3 Longest Path Activity Baseline Limitation

For P6 settings, critical activities are defined as being on the Longest Path. Longest Path (Critical) Activities must not make up more than 30 percent of all activity within the Construction Baseline NAS.

1.10.1.4 Assigned Calendars

All NAS activity must be assigned calendars that reflect required and anticipated non-work days.

Total work hours/day for all defined calendars is set to 8.

1.10.1.5 Activity Categories

1.10.1.5.1 Pre-construction Activities

Examples of pre-construction activities include, but are not limited to, bond approval, permits, pre-construction submittals and approvals. Include pre-construction activities that are required to be completed prior to the Contractor starting the demolition or construction stage of work.

1.10.1.5.2 Procurement Activities

Include activities necessary to manage the ordering, fabrication, and delivery of material and equipment. Procurement activities must not have a duration in excess of 60 calendar days without prior approval by the Contracting Officer. Include within sequence of off-site assembly and fabrication any quality control and testing being performed.

Examples of procurement activities include, but are not limited to: Material/equipment submittal preparation, submittal and approval of material/equipment; material/equipment fabrication and delivery, and material/equipment on-site. As a minimum, separate procurement activities must be provided for critical items, long lead items, items requiring Government approval and material/equipment procurement for which payment will be requested in advance of installation. Show each delivery with relationship tie to the Construction Activity specifically for the delivery.

1.10.1.5.3 Government Activities

Government and other agency activities that could impact progress must be

clearly identified. Government activities include, but are not limited to; Government approved submittal reviews, Government conducted inspections/tests, environmental permit approvals by State regulators, utility outages, and delivery of Government Furnished Material/Equipment.

1.10.1.5.4 Construction Quality Management (CQM) Activities

The Preparatory and Initial Phase meetings for each Definable Feature of Work identified in the Contractor's Quality Control Plan must be included in the Weekly Look Ahead Schedules. Preparatory and Initial phase meetings are not required in the NAS, but can be represented by a start milestone linked to successor parent Construction Activity. The Follow-up Phase must be represented by the Construction Activities themselves in the NAS.

1.10.1.5.5 Construction Activities

On-site construction activities that are the responsibility of the Contractor or Contractor's subcontractors must not have a duration in excess of 20 working days without prior approval by the Contracting Officer. Contractor activities must be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days, unless otherwise defined in this contract. Federal Holidays are as defined in Federal Law 5 USC 6103.

1.10.1.5.6 Turnover and Closeout Activities

Include activities or milestones for items on the NAVFAC Red Zone Checklist/POAM that are applicable to this project. As a minimum, include required Contractor testing, required Government acceptance inspections on equipment, Pre-Final Inspection, Punch List Completion, Final Inspection and Acceptance. Add an unconstrained start milestone for the initial NAVFAC Red Zone - Facility Turnover Planning Meeting at approximately 75 percent construction contract completion or six months prior to Contract Completion Date (CCD), whichever is sooner. Include a separate NAVFAC Red Zone - Facility Turnover Planning Meeting Milestone for each phase if the contract requires construction to be completed in phases.

1.10.1.6 Contract Milestones and Constraints

1.10.1.6.1 Project Start Date Milestones

Include as the first activity on the NAS a start milestone titled, "Contract Award", which must have a Mandatory Start constraint equal to the Contract Award Date.

1.10.1.6.1.1 Post-Award Kickoff (PAK) meeting Milestone

Include an unconstrained finish milestone on the NAS titled, "Post-Award Kickoff Meeting". The Post Award Kickoff Meeting may be a single day, or it may range over several days. The intent is to cover all PAK topics, including Partnering and Concept Design Workshop (if required) in one continuous session.

1.10.1.6.2 Pre-Construction Meeting Milestone

Include an unconstrained finish milestone on the NAS titled, "Pre-Construction Meeting". The Pre-Construction meeting may be a single day, or it may range over several days. The intent to cover all the

Pre-Con topics, including Partnering and DD1354.

1.10.1.6.3 Preconstruction Submittals Finish Milestone

Include an unconstrained finish milestone on the NAS titled, "Preconstruction Submittals". This milestone is complete when all required preconstruction submittals have been reviewed and approved by the Government.

1.10.1.6.4 Contractor Mobilization Finish Milestone

Include an unconstrained finish milestone on the NAS titled, "Contractor Mobilization".

1.10.1.6.5 NAVFAC Red Zone - Facility Turnover Planning Meeting Milestones

See paragraph TURNOVER AND CLOSEOUT ACTIVITIES above.

1.10.1.6.6 Substantial Completion Milestone

Include an unconstrained finish milestone on the NAS titled "Substantial Completion." Substantial Completion is defined as the point in time the Government would consider the project ready for beneficial occupancy wherein by mutual agreement of the Government and Contractor, Government use of the facility is allowed while construction access continues in order to complete remaining items (e.g., punch list and other close out submittals). Include a separate Substantial Completion Milestone for each phase if the contract requires construction to be completed in phases.

1.10.1.6.7 DD-1354 Finish Milestone

Add unconstrained finish milestone, titled "DD-1354" and scheduled 30 calendar days prior to Substantial Completion, whenever a Form DD-1354 is required in accordance with Section 01 20 00 PRICE AND PAYMENT PROCEDURES. Include a separate DD-1354 Finish Milestone for each phase if the contract requires construction to be completed in phases.

1.10.1.6.8 Project Completion Milestone

Include an unconstrained finish milestone on the NAS titled "Project Completion." Project Completion is defined as the point in time all contract requirements are complete and verified by the Government with a successful Final Inspection in accordance with Section 01 45 00 QUALITY CONTROL. This milestone must have the Contract Completion Date (CCD) milestone as its only successor.

1.10.1.6.9 Contract Completion Date (CCD) Milestone

Last NAS entry must be an unconstrained finish milestone titled "Contract Completion (CCD: DD-MM-YY)." DD-MM-YYYY is the current contract completion date at data date, day-month-year corresponding to P6 Must Finish By Date. NAS milestone updates of Project Completion finish date for longest path must reflect calculated float as positive or negative based on CCD. Calculation of NAS updates must be such that if the finish of the "Project Completion" milestone falls after the contract completion date, then negative float is calculated on the longest path. If the finish of the "Project Completion" milestone falls before the contract completion date, the float calculation must reflect positive float on the longest path.

1.10.1.6.10 Additional Milestones

Provide up to five additional milestones as required by Contracting Officer.

1.10.1.7 Work Breakdown Structure & Activity Code

At a minimum, establish a Work Breakdown Structure (WBS) and provide activity codes identified as follows:

1.10.1.7.1 Work Breakdown Structure (WBS)

Group all activities and milestones within appropriate WBS elements/levels including, at a minimum, the following:

a. Project Milestones:

(1) Management Milestones

(2) Project Administrative Meetings

(3) Permits

b. Pre-Construction Phase:

(1) Submittals and Reviews

(2) Procurement

(3) Mobilization

c. Construction Phase: Create multiple elements/levels in accordance with project specific definable features of work including in WBS descending order as follows:

(1) General Area

(a) Type of Work Item

1. Location

d. Project Closeout: Include activity items such as, but not limited to, Punchlist, Demobilization, O&M, As-built Drawings, Training, and As-built NAS.

e. Modifications: Create Conformed and Non-Conformed elements/levels under Modification WBS. Create multiple elements/levels as the project progresses identified by issue and Fragnet placed in Conformed for modifications issued prior data date, or Non-Conformed for issues not modified to contract prior data date.

f. Removed Activity: Activity is "removed" by remaining within logic sequence, eliminating duration and adding "(NO LONGER REQUIRED)" after Activity Name in Activity Table.

1.10.1.7.2 Responsibility Code

Use "RESP" for Activity Code Name. All activities in the project NAS must

be identified with the resource, including business name, for completing the task. Activities must not belong to more than one responsible party.

1.10.1.7.3 Activity Category Code

Use "CAT" for Activity Code Name for the following Project Level activity codes:

a. Assign "PROC" value to Procurement type activity

b. Assign "PRE-CON" value to Pre-construction activity

c. Assign "CONS" value to Construction type activity

d. Assign "TEST" value to dedicated testing type activities

e. Assign "CX" value to dedicated Commissioning type activities

f. Assign "CLOS" value to dedicated Close Out type activity

g. Assign "OTHR" to other activity not otherwise designated

1.10.1.7.4 Additional Activity Codes

Provide up to an additional five activity codes as required by the Contracting Officer

1.10.1.7.5 Drawing Code

Identify all activities in the project NAS with its respective Drawing Code. The Drawing Code is the Sheet Number on the primary project drawing which indicates work to be performed. If an activity does not have an applicable Drawing Code (e.g., Mobilize), the code must be "0000".

1.10.1.7.6 Construction Specification Institute (CSI) Masterformat Code

Identify all activities in the project NAS with its respective Specification Section number. Activities must not belong to more than one Section number. If an activity does not have an applicable CSI Code (e.g., Mobilize), the code must be "0000".

1.10.1.8 Adverse Weather Lost Work Days

Use the National Oceanic and Atmospheric Administration's (NOAA) Summary of Monthly Normals report to obtain the historical average number of days each month with precipitation, using a nominal 30-year, greater than 0.10 inch precipitation amount parameter, as indicated on the Station Report for the NOAA location closest to the project site as the basis for establishing a "Weather Calendar" showing the number of anticipated non-workdays for each month due to adverse weather, in addition to Saturdays, Sundays and all Federal Holidays as non-work days.

Use the following schedule of anticipated monthly non-work days due to adverse weather as the basis for establishing a "Weather Calendar" showing the number of anticipated non-workdays for each month due to adverse weather, in addition to Saturdays, Sundays and all Federal Holidays as non-work days.

HONTHLY ANTICIPATED ADVERSE WEATHER LOST WORK DAY											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2	1	1	1	2	2	5	7	6	5	3	2

Assign the Weather Calendar to any activity that could be impacted by adverse weather. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time only extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay days exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities are on the longest path to contract completion in the period when delay occurred. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity. Impacts resulting from adverse weather must be documented in Narrative Report for the month that it occurred.

Make changes to P6 project calendars to reflect as-built conditions where work occurred where originally anticipated as non-work days, and where work did not occur (lost work day).

1.10.1.9 Anticipated Restricted Delays

Use anticipated non-working days as defined in Section 01 14 00 WORK RESTRICTIONS, use Anticipated Restricted Delays as basis for establishing a "Security Calendar" showing the number of anticipated non-workdays for each month due to anticipated restrictions, in addition to anticipated adverse weather, Saturdays, Sundays and all Federal Holidays as non-work days. Assign the Security Calendar to any activity that could be impacted by restriction delays. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time extension for the difference of days between the anticipated and actual lost work days if the number of actual restriction delay days exceeds the number of anticipated for the month in which the delay occurs and the restriction delayed activities are critical to contract completion. A lost workday due to restriction delay is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity.

Impacts resulting from restriction delays must be documented in Narrative Report for the month that it occurred.

Make changes to P6 project calendars to reflect as-built conditions where work occurred where originally anticipated as non-work days, and where work did not occur (lost work day).

1.10.1.10 Cost Loading

The Project Network Analysis Schedule (NAS) must be cost-loaded and will provide the basis for progress payments. Earned Value Reports must be derived from and correspond to cost loaded NAS. Use the Critical Path Method (CPM) and the Precedence Diagram Method (PDM) to satisfy time and cost applications.

Sum of all costs assigned to activities must equal the current contract value as of the data date of the baseline or update NAS. Activity cost

loading must be without front-end loading. Provide additional documentation if requested by the Contracting Officer.

1.10.1.10.1 Cost Loading Activities

a. Cost load construction activities. Define construction activities as on-site work activities that can be traced directly to the construction, alteration, demolition, repair of a project facility, infrastructure, or sitework.

b. Assign costs for materials which payment will be requested in advance of installation, including their quantities, to their respective procurement activities that were approved by the Contracting Officer. Assign labor costs, including their quantities, for material and equipment paid for after installation to their respective construction activities.

c. Costs for mobilization will not be paid as individual pay items with the exception of batch plant set-up, mobilization of dredging equipment or other similar labor-intensive situations. If payment for mobilization costs are approved, assign costs for demobilization activities. The value of demobilization activities must not be less than 40 percent of the total costs for mobilization activities. If not approved as a separate line item, evenly disperse over construction activities the costs for mobilization and demobilization.

d. The value of commissioning, testing, and closeout WBS section may not be less than 10 percent of the total costs for procurement and construction activities.

e. ALL activities assigned Government responsibility will have Zero Cost. No contractor cost should be assigned to an activity designated as a Government responsibility.

f. Do not include field overhead positions as individual cost loaded activities. Evenly disperse non-construction costs (e.g., meetings, presentations, submittals, surveys, haul road or storage yard maintenance, dust control, security) and profit to construction activities assigned to the Construction Phase WBS level.

g. If assigning resources to activities, setting for Calculate costs from units in Resources tab must be unchecked.

1.10.1.10.2 Partial Payment

Breakdown unit of measure and cost must be defined within P6 Activity Detail Expenses for partial payment of any cost loaded activity. Lump sum cost loaded activity will not be partially paid.

1.10.2 NAS Software Settings and Restrictions

a. Activity Constraints: Date/time constraint(s), other than those required by the contract, are not allowed unless accepted by the Contracting Officer. Identify any constraints proposed and provide an explanation for the purpose of the constraint in the Narrative Report as described in paragraph REQUIRED TABULAR REPORTS.

b. Default Progress Data Disallowed: Actual Start is date work begins on activity with intent to pursue work to substantial completion. Actual

Finish is date work is substantially complete to point where successor activity can begin. Actual dates on the NAS must correspond with activity dates reported on the Contractor Quality Control and Production Reports.

c. At a minimum, include the following settings and parameters in P6 NAS preparation:

(1) General: Define or establish Calendars and Activity Codes at the "Project" level, not the "Global" level.

(2) Admin Drop-Down Menu, Admin Preferences, Time Periods Tab:

(a) Set time periods for P6 to 8.0 Hours/Day, 40.0 Hours/Week, 172.0 Hours/Month and 2000.0 Hours/Year.

(b) Use assigned calendar to specify the number of work hours for each time period: Must be checked.

(3) Admin Drop-Down Menu, Admin Preferences, Earned Value Tab:

(a) Technique for computing performance percent complete: Use "Activity percent Complete"

(b) Technique for computing Estimate to Complete: Use "PF = 1".

(c) Earned Value Calculation: Use "Budgeted values with current dates".

(4) Project Level, Dates Tab:

(a) Set "Must Finish By" date to "Contract Completion Date", and set "Must Finish By" time to 05:00pm.

(5) Project Level, Defaults Tab:

(a) Duration Type: Set to "Fixed Duration & Units".

(b) Percent Complete Type: Set to "Physical".

(c) Activity Type: Set to "Task Dependent".

(d) Calendar: Set to "Standard 5 Day Workweek". Calendar must reflect Saturday, Sunday and all Federal holidays as non-work days. Alternative calendars may be used with Contracting Officer approval.

(6) Project Level, Calculations Tab:

(a) Default Price/Unit for activities without resource or role Price/Units: Set to "$1/h".

(b) Activity percent complete based on activity steps: Must be Checked.

(c) Link Budget and At Completion for not started activities: Must be Checked.

(d) Reset Remaining Duration and Units to Original: Must be

Selected.

(e) Subtract Actual from At Completion: Must be Selected.

(f) Recalculate Actual units and Cost when duration percent complete changes: Must be Checked.

(g) Update units when costs change on resource assignments: Must be Unchecked.

(h) Link Actual to Date and Actual This Period Units and Cost: Must be Checked.

(7) Project Level, Settings Tab:

(a) Define Critical Activities: Check "Longest Path".

(8) Work Breakdown Structure Level, Earned Value Tab:

(a) Technique for Computing Performance Percent Complete: "Activity percent complete" is selected.

(b) Technique for Computing Estimate to Complete (ETC): "PF = 1" is selected.

1.10.3 Required Tabular Reports and Native P6 XER Files

Include the following reports with the Baseline, Monthly Update and any other required NAS submittals:

a. Time Scaled Logic NAS

Provide formatted 11 by 17-inch Time-scaled Logic NAS in color and landscape-oriented with each NAS submittal. Clearly show activities on the longest path setting Gantt chart longest path activity bars to red. Group activities by WBS and sort by finish date in ascending order. Include the following information in column form for each activity and include accompanying Gantt chart:

(1) Activity ID

(2) Activity Name

(3) Original Duration

(4) Remaining duration

(5) Physical Percent Complete

(6) Start Date

(7) Finish Date

(8) Total Float

(9) Project-level Calendar

b. Previous Monthly Update Comparison Time Scaled Logic NAS (Submit with

all Monthly NAS Update Submittals.)

Provide formatted 11 by 17-inch Time-scaled Logic NAS in color and landscape-oriented with each monthly NAS update submittal. Clearly show activities on the current month longest path setting Gantt chart longest path activities bars to red. Show previous month activities as yellow bars and previous month milestones in yellow within Gantt chart. Sort by finish date in ascending order. Filter activities for longest path. Maintain and assign the accepted previous monthly NAS update or the accepted baseline NAS for the first update submittal as the baseline and primary baseline in P6 before printing the NAS. Include the following information in column form for each activity and include accompanying Gantt chart:

(1) Activity ID

(2) Activity Name

(3) Original Duration

(4) Current Month Remaining Duration

(5) Current Month Start Date

(6) Previous Month Update Start Date (BL Project Start)

(7) Start Date Delta between Current Month and Previous Month (Variance - BL Project Start Date)

(8) Current Month Finish Date

(9) Previous Month Finish Date (BL Project Finish)

(10) Finish Date Delta between Current Month and Previous Month (Variance - BL Project Start Date)

(11) Current Month Total Float

c. P6 native XER file: Include the back-up native .xer program file compatible with the current Government version of Primavera P6. Each native NAS file must have a unique file name to include project name and data date using (yyyy-mm-dd) convention. Each native NAS must have a unique Project ID and Project Name.

d. Log Report: P6 Scheduling/Leveling Report.

e. Narrative Report: Identify and justify:

Each entry in the Narrative Report must cite the respective Activity ID and Activity Name, the date and reason for any changes, and description of the change.

(1) Provide Project Summary Data in format below:

(a) Data Date _____

(b) Award Date: _____

(c) Original Project Duration: _____ days post Award Date

(d) Current Project Duration: _____ days post Award Date

(e) Time percent elapsed: _____ percent at data date

(f) Original CCD: _____

(g) Current CCD: _____ (thru MOD _____)

(h) Anticipated CCD: _____ (___ calendar days early/late)

(i) Original Contract Value: $_____

(j) Current Contract Value: $_____

(k) Invoiced Amount: $_____ (____ percent)

(l) Cost Growth: ____ percent

(m) NAS Growth: ____ percent

(n) There are a total of _____ activities, _____ activities complete (____ percent), ____ activities in progress (____ percent), _____ activities not started (____ percent). Of the in progress and not started activities; ____ (____ percent) are on the longest path. The longest path has duration of _____ calendar days from data-date to anticipated project completion.

(2) Progress made in each area of the project;

(3) Longest Path;

(4) Date/time constraint(s), other than those required by the contract

(5) Listing of all changes made between the previous monthly NAS update and current monthly NAS update include as a minimum: added or deleted activities, original and remaining durations for activities that have not started, logic (sequence constraint lag/lead), milestones, planned sequence of operations, longest path, calendars or calendar assignments, and cost loading. Identify any other changes that relate to calculations within Oracle Primavera P6;

(6) Any decrease in previously reported activity Earned Amount;

(7) Pending items and status thereof, including permits, changes orders, and time extensions;

(8) Status of Contract Completion Date and interim milestones;

(9) Status of Projected Completion Milestone and account of difference in calendar days between previous update Projected Completion Milestone

(10) Current and anticipated delays listing Activity Names and IDs for impacted activities(describe cause of delay and corrective actions(s) and mitigation measures to minimize);

(11) Description of current and potential future NAS problem areas.

(12) Identification of any weather and restricted lost time as compared to anticipated weather for the month and anticipated restricted days for which the update is submitted. Impacts resulting from adverse weather must be documented in tabular form showing the calendar month (or billing period) with the days on which construction activity incurred Lost Work Days due to adverse weather. In narrative form, describe the adverse weather cause such as precipitation measurement, temperature, wind or other influencing factors, and why work was impacted. Identify the construction activity(s) by ID and Name that was (were) scheduled, impacted.

f. Earned Value Report: Derive from and correspond to P6 cost loaded Monthly NAS Update. List all activities having a budget amount cost loaded. Compile total earnings on the project from notice to proceed to current progress payment request. Show on the report for each activity:

(1) Current budget;

(2) Previous Physical Percent Complete;

(3) To-Date Physical Percent Complete;

(4) Previous Earned Value;

(5) To-Date Earned Value;

(6) Cost This Period;

(7) Cost to Complete.

g. Schedule Variance Control (SVC) Diagram: With each NAS submission, provide a SVC diagram representing only the current file showing 1) A Cash Flow Curve indicating planned project cost based on each of projected early and projected late activity finish dates and 2) one curve for Earned Value to-date. Revise Cash Flow Curves when the contract is modified, or as directed by the Contracting Officer Include a legend on report clearly indication 3 curves: early finish, late finish, and earned-value to date.

Use the following settings in Activity Usage Profile Options:

(1) In the Data section, under Display, the radio box for Cost must be selected.

(2) In the Data section, under Filter for Bars/Graphs, the checkbox for Total must be checked.

(3) In the Show Bars/Curves section:

(a) Under the By Date column, the checkboxes for Baseline, Actual and Remaining Late must be checked. The checkboxes for Budgeted and Remaining Early must be unchecked.

(b) Under the Cumulative column, the checkboxes for Baseline, Actual and Remaining Late must be checked. The checkboxes

for Budgeted and Remaining Early must be unchecked.

(c) Set the color for Baseline to green.

(d) Set the color for Actual to blue.

(e) Set the color for Remaining Late to red.

(4) In the Show Earned Value Curves section, the checkboxes for Planned Value Cost, Earned Value Cost and Estimate at Completion must be unchecked.

h. Logic Diagram showing timescale from data date to 60 days after data date with filter for longest path. Leave Group By selection blank and sort by finish date in ascending order.

i. Logic Diagram showing timescale from data date to contract completion date with filter for longest path. Leave Group By selection blank and sort by finish date in ascending order.

j. Baseline or Monthly Update Checklist as applicable completed and certified by Qualified Scheduler. Contractor Baseline Project Schedule Review, Contractor Monthly Update Schedule Review, and Contractor Baseline Project Schedule, and General Commissioning/HVAC Review Checklist. Checklists can be found on the Whole Building Design Guide website as Related Materials to UFGS 01 32 17.00 20.

k. Screen shot PDF of Primavera P6 Time Periods Settings referenced in paragraph NAS SOFTWARE SETTINGS AND RESTRICTIONS, list item c.(2): ADMIN DROP-DOWN MENU, ADMIN PREFERENCES, TIME PERIODS TAB

l. Screen shot PDF of Primavera P6 Earned Value Settings referenced in paragraph NAS SOFTWARE SETTINGS AND RESTRICTIONS, list item c.(3): ADMIN DROP-DOWN MENU, ADMIN PREFERENCES, EARNED VALUE TAB

m. Daily Reported Production Activity: Submit on a monthly basis, in electronic spreadsheet, summary of daily reported production activity for the reporting month in the update NAS. Use the following columns for reporting:

(1) Date

(2) Activity ID

(3) Work Description

(4) Contractor

(5) Billable Hours

1.11 CONTRACT MODIFICATION

1.11.1 Time Impact Analysis (TIA)

Submit a Time Impact Analysis with each cost and time proposal for a proposed change. TIA must illustrate the influence of each change or delay on the Contract Completion Date or milestones. No time extensions will be granted nor delay damages paid unless a delay occurs which consumes all available Project Float, impacts the longest path, and

extends the Projected Completion beyond the Contract Completion Date.

a. Each TIA must be in both narrative and NAS form. The narrative must:

(1) Define the scope and conditions of the change;

(2) Provide start and finish dates of impact to longest path;

(3) Identify and include any accepted NAS referenced in TIA and any changes made to accepted NAS to prepare additional NAS included in the TIA;

(4) Successor(s) and predecessor(s) activities to impact period;

(5) Responsible party;

(6) Describe how the impact originated;

b. The TIA submission must consist of at least three native XER files:

(1) Fragnet used to define the scope of the changed condition

(2) Most recent accepted baseline NAS or monthly NAS update as of the time of the impact start date. If the data date of this NAS is different than the start date of impact, update this NAS to show all activity progress as of the time of the impact start. The impact start date is identified as the time when an existing activity is impeded for either starting or finishing. This NAS must have a data date that is the same as the identified start date of impact in "a.(2)". Identify any changes made to most recent accepted NAS.

(3) The impacted NAS that has the Fragnet inserted in the updated NAS from "b.(2)" and the NAS scheduled using the Schedule command in Oracle Primavera P6 so that the new completion date is determined.

c. For claimed as-built project delay, the inserted Fragnet TIA method must be modified to account for as-built events known to occur after the data date of NAS update used. Updated NAS for periods following the impact start date will be used and included in submittal to evaluate how the project progressed (as-built) through the finish of impact. Impact to longest path must be determined for each following update period.

d. All TIAs must include any mitigation, and must determine the apportionment of the overall delay assignable to each individual delay. Apportionment must provide identification of delay type and classification of delay by compensable and non-compensable events. The associated narrative must clearly describe analysis methodology used, and the findings in a chronological listing beginning with the earliest delay event.

(1) Identify and classify types of delay defined as follows:

(a) Force majeure delay (e.g., weather delay): Any delay event caused by something or someone other than the Government or the Contractor, or the risk of which has not been assigned solely to the Government or the Contractor. If the force majeure delay is on the longest path, in absence of other

types of concurrent delays, the Contractor is granted an extension of contract time, classified as a non-compensable event.

(b) A Contractor-delay: Any delay event caused by the Contractor, or the risk of which has been assigned solely to the Contractor. If the contractor-delay is on the longest path, in absence of other types of concurrent delays, Contractor is not granted extension of contract time, and classified as a non-compensable event. Where absent other types of delays, and having impact to project completion, Contractor must provide to Contracting Officer a Corrective Action Plan identifying plan to mitigate delay.

(c) A Government-delay: Any delay event caused by the Government, or the risk of which has been assigned solely to the Government. If the Government-delay is on the longest path, in absence of other types of concurrent delays, the Contractor is granted an extension of contract time, and classified as a compensable event.

(2) Functional concurrency must be used to analyze concurrent delays, where: separate delay issues delay project completion, do not necessarily occur at same time, rather occur within same monthly NAS update period at minimum, or within same as-built period under review. If a combination of functionally concurrent delay types occurs, it is considered Concurrent Delay, which is defined in the following combinations:

(a) Government-delay concurrent with contractor-delay: excusable time extension, classified non-compensable event.

(b) Government-delay concurrent with force majeure delay: excusable time extension, classified non-compensable event.

(c) Contractor-delay concurrent with force majeure delay: excusable time extension, classified non-compensable event.

(3) Pacing delay reacting to another delay (parent delay) equally or more critical than paced activity must be identified prior to pacing. Contracting Officer will notify Contractor prior to pacing. Contractor must notify Contracting Officer prior to pacing. Notification must include identification of parent delay issue, estimated parent delay time period, paced activity(s) identity, and pacing reason(s). Pacing Concurrency is defined as follows:

(a) Government-delay concurrent with contractor-pacing: excusable time extension, classified compensable event.

(b) Contractor-delay concurrent with Government-pacing: inexcusable time extension, classified non-compensable event

e. Submit electronic files containing the narrative and the Native XER NAS files used and or referenced in the time impact analysis.

1.12 PROJECT FLOAT

Project Float is the length of time between the Project Completion

Milestone and the Contract Completion Date. Project Float available in the NAS will not be for the exclusive use of either the Government or the Contractor.

The use of Resource Leveling is prohibited. Techniques used for the purpose of artificially adjusting activity durations to consume float and influence longest path are prohibited.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES
08/18, CHG 4: 02/21

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Submit Division 01 SD-01 preconstruction submittals with a "G"; designation within 30 calendar days of contract award unless specified elsewhere in the specifications. Submit Division 01 SD-01 preconstruction submittals not having a "G"; designation within 45 calendar days of contract award unless specified elsewhere in the specifications.

Government approved Division 01 preconstruction submittals that are required prior to or commencing with the start of work must be submitted within 30 calendar days of contract award unless specified elsewhere in the specifications. Contractor approved Division 01 submittals that are required prior to or commencing with the start of work must be submitted within 45 calendar days of contract award unless specified elsewhere in the specifications.

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates Of Insurance

Surety Bonds

Baseline Network Analysis Schedule (NAS)

Schedule Of Prices Or Earned Value Report

Accident Prevention Plan

Quality Control (QC) plan

Environmental Protection Plan

Explosive Safety Submission ESS Work Plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in

producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits

Text of posted operating instructions

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (SDS)concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction

contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.1.2 Approving Authority

Office or designated person authorized to approve the submittal.

1.1.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or “S” classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submittal Register; G

1.3 SUBMITTAL CLASSIFICATION

1.3.1 Government Approved (G)

Government approval is required for extensions of design, critical materials, variations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Government.

Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings."

1.3.2 For Information Only

Submittals not requiring Government approval will be for information only, refer to paragraph 1.7 INFORMATION ONLY SUBMITALLS. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

1.3.3 Sustainability Reporting Submittals (S)

Submittals for Guiding Principle Validation (GPV) or Third Party Certification (TPC) are indicated with an "S" designation. These submittals are for information only and for use as specified in Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

As soon as practicable after award of contract, and before procurement or fabrication, forward to the Contracting Officer submittals required in the

technical sections of this specification, including shop drawings, product data and samples. In addition, forward a copy of the submittals to the Contracting Officer.

1.4.1 O&M Data

Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

In the event the Contractor fails to deliver O&M data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the items to which such O&M data apply.

1.4.2 Submittals Reserved for NAVFAC Pacific Approval

As an exception to the standard submittal procedure for Government Approval, submit the following to the Commander, NAVFAC Pacific, Code CI4 1:

a. Fire Protection Quality Control Specialist (FPQC) credentials:

(1) Company letter attesting to FPQC performing contract functions had passed the National Council of Examiners for Engineering and Surveying NCEES) written examination in Fire Protection Engineering.

(2) Current Active U.S. Professional Engineer certificate of license in Fire Protection Engineering. Certificate shall indicate the licensing State and Registration Number.

(3) Past project experiences and dates when experiences were obtained.

b. National Institute for Certification in Engineering Technologies (NICET) Technician credentials:

(1) Current Active NICET Certification.

(2) Past project experiences and dates when experiences were obtained.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to the office of the approving authority using the transmittal form prescribed by the Contracting Officer. Include all information prescribed by the transmittal form and required in paragraph IDENTIFYING SUBMITTALS. Use the submittal transmittal forms to record actions regarding samples.

1.5.2 Identifying Submittals

The Contractor's Quality Control Manager must prepare, review and stamp submittals, including those provided by a subcontractor, before submittal to the Government.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location

b. Construction contract number

c. Dates of the drawings and revisions

d. Name, address, and telephone number of Subcontractor, supplier, manufacturer, and any other Subcontractor associated with the submittal.

e. Section number of the specification by which submittal is required

f. Submittal description (SD) number of each component of submittal

g. For a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission

h. Product identification and location in project.

1.5.3 Submittal Format

1.5.3.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.3.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.

b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Present shop drawings sized 8 1/2 by 11 inches as part of the bound volume for submittals. Present larger drawings in sets. Submit an electronic copy of drawings in PDF format and native electronic format.

1.5.3.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the

Government contract number in the margin, immediately below the title block, for each drawing.

1.5.3.3 Format of SD-03 Product Data

Present product data submittals for each section as a complete, bound volume. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

1.5.3.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

1.5.3.3.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.3.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.5.3.4 Format of SD-04 Samples

1.5.3.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

1.5.3.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

1.5.3.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.3.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

1.5.3.6 Format of SD-06 Test Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.3.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

1.5.3.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section as a complete, bound volume. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.5.3.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.3.9 Format of SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.3.10 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.3.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.4 Source Drawings for Shop Drawings

1.5.4.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.5.4.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

1.5.5 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. In addition to the electronic submittal, provide three hard copies of the submittals. Compile the submittal file as a single, complete document, to include the Transmittal Form described within, and also separately attach the native files which were used to create PDF. The attached files should include the original digital files used to create the submittal. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to

allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the DOD SAFE Web Application located at the following website https://safe.apps.mil/. Contact the Contracting Officer to receive a drop-off request. When the Contracting Officer generates the drop-off request, an email with a link to submit drop-off will be provided.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit two sets of administrative submittals.

1.6.2 Number of SD-02 Shop Drawing Copies

Submit six copies of submittals of shop drawings requiring review and approval by a QC organization. Submit seven copies of shop drawings requiring review and approval by the Contracting Officer.

1.6.2.1 Fire Protection System Shop Drawings

a. Qualified technician certified in the applicable program of National Institute for Certification in Engineering Technologies (NICET) Level III for the specific trade must prepare and/or supervise the preparation of drawings. The NICET technician must provide certification credentials on drawings.

b. Prepare drawings in electronic drawing files compatible with AutoCAD® computer software. Scale drawings to fit on uniform 22 by 34 inches size sheets having borders, title block and information fields exact to that of the Contract Drawings. Drawings shall have same Project title and project location as specified in the Contract Drawings.

c. Prior to construction, Drawings must bear the signature approval of the Registered Fire Protection Engineer specified in Section 01 45 00 QUALITY CONTROL.

1.6.3 Number of SD-03 Product Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.4 Number of SD-04 Samples

a. Submit one samples, or one sets of samples showing the range of variation, of each required item.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

1.6.5 Number of SD-05 Design Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.6 Number of SD-06 Test Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings, other than field test results that will be submitted with QC reports.

1.6.7 Number of SD-07 Certificate Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.8 Number of SD-08 Manufacturer's Instructions Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.9 Number of SD-09 Manufacturer's Field Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.10 Number of SD-10 Operation and Maintenance Data Copies

Submit three copies of O&M data to the Contracting Officer for review and approval.

1.6.11 Number of SD-11 Closeout Submittals Copies

Unless otherwise specified, submit two sets of administrative submittals.

1.7 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Provide information-only submittals to the Contracting Officer a minimum of 14 calendar days prior to the Preparatory Meeting for the associated Definable Feature of Work (DFOW). Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.8 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register."

1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Column (f): Lists the approving authority for each submittal. Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

1.8.2 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.8.3 Contractor Use of Submittal Register

Update the following fields with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

1.8.4 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

1.8.5 Action Codes

1.8.5.1 Government Review Action Codes

"A" - "Approved as submitted"

"AN" - "Approved as noted"

"RR" - "Disapproved as submitted"; "Completed"

"NR" - "Not Reviewed"

"RA" - "Receipt Acknowledged"

1.8.6 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

1.9 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission of a variation submittal will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the Government may require an evaluation and analysis by a licensed professional engineer hired by the contractor.

Specifically point out variations from contract requirements in a variation submittal. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional

cost to the Government.

1.9.2 Proposing Variations

When proposing variation, deliver a submittal, clearly marked as a "VARIATION" to the Contracting Officer, with documentation illustrating the nature and features of the variation including any necessary technical submittals and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

The Contracting Officer will indicate an approval or disapproval of the variation request; and if not approved as submitted, will indicate the Government's reasons therefore. Any work done before such approval is received is performed at the Contractor's risk."

Specifically point out variations from contract requirements in a variation submittal. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 working days will be allowed for the Government to consider submittals with variations.

1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. Allow an additional 7 working days for review and approval of submittals for refrigeration and HVAC control systems.

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.

b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or

marked "N/A."

c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 10 working days after the date of submission.

d. Except as specified otherwise, allow a review period, beginning with receipt by the approving authority, that includes at least 15 working days for submittals for QC manager approval and 20 working days for submittals where the Contracting Officer is the approving authority. The period of review for submittals with Contracting Officer approval begins when the Government receives the submittal from the QC organization.

e. For submittals requiring review by a Government fire protection engineer, allow a review period, beginning when the Government receives the submittal from the QC organization, of 30 working days for return of the submittal to the Contractor.

1.10.1 Reviewing, Certifying, and Approving Authority

The QC Manager is responsible for reviewing all submittals and certifying that they are in compliance with contract requirements. The approving authority on submittals is the QC Manager unless otherwise specified. At each "Submittal" paragraph in individual specification sections, a notation "G" following a submittal item indicates that the Contracting Officer is the approving authority for that submittal item. Provide an additional copy of the submittal to the Government Approving authority

1.10.2 Constraints

Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

Submit complete submittals for each definable feature of the work. At the same time, submit components of definable features that are interrelated as a system.

When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, the submittal will be returned without review.

Approval of a separate material, product, or component does not imply approval of the assembly in which the item functions.

1.10.3 QC Organization Responsibilities

a. Review submittals for conformance with project design concepts and compliance with contract documents.

b. Process submittals based on the approving authority indicated in the submittal register.

(1) When the QC manager is the approving authority, take appropriate action on the submittal from the possible actions defined in paragraph APPROVED SUBMITTALS.

(2) When the Contracting Officer is the approving authority or when variation has been proposed, forward the submittal to the Government, along with a certifying statement, or return the submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of the submittal determines the appropriate action.

c. Ensure that material is clearly legible.

d. Stamp each sheet of each submittal with a QC certifying statement or an approving statement, except that data submitted in a bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When the approving authority is the Contracting Officer, the QC organization will certify submittals forwarded to the Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with Contract Number { } is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC Manager _____, Date _____"
(Signature)

(2) When approving authority is the QC manager, the QC manager will use the following approval statement when returning submittals to the Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with Contract Number { } is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Approved by QC Manager _____, Date _____"
(Signature)

e. Sign the certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.

f. Update the submittal register as submittal actions occur, and maintain the submittal register at the project site until final acceptance of all work by the Contracting Officer.

g. Retain a copy of approved submittals and approved samples at the project site.

h. For "S" submittals, provide a copy of the approved submittal to the

Government Approving authority.

1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

a. Note the date on which the submittal was received from the QC manager.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. one copy of the submittal will be retained by the Contracting Officer and remaining copies of the submittal will be returned to the Contractor.

1.11.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.

b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.

c. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.

d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

1.12 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out

variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained with in each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 14 00	SD-01 Preconstruction Submittals																
			List of Contact Personnel	1.5.1.1															
			Personnel List	1.6.1															
			Free-Zone Request	1.5.1.2	G														
			Vehicle List	1.6.2	G														
			Statement Of Acknowledgement	1.6.3	G														
		01 20 00	SD-01 Preconstruction Submittals																
			Earned Value Report	1.2	G														
		01 30 00	SD-01 Preconstruction Submittals																
			View Location Map	1.3															
			Progress and Completion	1.4															
			Pictures																
		01 31 23.13 20	SD-01 Preconstruction Submittals																
			List of Contractor's Personnel	1.4.2															
		01 32 17.00 20	SD-01 Preconstruction Submittals																
			Baseline NAS	1.2.2	G														
			Designated Project Scheduler	1.9	G														
			SD-07 Certificates																
			Weekly Look Ahead Schedule	1.3															
			Monthly NAS Updates	1.4.2	G														
			SD-11 Closeout Submittals																
			As-Built NAS	1.4.3	G														
		01 33 00	SD-01 Preconstruction Submittals																
			Submittal Register	1.8	G														
		01 33 29	SD-01 Preconstruction Submittals																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 33 29	Preliminary High Performance and Sustainable Building Checklist	1.5.3.2	G														
			Sustainability Action Plan	1.4.1	G														
			Preliminary Sustainability eNotebook	1.5.3.2	G														
			SD-11 Closeout Submittals																
			Final High Performance and Sustainable Building Checklist	1.5.3.2	G														
			Final Sustainability eNotebook	1.5.3.2	G														
		01 35 13.04 30	SD-01 Preconstruction Submittals																
			System Authorization Access Request (SAAR)	3.1	G														
			ICS IA Addendum	3.1	G														
			Dod CYBER AWARENESS CHALLENGE Training	3.1	G														
			Privileged User Cybersecurity Responsibilities Training	3.1	G														
			CONTRACTOR PERSONNEL REQUIREMENTS	3.1	G														
			SAAR User Agreement	3.1	G														
			Pre-Construction Hardware List	3.6.3.1	G														
			Pre-Construction Software List	3.6.3.2	G														
			Pre-Construction Network Diagam	3.6.3.3	G														
			SD-03 Product Data																
			Media Converters	2.3.2	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 35 13.04 30	Uninterruptible Power Supply	2.3.3	G													
			(UPS)															
			Remote Terminal Unit (RTU)	2.3.4	G													
			Intermediary Network Devices	2.3.5	G													
			Ethernet Switches	2.3.1	G													
			SD-10 Operation and Maintenance															
			Data															
			Operator Manual	3.6.1	G													
			Sustainment Materials	3.6.2	G													
			Access Controls Summary	3.6.3.7	G													
			Auditing Controls Summary	3.6.3.8	G													
			Configuration Management Plan	3.6.3.9	G													
			Contingency Plan	3.6.3.10	G													
			Vulnerability Management Plan	3.6.3.12	G													
			Maintenance Plan	3.6.3.13	G													
			SD-11 Closeout Submittals															
			Technical Narrative	3.3.1	G													
			Systems Testing	3.4	G													
			Final Hardware List	3.6.3.4	G													
			Final Software List	3.6.3.5	G													
			Final Network Diagram	3.6.3.6	G													
			Security Features Guide	3.6.3.11	G													
			Documented Statements	3.6.3.14	G													
			Test Results	3.6.3.15	G													
		01 35 26	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.9.1	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 35 26	Indoor Air Quality (IAQ)	1.17	G														
			Management Plan																
			SD-06 Test Reports																
			Accident Reports	1.13.2	G														
			LHE Inspection Reports	1.13.3															
			Monthly Exposure Reports	1.5	G														
			SD-07 Certificates																
			Activity Hazard Analysis (AHA)	1.10	G														
			Certificate of Compliance	1.13.4															
			Contractor Safety Self-Evaluation	1.6															
			Checklist																
			Hot Work Permit	1.14															
			License Certificates	1.15															
			Portable Gauge Operations	1.15.1	G														
			Planning Worksheet																
			Radiography Operation Planning	1.15.1	G														
			Work Sheet																
			Standard Lift Plan	1.13.4.2	G														
			Critical Lift Plan	1.13.4.2	G														
		01 35 29.13	SD-02 Shop Drawings																
			Work Zones	3.8.1	G														
			Decontamination Facilities	3.9.1	G														
			SD-03 Product Data																
			Amendments to the APP/SSHP	1.4	G														
			G-RAM/LLRW Exposure	3.5	G														
			Monitoring/Air Sampling Program																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 35 29.13	Site Control Log	3.8.2														
			SSHO's Daily Inspection Logs	1.8														
			SD-07 Certificates															
			Certificate Of Worker/Visitor	1.7														
			Acknowledgement															
			Certification Of 40 Hour Radiation	1.5.3	G													
			Safety Officer Training															
			SD-11 Closeout Submittals															
			Safety And Health Phase-Out	1.9	G													
			Report															
		01 45 00	SD-01 Preconstruction Submittals															
			Contractor Quality Control (CQC)	1.5.2	G													
			Plan															
			SD-06 Test Reports															
			Verification Statement	1.12.3														
		01 45 35	SD-06 Test Reports															
			Special Inspection Daily Reports	3.1.1														
			Special Inspection Daily Reports	3.1.2														
			Special Inspection Biweekly	3.1.1														
			Reports															
			SD-07 Certificates															
			AISC Certified Steel Fabricator	2.1														
			Certificate of Compliance	2.1														
			Special Inspector	1.5	G													
			SD-11 Closeout Submittals															
			Comprehensive Final Report	3.1.2	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 50 00	SD-01 Preconstruction Submittals																
			Construction Site Plan	1.3	G														
			Traffic Control Plan	3.4.1	G														
			Haul Road Plan	2.2.1	G														
			Contractor Computer	1.6.1.4	G														
			Cybersecurity Compliance																
			Statements																
			Contractor Temporary Network	1.6.6	G														
			Cybersecurity Compliance																
			Statements																
			SD-06 Test Reports																
			Backflow Preventer Tests	3.5															
			SD-07 Certificates																
			Backflow Tester	1.4.1															
			Backflow Preventers	1.4															
		01 57 19	SD-01 Preconstruction Submittals																
			Contractor Hazardous Material	3.8.1	G														
			Inventory Log																
			Storage Material Inventory	1.5.4.1.2															
			Preconstruction Survey	1.6.1															
			Regulatory Notifications	1.6.2															
			Environmental Manager	1.6.4															
			Qualifications																
			Employee Training Records	1.6.5															
			Environmental Protection Plan	1.7	G														
			Dirt and Dust Control Plan	1.7.9.1															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 57 19	Solid Waste Management Permit	1.10															
			Stormwater Pollution Prevention	3.2.1.1	G														
			Plan																
			Stormwater Notice of Intent	3.2.1.2															
			Spill Prevention Control and	3.15.2	G														
			Countermeasure (SPCC) Plan																
			Hazard Analysis and Critical	3.1.1	G														
			Control Point (HACCP) Plan																
			GEPA Clearing, Grubbing,	3.2.1.1	G														
			Grading, and Stockpiling Permit /																
			General Permit Application																
			Final Work Plan for Tarague	3.1.1	G														
			Forest Enhancement Area																
			Draft Work Plan for Tarague	3.1.1	G														
			Forest Enhancement Area																
			Draft Natural Resource Work	3.1.1	G														
			Plan																
			Final Natural Resource Work	3.1.1	G														
			Plan																
			Natural Resource Field	3.1.1	G														
			Assessment Report for P-012																
			Construction Footprint																
			Natural Resource Field	3.1.1	G														
			Assessment Report for Tarague																
			Forest Enhancement Area																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 57 19	Archaeological Monitoring and	3.4.4	G														
			Discovery Plan																
			SD-02 Shop Drawings																
			Alignment of Ungulate Fence	3.1.1	G														
			SD-06 Test Reports																
			Monthly Solid Waste Disposal	1.10.1	G														
			Report																
			SWPPP Inspection Reports	3.2.1.3															
			Laboratory Analysis	3.7.1.1.2															
			SD-07 Certificates																
			ECATTS Certificate of	1.4.1.2	G														
			Completion																
			Employee Training Records	1.6.5	G														
			Erosion and Sediment Control	1.6.5															
			Inspector Qualifications																
			Qualification of Qualified	3.1.1	G														
			Biologist(S)																
			Qualification of Archaeologist(s)	3.4.2	G														
			SD-10 Operation and Maintenance																
			Data																
			Weekly Natural Resources	3.1.1	G														
			Conservation Status Report																
			Monthly Natural Resources	3.1.1	G														
			Conservation Progress Report																
			Annual Natural Resources	3.1.1	G														
			Conservation Progress Report																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 57 19	Reports and Submittals required	3.4.3.2	G													
			by Data Recovery Plan															
			End of Field (EOF) Letter for	3.4.4	G													
			Archaeological Monitoring -															
			Tarague FEA															
			SD-11 Closeout Submittals															
			Contractor Hazardous Material	3.8.1	G													
			Inventory Log															
			Regulatory Notifications	1.6.2	G													
			Assembled Employee Training	1.6.5	G													
			Records															
			Solid Waste Management Permit	1.10	G													
			Stormwater Pollution Prevention	3.2.1.4	G													
			Plan Compliance Notebook															
			Stormwater Notice of Termination	3.2.1.5	G													
			As-Built Topographic Survey	3.2.1.5														
			Waste Determination	3.7.1	G													
			Documentation															
			Project Solid Waste Disposal	3.7.2.1	G													
			Documentation Report															
			Sales Documentation	3.7.2.1	G													
			Contractor Certification	3.7.2.1														
			Hazardous Waste/Debris	3.7.3.1	G													
			Management															
			Disposal Documentation for	3.7.3.6	G													
			Hazardous and Regulated Waste															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 57 19	Draft Natural Resources	3.1.1	G													
			Conservation Report															
			Final Natural Resources	3.1.1	G													
			Conservation Report															
			Weekly archaeological monitoring	3.4.4	G													
			report-Tarague FEA															
			Draft Archaeological Monitoring	3.4.4	G													
			Report-Tarague FEA															
			Final Archaeological Monitoring	3.4.4	G													
			Report-Tarague FEA															
		01 57 19.03 21	SD-01 Preconstruction Submittals															
			MEC Work Plan	1.2.1	G													
			Initial GIS Data Files	1.2.2														
			SD-11 Closeout Submittals															
			Final GIS Data Files	1.2.3														
		01 58 00	SD-02 Shop Drawings															
			Preliminary Drawing Indicating	1.4.1	G													
			Layout And Text Content															
		01 74 19	SD-01 Preconstruction Submittals															
			Construction Waste Management	1.7														
			Plan															
			SD-06 Test Reports															
			Sampling and Analytical Report	1.12	G													
			for Surplus Soil															
			SD-07 Certificates															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 74 19	Disposal Documentation or	1.12	G														
			Acceptance of Surplus Soil																
			SD-11 Closeout Submittals																
			Final Construction Waste	1.2.6	S														
			Diversion Report																
		01 78 00	SD-03 Product Data																
			Warranty Management Plan	1.6.1															
			Warranty Tags	1.6.4															
			Final Cleaning	3.4															
			Spare Parts Data	1.5															
			SD-08 Manufacturer's Instructions																
			Instructions	1.6.1															
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.3	G														
			Manuals																
			SD-11 Closeout Submittals																
			As-Built Drawings	3.1	G														
			Record Drawings	3.2	G														
			As-Built Record of Equipment	1.6.1															
			and Materials																
			Certification of EPA Designated	2.1	G														
			Items																
			Certification Of USDA Designated	2.2	G														
			Items																
			Interim DD FORM 1354	3.5.1	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 78 00	Checklist for DD FORM 1354	3.5.2	G													
			High Performance and	3.5.2	G													
			Sustainable Building (HPSB)															
			Checklist															
		01 78 23	SD-10 Operation and Maintenance															
			Data															
			Facility Data Workbook	1.4	G													
			Training Plan	3.1.1	G													
			Training Outline	3.1.3	G													
			Training Content	3.1.2	G													
			Operation And Maintenance	3.2.1	G													
			Manual, Progress Submittal															
			Operation And Maintenance	3.2.2	G													
			Manual, Prefinal Submittal															
			Operation And Maintenance	3.2.3	G													
			Manual, Final Submittal															
			SD-11 Closeout Submittals															
			Training Video Recording	3.1.4	G													
			Validation of Training Completion	3.1.6	G													
			Training Plan	3.1.1	G													
			Record Drawings And Utility	1.6.6.7	G													
			Systems															
		01 78 23.33	SD-10 Operation and Maintenance															
			Data															
			System Instructions	2.1.1	G													
		01 78 24.00 20	SD-11 Closeout Submittals															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 78 24.00 20	Facility Data Workbook (FDW),	1.3.1	G														
			Progress Submittal																
			Facility Data Workbook (FDW),	1.3.2	G														
			Prefinal Submittal																
			Facility Data Workbook (FDW),	1.3.3	G														
			Final Submittal																
		02 41 00	SD-01 Preconstruction Submittals																
			Demolition Plan	1.2.2	G														
			Existing Conditions	1.9															
			SD-07 Certificates																
			Notification	1.6	G														
		02 61 13	SD-01 Preconstruction Submittals																
			Pre-Installation Meeting Agenda	1.3															
			Pre-Installation Meeting Minutes	1.3	G														
			SMP Work Plan	1.2	G														
			SMP Work Plan	1.2.1.1	G														
			Pre-Installation Examination	3.1.2															
			Report																
			Pre-Construction Equipment	3.1.3															
			Examination																
			Qualification of Professional	1.2	G														
			Engineer (PE) or Environmental																
			Consultant (EC)																
			Qualification of Nuclear	1.2	G														
			Regulatory Commission (NRC)																
			Licensed Service Provider																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02 61 13	Key Personnel Qualification for G-RAM/LLRW	1.2	G													
			Radiation Work Plan	1.2	G													
			Qualification Of Radiation Safety Officer (RSO)	1.2	G													
			SD-02 Shop Drawings															
			Surveys	3.1.1														
			SD-03 Product Data															
			Specifications Of Geomembrane	2.1.3	G													
			SD-06 Test Reports															
			Report for G-RAM Site Screening Level	1.2	G													
			Additional PFAS Testing Report With Sampling Procedures	1.2	G													
			SD-07 Certificates															
			Qualifications	1.5.2	G													
			SD-08 Manufacturer’s Instructions															
			Geomembrane Manufacturer's Installation Instructions	1.2	G													
			SD-10 Operation and Maintenance Data															
			Weekly G-RAM/LLRW Inventory Report	1.2	G													
			SD-11 Closeout Submittals															
			SMP Closure Report	1.2	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		02 61 13	Final G-RAM/LLRW Status	1.2	G														
			Survey Report																
			G-RAM/LLRW Closure Report	1.2	G														
			Topographic Survey Drawings for	1.2	G														
			PFAS-Impacted Soil Relocation																
			Area																
		02 81 00	SD-03 Product Data																
			Packaging Notifications	2.1.1															
			Hazardous Waste Management	3.1	G														
			Plan																
			Onsite Hazardous Waste	3.2	G														
			Management																
			Notices of Non-Compliance and	3.3															
			Notices of Violation																
			SD-06 Test Reports																
			Recordkeeping	3.8	G														
			Exception Report	3.8	G														
			Spill Response	3.9															
			SD-07 Certificates																
			Transportation and Disposal	1.4.1	G														
			Coordinator																
			Training	1.4.2	G														
			Pipeline Hazardous Materials	1.4.3															
			Safety Administration Certification																
			Shipping Documents and	3.3.3	G														
			Packagings Certification																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		02 81 00	Security Plan	3.3.4															
			Certificates of Disposal	3.3.5															
			Waste Minimization	3.7															
		02 82 00	SD-01 Preconstruction Submittals																
			Asbestos Sampling And	1.3.2	G														
			Analytical Report																
			SD-03 Product Data																
			Amended Water	1.2.1	G														
			Safety Data Sheets (SDS) for All	1.3.9	G														
			Materials																
			Respirators	3.1.2.1	G														
			Local Exhaust Equipment	3.1.7	G														
			Pressure Differential Automatic	3.1.7	G														
			Recording Instrument																
			Vacuums	3.1.8	G														
			Glovebags	3.1.10	G														
			SD-06 Test Reports																
			Air Sampling Results	1.5.5	G														
			Pressure Differential Recordings	1.5.6	G														
			for Local Exhaust System																
			Clearance Sampling	3.2.11.4	G														
			Asbestos Disposal Quantity	3.3.3.2	G														
			Report																
			SD-07 Certificates																
			Employee Training	1.3.4	G														
			Notifications	1.3.5	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		02 82 00	Respiratory Protection Program	1.3.7	G														
			Asbestos Hazard Abatement Plan	1.3.10	G														
			Testing Laboratory	1.3.11	G														
			Landfill Approval	1.3.12	G														
			Delivery Tickets	1.3.12	G														
			Waste Shipment Records	1.3.12	G														
			Transporter Certification	1.3.13	G														
			Medical Certification	1.3.14	G														
			Private Qualified Person	1.5.1	G														
			Documentation																
			Designated Competent Person	1.5.2	G														
			Worker's License	1.5.3	G														
			Contractor's License	1.5.4	G														
			Federal, State or Local Citations	1.5.7	G														
			on Previous Projects																
			Equipment Used to Contain	3.1	G														
			Airborne Asbestos Fibers																
			Water Filtration Equipment	3.1.3.2	G														
			Vacuums	3.1.8	G														
			Ventilation Systems	3.1.8	G														
			SD-11 Closeout Submittals																
			Permits and Licenses	1.3.5	G														
			Notifications	1.3.5	G														
			Respirator Program Records	1.3.7.1	G														
			Rental Equipment	1.7.1	G														
		02 83 00	SD-01 Preconstruction Submittals																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		02 83 00	Competent Person	1.5.1.1	G														
			Training Certification	1.5.1.2	G														
			Occupational and Environmental	1.5.2.3	G														
			Assessment Data Report																
			Medical Examinations	1.5.2.4	G														
			Lead, Cadmium, Chromium	1.5.2.8	G														
			Waste Management Plan																
			Lead, Cadmium, Chromium	1.5.2.2	G														
			Compliance Plan																
			Lead, Cadmium, Chromium	3.1.1.3	G														
			Compliance Plan																
			Written Evidence of TSD	3.5.2.1	G														
			Approval																
			SD-03 Product Data																
			Respirators	1.6.1															
			Vacuum Filters	1.6.4															
			Negative Air Pressure System	1.6.6	G														
			Materials and Equipment	2.1															
			Expendable Supplies	2.1.1															
			Pressure Differential Log	3.1.1.3	G														
			SD-06 Test Reports																
			Occupational and Environmental	1.5.2.3	G														
			Assessment Data Report																
			Sampling Results	1.5.2.3	G														
			Pressure Differential Recordings	1.5.3															
			For Local Exhaust System																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		02 83 00	SD-07 Certificates																
			Testing Laboratory	1.5.1.3	G														
			Clearance Certification	3.5.1.1	G														
			SD-11 Closeout Submittals																
			Hazardous Waste Manifest	3.5.2.1	G														
			Turn-In Documents or Weight Tickets	3.5.2.1	G														
		02 84 16	SD-07 Certificates																
			Qualifications of CIH	1.8.1	G														
			Training Certification	1.8.1	G														
			PCB and Lamp Removal Work Plan	1.8.2	G														
			PCB and Lamp Disposal Plan	1.8.3	G														
			SD-11 Closeout Submittals																
			Transporter Certification	3.5.2	G														
			Certification of Decontamination	3.2.4															
			Certificate of Disposal and/or recycling	3.5.2.1															
			Testing Results	3.3.1															
		02 84 33	SD-01 Preconstruction Submittals																
			PCB Removal Work Plan	1.7.3	G														
			PCB Disposal Plan	1.7.4	G														
			SD-07 Certificates																
			Training certification	1.7.1															
			Qualifications of IH	1.7.2	G														
			Notification	1.7.5															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		02 84 33	Transporter Certification	3.8	G														
			Disposal Facility Certification	3.8	G														
			Certification of Decontamination	3.5.4															
			Post Cleanup Sampling	3.5.5															
			Certificate of Disposal	3.8.2															
		03 30 00	SD-01 Preconstruction Submittals																
			Concrete Curing Plan	1.6.3.1															
			Quality Control Program	1.6.5	G														
			Quality Control Personnel	1.6.6	G														
			Certifications																
			Quality Control Organizational	1.6.6															
			Chart																
			Laboratory Accreditation	1.6.8	G														
			Maturity Method Data	3.3.8															
			SD-02 Shop Drawings																
			Reinforcing Steel	1.6.2.1	G														
			SD-03 Product Data																
			Joint Sealants	2.4.5	G														
			Joint Filler	2.4.4	G														
			Formwork Materials	2.1															
			Recycled Aggregate Materials	2.3.3.2	G														
			Cementitious Materials	2.3.1	G														
			Vapor Retarder	2.4.6	G														
			Concrete Curing Materials	2.4.1	G														
			Reinforcement	2.6	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03 30 00	Liquid Chemical Floor Hardeners	2.4.3.1														
			and Sealers															
			Admixtures	2.3.4	G													
			Mechanical Reinforcing Bar	2.6.2	G													
			Connectors															
			Waterstops	2.2.2	G													
			Biodegradable Form Release	2.2.3														
			Agent															
			Pumping Concrete	1.6.3.2	G													
			Nonshrink Grout	2.4.2	G													
			SD-05 Design Data															
			Construction and Movement	2.2.5	G													
			Joints Locations and Details															
			Concrete Mix Design	1.6.1.1	G													
			SD-06 Test Reports															
			Concrete Mix Design	1.6.1.1	G													
			Fly Ash	1.6.4.1	G													
			Pozzolan	1.6.4.1	G													
			Slag Cement	1.6.4.2	G													
			Aggregates	1.6.4.3	G													
			Portland Cement	2.3.1.1	G													
			Blended Cements	2.3.1.2	G													
			Compressive Strength Tests	3.13.3.3	G													
			Slump Tests	3.13.3.1														
			Water	2.3.2														
			SD-07 Certificates															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03 30 00	Reinforcing Bars	2.6.1														
			Welder Qualifications	1.9														
			VOC Content for Form Release	1.6.3.3														
			Agents, Curing Compounds, and															
			Concrete Penetrating Sealers															
			Safety Data Sheets	1.6.3.4														
			Forest Stewardship Council	1.8.1														
			(FSC) Certification															
			Field Testing Technician and	1.6.6.2														
			Testing Agency															
			SD-08 Manufacturer's Instructions															
			Liquid Chemical Floor Hardeners	2.4.3.1														
			and Sealers															
			Joint Sealants	2.4.5	S													
			Curing Compound	2.4.1														
		04 20 00	SD-02 Shop Drawings															
			Cut CMU	3.3.2.1	G													
			Detail Drawings	3.4.1.1	G													
			SD-03 Product Data															
			Hot Weather Procedures	1.5.1	G													
			Cementitious Materials	2.4.1.1	G													
			SD-04 Samples															
			Concrete Masonry Units (CMU)	2.2.2.2	G													
			Admixtures for Masonry Mortar	2.4.1.3	G													
			Anchors, Ties, and Bar	2.6.2	G													
			Positioners															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		04 20 00	Joint Reinforcement	2.6.3	G														
			SD-05 Design Data																
			Masonry Compressive Strength	2.1.2	G														
			Bracing Calculations	3.2.4	G														
			SD-06 Test Reports																
			Field Testing of Mortar	3.6.1.1															
			Field Testing of Grout	3.6.1.2															
			SD-07 Certificates																
			Concrete Masonry Units (CMU)	2.2.2.2															
			Cementitious Materials	2.4.1.1															
			Admixtures for Masonry Mortar	2.4.1.3															
			Admixtures for Grout	2.4.2.2															
			Anchors, Ties, and Bar	2.6.2															
			Positioners																
			Joint Reinforcement	2.6.3															
			SD-08 Manufacturer's Instructions																
			Admixtures for Masonry Mortar	2.4.1.3															
			Admixtures for Grout	2.4.2.2															
		05 05 20	SD-01 Preconstruction Submittals																
			Installer Qualifications	1.5.1.1	G														
			Post-Installed Anchor Special	1.5.1.2	G														
			Inspector Qualifications																
			SD-03 Product Data																
			Mechanical Anchors in Concrete	2.1.1.3	G														
			Adhesive Anchor System in	2.1.1.4	G														
			Concrete																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		05 05 20	Non-Shrink, Non-Metallic Grout	3.1.3	G													
			SD-06 Test Reports															
			Post-Installed Anchor Special	3.3.4	G													
			Inspections Report															
			SD-07 Certificates															
			Post-Installed Anchor	2.1.1.1	G													
			Certification															
			SD-08 Manufacturer’s Instructions															
			Manufacturer's Printed	2.1.1.2	G													
			Installation Instructions															
			Non-Shrink, Non-Metallic Grout	3.1.3	G													
			Manufacturer's Safety Data	1.5														
			Sheets															
		05 50 13	SD-02 Shop Drawings															
			Floor Gratings	2.4	G													
			Bollards/Pipe Guards	2.5	G													
			Angles and Plates	2.6	G													
			Pit Access Hatches	2.7	G													
			Installation Drawings	2.6	G													
			Structural System	1.5.1	G													
			SD-03 Product Data															
			Floor Gratings	2.4	G													
			Pit Access Hatches	2.7	G													
			Certified Mill	2.2	G													
		05 59 10	SD-01 Preconstruction Submittals															
			Assembly Tests	2.6.2	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		05 59 10	Acceptance Testing	3.3	G													
			SD-02 Shop Drawings															
			Detail Drawings	1.4.3	G													
			SD-03 Product Data															
			Wheel Assemblies	2.1.7	G													
			Materials List	1.4.3	G													
			Welding	2.4	G													
			Welding of Aluminum	2.4.2	G													
			Steel Welding Repairs	2.4.4	G													
			SD-07 Certificates															
			Welder Qualifications	1.4.1														
			Welding of Aluminum	2.4.2														
		07 11 13	SD-03 Product Data															
			Asphalt Primer	2.1	G													
			Fibrated Emulsion-Based Asphalt	2.2.1	G													
			Glass Fabric Reinforcement	2.3	G													
			Saturated Felt	2.4.1	G													
			Geotextile Fabric	2.4.2	G													
			SD-07 Certificates															
			Materials	1.3														
		07 84 00	SD-02 Shop Drawings															
			Firestopping System	2.1	G													
			SD-03 Product Data															
			Firestopping Materials	2.2	G													
			SD-06 Test Reports															
			Inspection	3.3	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		07 84 00	SD-07 Certificates																
			Inspector Qualifications	1.5.2															
			Firestopping Materials	2.2															
			Installer Qualifications	1.5.1	G														
		09 90 00	SD-02 Shop Drawings																
			Piping Identification	3.9															
			SD-03 Product Data																
			Coating	2.1	G														
			Product Data Sheets	2.1															
			SD-07 Certificates																
			Qualification Testing	1.6.5.2	G														
			Indoor Air Quality for Paints and	1.6.4															
			Primers																
			SD-08 Manufacturer’s Instructions																
			Mixing	2.1															
			Manufacturer's Safety Data	1.8.1															
			Sheets																
			SD-10 Operation and Maintenance																
			Data																
			Coatings	2.1	G														
		09 96 00	SD-01 Preconstruction Submittals																
			Equipment List	1.3															
			SD-03 Product Data																
			Epoxy Coatings	2.2.1	G														
			SD-04 Samples																
			Color Chips	1.3	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		09 96 00	SD-07 Certificates																
			Epoxy Coatings	2.2.1	G														
			Manufacturer's Printed	3.1.4															
			Instructions																
		09 96 53.13	SD-01 Preconstruction Submittals																
			Equipment List	1.3															
			SD-03 Product Data																
			Silicone Elastomeric Coating	2.2.1															
			Primer	2.3															
			Sealants	2.4															
			SD-04 Samples																
			Color Selection Guide	2.2.1															
		09 97 13.27	SD-05 Design Data																
			Containment System	1.4.4.1															
			SD-06 Test Reports																
			Joint Sealant Qualification Test	1.4.5.1															
			Reports																
			Coatings Qualification Test	1.4.5.2															
			Reports																
			Metallic Abrasive Qualification	1.4.5.3															
			Test Reports																
			Coating Sample Test Reports	3.1.3															
			Abrasive Sample Test Reports	3.1.4	G														
			Inspection Report Forms	3.8.2.2															
			Daily Inspection Reports	3.8.2.3															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09 97 13.27	Recycled Metallic Abrasive Field	1.4.5.4														
			Test Reports (Daily and Weekly)															
			SD-07 Certificates															
			Contract Errors, Omissions, and	1.4.1														
			Other Discrepancies															
			Corrective Action Procedures	1.4.2.1														
			Coating Work Plan	1.4.3	G													
			Qualifications of Certified	1.4.6.1														
			Industrial Hygienist (CIH)															
			Qualifications Of Individuals	1.4.6.5														
			Performing Abrasive Blasting															
			Qualifications of Certified	1.4.6.2														
			Protective Coatings Specialist															
			(PCS)															
			Qualifications of Coating	1.4.6.3														
			Inspection Company															
			Qualifications of QC Specialist	1.4.6.4														
			Coating Inspector															
			Qualifications of Testing	1.4.6.6														
			Laboratory for Coatings															
			Qualifications of Testing	1.4.6.7														
			Laboratory for Abrasive															
			Qualifications of Coating	1.4.6.8														
			Contractors															
			Joint Sealant Materials	1.4.6.9														
			Coating Materials	1.4.6.10														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		09 97 13.27	Coating System Component	1.4.6.11															
			Compatibility																
			Non-metallic Abrasive	1.4.6.12															
			Metallic Abrasive	1.4.6.13															
			SD-08 Manufacturer’s Instructions																
			Joint Sealant Instructions	1.5.1															
			Coating System Instructions	1.5.2															
			SD-11 Closeout Submittals																
			Disposal of Used Abrasive	3.5.6	G														
			Inspection Logbook	3.8.2.4	G														
		25 05 11.26	SD-01 Preconstruction Submittals																
			Device Account Lock Exception	3.3.2	G														
			Request																
			Contractor Computer	1.10.1.6	G														
			Cybersecurity Compliance																
			Statements																
			Contractor Temporary Network	1.10.6	G														
			Cybersecurity Compliance																
			Statements																
			Cybersecurity Subject Matter	1.7.2	G														
			Expert Qualifications																
			SD-02 Shop Drawings																
			Network Communication, Ports,	1.8.1	G														
			Protocols and Services Report																
			Cybersecurity Network (Riser)	1.8.4	G														
			Diagram																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		25 05 11.26	SD-03 Product Data																
			Control System Cybersecurity	1.8.6	G														
			Documentation																
			SD-06 Test Reports																
			Control System Cybersecurity	3.12.1	G														
			Testing Procedures																
			Control System Cybersecurity	3.12.3	G														
			Testing Report																
			SD-07 Certificates																
			Software Licenses	1.9	G														
			SD-11 Closeout Submittals																
			Password Change Summary	3.4.5.3	G														
			Report																
			Enclosure Keys	3.3.5	G														
			Software and Configuration	1.8.3	G														
			Backups																
			Auditing Front End Software	3.5.3	G														
			Device Audit Record Upload	3.5.4.1	G														
			Software																
			System Maintenance Tool	3.9	G														
			Software																
			Control System Scanning Tools	3.11.1	G														
			Vendor Guide Compliance Result	1.8.5	G														
			Report																
			Final Control System Inventory	1.8.2	G														
			Report																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		26 05 48	SD-02 Shop Drawings																
			Equipment Requirements	2.1	G														
			SD-03 Product Data																
			Equipment Requirements	2.1	G														
			Anchors	3.3	G														
			SD-06 Test Reports																
			Anchors	3.3	G														
		26 05 73	SD-01 Preconstruction Submittals																
			Field Examination Plan	3.1	G														
			Arc Flash Label Formats	3.2.9	G														
			SD-06 Test Reports																
			Field Examination	3.1.1															
			SD-07 Certificates																
			System Analyzer	1.4.1	G														
			SD-11 Closeout Submittals																
			Model Files	3.3	G														
			Load Flow Study	3.2.4	G														
			Fault Current Study	3.2.5	G														
			System Coordination Study	3.2.6	G														
			Arc Flash Hazard Study	3.2.7	G														
		26 08 00	SD-06 Test Reports																
			Acceptance Tests and	3.1	G														
			Inspections																
			SD-07 Certificates																
			Qualifications	1.4.1	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		26 08 00	Acceptance Test and Inspections	1.4.3	G														
			Procedure																
		26 12 19	SD-02 Shop Drawings																
			Pad-mounted Transformer	1.5.1	G														
			Drawings																
			SD-03 Product Data																
			Pad-mounted Transformers	2.2	G														
			SD-06 Test Reports																
			Acceptance Checks and Tests	3.7.1	G														
			SD-07 Certificates																
			Transformer Efficiencies	2.2.2.1	G														
			SD-09 Manufacturer’s Field																
			Reports																
			Transformer Test Schedule	2.7.1	G														
			Design Tests	2.7.2	G														
			Routine and Other Tests	2.7.3	G														
			SD-10 Operation and Maintenance																
			Data																
			Transformer(s)	1.6.1	G														
		26 13 00	SD-02 Shop Drawings																
			Switchgear Drawings	1.5.1	G														
			SD-03 Product Data																
			Electronic Overcurrent Control	1.5.3	G														
			Curves																
			SF6/High-Firepoint Fluid	1.6.1	G														
			Insulated Pad-mounted Switchgear																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		26 13 00	SF6/High-Firepoint Fluid	2.1	G														
			Insulated Pad-mounted Switchgear																
			Insulated High-Voltage	2.2	G														
			Connectors																
			Surge Arresters	2.3	G														
			SD-06 Test Reports																
			Acceptance Checks and Tests	3.4.1	G														
			SD-07 Certificates																
			Paint Coating System	1.5.2	G														
			SD-09 Manufacturer's Field																
			Reports																
			Switchgear Design and	2.4.1	G														
			Production Tests																
		26 20 00	SD-02 Shop Drawings																
			Panelboards	2.7	G														
			Transformers	2.8	G														
			Wireways	2.12	G														
			Marking Strips	3.1.3.1	G														
			SD-03 Product Data																
			Receptacles	2.6	G														
			Circuit Breakers	2.7.3	G														
			Transformers	2.8	G														
			Surge Protective Devices	2.13	G														
			SD-06 Test Reports																
			Grounding System Test	3.5.3	G														
			Transformer Tests	3.5.2	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		26 20 00	SD-09 Manufacturer's Field																
			Reports																
			Transformer Factory Tests	2.15.1															
		26 27 14.00 20	SD-02 Shop Drawings																
			Installation Drawings	1.3.1	G														
			SD-06 Test Reports																
			Acceptance Checks and Tests	3.2.1	G														
			System Functional Verification	3.2.2	G														
			Building Meter Installation Sheet,	3.2.1	G														
			per Building																
			Completed Meter Installation	3.2.1	G														
			Schedule																
			Completed Meter Data Schedule	3.2.1	G														
			Meter Configuration Template	2.1.1	G														
			Meter Configuration Report	3.2.1	G														
			SD-10 Operation and Maintenance																
			Data																
			Electricity Meters and	1.4.1	G														
			Accessories																
			SD-11 Closeout Submittals																
			System Functional Verification	3.2.2	G														
		26 42 13	SD-02 Shop Drawings																
			Drawings	1.4.3	G														
			Dielectric Gasket Kit	2.2.4	G														
			Test Station Housing	2.1.1	G														
			Over Voltage Protector (OVP)	2.2.6	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 42 13	Materials List	2.2	G													
			SD-03 Product Data															
			Test Station Housing	2.1.1	G													
			Test Station Terminal Board	2.1.3	G													
			Calibrated Shunt	2.1.2	G													
			Insulated Ring Terminals	2.1.3	G													
			Magnetic Switch	2.2.3	G													
			Magnetic Switch Key	2.2.3	G													
			Printed Label	2.1.3	G													
			Pipe Test Lead	3.2.6	G													
			Exothermic Weld Mold	2.2.7	G													
			Exothermic Weld Charge	2.2.7	G													
			Exothermic Weld Coating	2.2.7	G													
			Galvanic Anode Ingot	2.2.1.2.2	G													
			Galvanic Anode Backfill	2.2.1.2.3	G													
			Galvanic Anode Test Lead	2.2.1.2.2	G													
			Coupon and Test Lead	2.2.3	G													
			Dielectric Gasket Kit	2.2.4	G													
			Dielectric Tubing Union	2.2.5	G													
			Dielectric Tubing Union	3.2.9	G													
			Over Voltage Protector (OVP)	2.2.6	G													
			OVP Mounting Bracket	2.2.6.2	G													
			Protective Flange Band	2.2.6.3	G													
			SD-06 Test Reports															
			Final Compliance Test Report	3.3.1.3	G													
			As-built Drawings	3.3.1.3	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		26 42 13	SD-07 Certificates																
			Qualifications	1.4.2	G														
			SD-10 Operation and Maintenance																
			Data																
			Cathodic Protection System	3.3.1.3	G														
			Training Course Outline	3.3.1.2	G														
			SD-11 Closeout Submittals																
			Final Compliance Test Report	3.3.1.3	G														
		26 56 00	SD-02 Shop Drawings																
			Luminaire Drawings	1.5.1.1	G														
			Pole Drawings	1.5.1.2	G														
			Control System One-Line	1.8.2	G														
			Diagram																
			Sequence of Operation for	2.5.1	G														
			Exterior Lighting Control System																
			SD-03 Product Data																
			Luminaires	2.2	G														
			Light Sources	2.3	G														
			LED Drivers	2.4	G														
			Luminaire Warranty	1.7.1	G														
			Lighting Controls Warranty	1.7.2	G														
			Pole Warranty	1.7.3	G														
			Photosensors	2.5.2.2	G														
			Time Clock	2.5.2.1	G														
			Poles	2.6	G														
			Brackets	2.6.2															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		26 56 00	Pole Foundations	2.6.3	G														
			Obstruction Marker Luminaires	2.2.2	G														
			SD-05 Design Data																
			Luminaire Design Data	1.5.2	G														
			SD-06 Test Reports																
			ANSI/IES LM-79 Test Report	1.5.3	G														
			ANSI/IES LM-80 Test Report	1.5.4	G														
			ANSI/IES TM-21 Test Report	1.5.5	G														
			SD-08 Manufacturer’s Instructions																
			Poles	2.6															
			SD-10 Operation and Maintenance																
			Data																
			Lighting System	1.8.1	G														
			Exterior Lighting Control System	1.8.2	G														
			Maintenance Staff Training Plan	3.3.1.1	G														
			End-User Training Plan	3.3.1.2	G														
		26 56 20	SD-01 Preconstruction Submittals																
			Protection plan	1.4.4	G														
			Training	3.10.2	G														
			SD-02 Shop Drawings																
			Lighting and visual navigation aids	2.1	G														
			Posted instructions	3.10.4	G														
			SD-03 Product Data																
			Taxiway edge lights	2.2.1	G														
			Guidance signs	2.3.3	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 56 20	Obstruction lighting	2.4	G													
			Light bases	2.5	G													
			Isolation transformers	2.6	G													
			Constant current regulators	3.9.1	G													
			Frangible couplings	2.7.2.5	G													
			Materials and equipment	1.4.2	G													
			SD-06 Test Reports															
			Visual inspection	3.8	G													
			Visual inspection	3.8.1	G													
			Progress testing for series	3.8.5	G													
			lighting circuits															
			Counterpoise system test and	3.8.4	G													
			inspection															
			Operating test	3.8.2	G													
			Distribution conductors, 600-volt	3.8.3	G													
			class															
			Electrical acceptance tests	3.8.6	G													
			Low-voltage continuity tests	3.8.7	G													
			High-voltage insulation resistance	3.8.8	G													
			tests															
			Constant current regulators	3.9.1	G													
			SD-07 Certificates															
			Qualifications of contractor	1.4.3	G													
			Special tools	2.8.1	G													
			Special tools	3.10.2	G													
			Crimping tool	3.2.2.2	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 56 20	Cable penciler	3.2.2.3														
			List of parts	3.11.1	G													
			SD-08 Manufacturer's Instructions															
			Posted instructions	3.10.4	G													
			SD-10 Operation and Maintenance															
			Data															
			Constant current regulators	3.9.1	G													
			Maintenance and repair	3.11.2	G													
			instructions															
			Posted operations and	3.11.3														
			maintenance instructions															
			SD-11 Closeout Submittals															
			As-built drawings	3.10.3														
		31 00 00	SD-01 Preconstruction Submittals															
			Excavation and Trenching Plan	3.1.3	G													
			Borrow Plan	3.2	G													
			Dewatering Work Plan	3.1.2.2	G													
			Disposition of Surplus Materials	3.10	G													
			Preconstruction Meeting	1.6.4	G													
			SD-06 Test Reports															
			Material Test Report	3.11	G													
			Borrow Site Testing	3.2.3	G													
			Pipe Inspection Report	3.6.1.6	G													
			Geotechnical Evaluation Report	1.6.1	G													
			Subsurface Extents of Karst	3.3.3	G													
			Features Report															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		31 00 00	Karst Feature Repair	3.3.3	G													
			Methodology and Hydrogeologic															
			Assessment Report															
		31 32 19.16	SD-03 Product Data															
			Thread	2.1.2														
			Manufacturing Quality Control	2.2														
			Sampling and Testing															
			SD-04 Samples															
			Quality Assurance Samples and	3.1														
			Tests															
			SD-07 Certificates															
			Geotextile	2.1.1														
		31 33 10	SD-01 Preconstruction Submittals															
			Grout Installation Procedure	3.1.2														
			SD-02 Shop Drawings															
			Grouting Location Plan	3.1.1														
			SD-03 Product Data															
			Drilling Equipment	3.2.2														
			Grouting Equipment	3.2.3														
			Grout Plant	3.2.3	G													
		32 01 19.61	SD-03 Product Data															
			Sealants	2.1														
			Manufacturer's	3.5.2														
			Recommendations															
			SD-04 Samples															
			Sealants	2.1														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 01 19.61	Blocking Media/Backup Materials	2.3.1															
			Backer Rod	3.3.1.1															
			Bond Breaking Tapes	2.3.2															
			SD-06 Test Reports																
			Sealants	2.1															
			SD-07 Certificates																
			Equipment List	3.1															
			SD-08 Manufacturer’s Instructions																
			Sealants	2.1															
		32 05 33	SD-01 Preconstruction Submittals																
			Integrated Pest Management	2.4	G														
			Plan																
			SD-03 Product Data																
			Fertilizer	2.1	G														
			Mulches Topdressing	2.3															
			Organic Mulch Materials	2.3.1															
			SD-07 Certificates																
			Maintenance Inspection Report	3.5.1															
			Plant Quantities	3.5.2	G														
			SD-10 Operation and Maintenance																
			Data																
			Maintenance	1.5															
		32 11 20	SD-03 Product Data																
			Plant, Equipment, and Tools	2.3	G														
			Waybills and Delivery Tickets	1.1.1															
			SD-06 Test Reports																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 11 20	Initial Tests	2.2.1	G														
			In-Place Tests	3.13.1	G														
			Test Section Report	1.7.2	G														
		32 11 23	SD-03 Product Data																
			Plant, Equipment, and Tools	2.5	G														
			SD-06 Test Reports																
			Initial Tests	2.4.1	G														
			In-Place Tests	3.13.1	G														
			Test Section Report	1.6.2	G														
		32 11 23.23	SD-03 Product Data																
			Plants, Equipment, and Tools	2.2.1	G														
			SD-06 Test Reports																
			Initial Tests	1.3.3.1	G														
			Test Section Construction Report	1.5.2.7	G														
		32 12 13	SD-03 Product Data																
			Prime Coat Certificate Of	2.2	G														
			Analysis (COA)																
			Tack Coat Certificate Of Analysis	2.3	G														
			(COA)																
			SD-06 Test Reports																
			Sampling and Testing	3.7.1															
			Application Rate Calibration	3.3.4	G														
			Daily Application Rate Verification	3.3.5															
			SD-07 Certificates																
			Certificates Of Compliance	3.7															
			(COC)																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 12 15.13	SD-01 Preconstruction Submittals																
			Equipment	2.2	G														
			SD-02 Shop Drawings																
			Placement Plan	2.1	G														
			SD-03 Product Data																
			Diamond Grinding Plan	2.2.6	G														
			Mix Design	2.5	G														
			Contractor Quality Control	3.1	G														
			SD-04 Samples																
			Aggregates	2.3															
			Asphalt Binder	2.4															
			Warm-mix Additive	2.5.1															
			SD-06 Test Reports																
			Aggregates	2.3	G														
			QC Monitoring	3.1.3.10															
			Pavement Lots	1.7.3	G														
			SD-07 Certificates																
			Asphalt Binder	2.4	G														
			Testing Laboratory	3.1.2															
			Warm-mix Additive	2.5.1															
			Airfield Asphalt Pavement QC Manager	1.6															
			Airfield Asphalt Pavement Inspector	1.6															
			Airfield Asphalt Pavement Laboratory Technician	1.6															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 12 16.16	SD-02 Shop Drawings																
			Placement Plan	2.1	G														
			SD-03 Product Data																
			Diamond Grinding Plan	2.1.6	G														
			Mix Design	2.4	G														
			Contractor Quality Control	3.1	G														
			SD-04 Samples																
			Aggregates	2.2															
			Asphalt Cement Binder	2.3															
			Warm-mix Additive	2.4.1															
			SD-06 Test Reports																
			Aggregates	2.2	G														
			QC Monitoring	3.1.3.9															
			SD-07 Certificates																
			Asphalt Cement Binder	2.3	G														
			Laboratory Accreditation and Validation	1.5.11															
			Warm-mix Additive	2.4.1															
		32 13 14.13	SD-01 Preconstruction Submittals																
			Proposed Techniques	3.1.2	G														
			Preliminary Proposed Proportioning	2.13.2	G														
			Pavement Quality Control Plan	1.4.3.3	G														
			Stringless Technology	3.5.6.3	G														
			SD-03 Product Data																
			Diamond Grinding Plan	2.1.7	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 13 14.13	Dowels	2.9.1	G														
			Dowel Bar Assemblies	2.9.2	G														
			Equipment	2.11	G														
			Concrete Patching Mixture	2.1.5	G														
			SD-05 Design Data																
			Proportioning Studies	2.13.2	G														
			SD-06 Test Reports																
			Batch Plant Manufacturer's	1.4.1	G														
			Inspection Report																
			Batch Plant Manufacturer's	1.4.1	G														
			Inspection Report																
			Slipform Paver Manufacturer's	1.4.1	G														
			Inspection Report																
			Sampling and Testing	2.1.4.1	G														
			Diamond Grinding of PCC	2.1.7	G														
			Surfaces																
			Mixer Performance (Uniformity)	2.11.2.1	G														
			Testing																
			Repair Recommendations Plan	3.9.1	G														
			Paving Lot Report	3.12.5	G														
			Test Section Lot Report	1.4.6.4	G														
			SD-07 Certificates																
			Contractor Quality Control (CQC)	1.4.1	G														
			Staff																
			Laboratory Accreditation and	1.4.3	G														
			Validation																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 13 14.13	NRMCA Certificate of	2.11															
			Conformance																
			Petrographer Resume	1.4.2	G														
			Licensed Surveyor	1.4.2	G														
			Concrete Batch Plant Operator	1.4.2	G														
			Profilograph Operator	1.4.2	G														
		32 13 73.19	SD-03 Product Data																
			Equipment	2.1															
			Manufacturer's Instructions	3.1.1															
			SD-04 Samples																
			Compression Seals	2.2	G														
			SD-06 Test Reports																
			Test Requirements	2.1.3	G														
		32 16 19	SD-03 Product Data																
			Concrete	2.1															
			Biodegradable Form Release	2.6.4															
			Agent																
			Biodegradable Form Release	3.2															
			Agent																
			SD-06 Test Reports																
			Field Quality Control	3.7															
		32 17 23.16	SD-01 Preconstruction Submittals																
			Quality Control Plan	1.3.1	G														
			Qualifications	1.3.2	G														
			Safety Data Sheets For Each	2.2	G														
			Paint Type																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		32 17 23.16	Surface Preparation Equipment	2.1	G													
			List															
			Marking Applications Equipment	2.1.2	G													
			List															
			Detour Plans	1.5.2	G													
			SD-03 Product Data															
			Manufacturer Data Sheets for all	2.2	G													
			Marking Materials															
			Manufacturer Data Sheets for all	2.2.3	G													
			Reflective Media															
			SD-04 Samples															
			Samples of Marking Materials	3.5.2	G													
			Samples of each Reflective	3.5.2	G													
			Media															
			SD-06 Test Reports															
			Marking Application Wet Film	3.1.1	G													
			Thickness Test															
			Marking Application Wet Film	3.5.4.1	G													
			Thickness Test															
			Marking Application Wet Film	3.5.4.2	G													
			Thickness Test															
			Reflective Media Reflectivity Test	3.1.2	G													
			Reflective Media Reflectivity Test	3.5.4.1	G													
			SD-07 Certificates															
			Manufacturer Certificate of	2.2	G													
			Compliance for Marking Materials															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 17 23.16	Manufacturer Certificate of	2.2	G														
			Compliance for Reflective																
			Materials																
			Manufacturer Certificate of	1.5.1.3	G														
			Conformance for Volatile Organic																
			Compliance																
			SD-08 Manufacturer's Instructions																
			Marking Materials Storage and	1.4	G														
			Application																
			Reflective Media Storage and	1.4	G														
			Application																
			Chemicals Used in Surface	1.4	G														
			Preparation																
		32 17 23.19	SD-01 Preconstruction Submittals																
			Quality Control Plan	1.3.1	G														
			Qualifications	1.3.2.1	G														
			Safety Data Sheets For Each	2.2	G														
			Paint Type																
			Marking Applications Equipment	2.1.2	G														
			List																
			SD-03 Product Data																
			Manufacturer Data Sheets for all	2.2	G														
			Marking Materials																
			Manufacturer Data Sheets for all	2.2	G														
			Reflective Materials																
			SD-04 Samples																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		32 17 23.19	Samples Of Marking Materials	3.5.2	G													
			Samples Of Each Reflective	3.5.2	G													
			Media															
			SD-06 Test Reports															
			Marking Application Wet Film	3.1.1	G													
			Thickness															
			Marking Application Wet Film	3.5.4.1	G													
			Thickness															
			Marking Application Wet Film	3.5.4.2	G													
			Thickness															
			Reflective Media Reflectivity Test	3.1.2	G													
			Reflective Media Reflectivity Test	3.5.4.1	G													
			Reflective Media Reflectivity Test	3.5.4.3	G													
			SD-07 Certificates															
			Manufacturer Certificate of	2.2	G													
			Compliance for Marking Materials															
			Manufacturer Certificate of	2.2	G													
			Compliance for Reflective															
			Materials															
			Manufacturer Certificate Of	1.5.1.3	G													
			Conformance For Volatile Organic															
			Compliance															
			SD-08 Manufacturer’s Instructions															
			Marking Materials Storage and	1.4	G													
			Application															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		32 17 23.19	Reflective Media Storage and	1.4	G													
			Application															
			Chemicals Used in Surface	1.4	G													
			Preparation															
		32 31 13.53	SD-02 Shop Drawings															
			Fence Installation Drawings	3.2.1	G													
			SD-03 Product Data															
			Fabric	2.1.1.1														
			Posts	2.1.2														
			Post Caps	2.1.2.2														
			Chain Link Braces	2.1.3														
			Rails	2.1.3														
			Barbed Wire	2.2.1.2														
			Barbed Wire Supporting Arms	2.1.2.2														
			Latches	2.1.4.3														
			Hinges	2.1.4.3														
			Stops	2.1.4.3														
			Keepers	2.1.4.3														
			Rollers	2.1.4.3														
			Wire Ties	2.2.1.1														
			Swing Gates	2.1.5.1														
			SD-07 Certificates															
			Chain Link Fence	2.1.2.1														
			Fabric	2.1.1.1														
			Barbed Wire	2.2.1.2														
			Gate Hardware and Accessories	3.2.1														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 31 13.53	Concrete	2.2.2															
		32 84 24	SD-02 Shop Drawings																
			Temporary Irrigation Sprinkler	1.2															
			System																
			SD-03 Product Data																
			Piping Materials	2.1	G														
			Valves	2.3	G														
			Heads	2.2	G														
			Backflow Preventers	2.3.4	G														
			Automatic Controller	2.5	G														
			Controller Enclosure	2.5.1	G														
			Solvent Cement	2.1.4	G														
			Control Wiring	2.6.1	G														
			Water Meter	2.4.1	G														
			Rain Shut-Off Device	2.4.3.1	G														
			SD-06 Test Reports																
			Tests	1.6.1															
			Backflow Preventers	2.3.4															
			Pressure Test	3.2.1															
			Operation Test	3.2.2															
			SD-07 Certificates																
			Backflow Preventers	2.3.4															
			SD-08 Manufacturer’s Instructions																
			Automatic Controller	2.5															
			Heads	2.2															
			Backflow Preventers	2.3.4															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		32 84 24	Valves	2.3															
			Rain Shut-Off Device	2.4.3.1															
		32 92 19	SD-03 Product Data																
			Wood Cellulose Fiber Mulch	2.5.1															
			Fertilizer	2.4															
			SD-06 Test Reports																
			Topsoil Composition Tests	2.2.3															
			SD-07 Certificates																
			Seed	2.1															
			SD-08 Manufacturer’s Instructions																
			Erosion Control Materials	2.7															
		32 93 00	SD-01 Preconstruction Submittals																
			State Landscape Contractor's License	1.4.2															
			Time Restrictions and Planting Conditions	1.6															
			SD-03 Product Data																
			Peat	2.2.5															
			Composted Derivatives	2.2.8															
			Gypsum	2.2.9															
			Fertilizer	2.4															
			SD-06 Test Reports																
			Topsoil Composition Tests	2.1.4															
		33 08 53	SD-01 Preconstruction Submittals																
			System Start-Up Plan	1.2.1	G														
			Performance Testing Plan	3.5.2	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 08 53	SD-06 Test Reports															
			Equipment Tests	3.4	G													
			Final Reports	1.4.1	G													
			SD-11 Closeout Submittals															
			Certification of Entire System	1.5.2														
		33 09 53	SD-02 Shop Drawings															
			Shop Drawing	3.3.1	G													
			SD-03 Product Data															
			EPDS Cabinet and Components	2.1.1	G													
			EPDS Cabinet and Components	3.1	G													
			Programmable Logical Controller	2.2	G													
			(PLC) Hardware and Software															
			Programmable Logical Controller	3.2	G													
			(PLC) Hardware and Software															
			Control Wiring Data Lists	3.1.2	G													
			Tools and Spare Parts	1.5														
			SD-06 Test Reports															
			Certified EPDS Cabinet Shop	3.1.3														
			Test Report															
			Record of Test	3.3.2														
			SD-07 Certificates															
			Experience and Qualifications	1.6	G													
			Training Plan for Instructing	3.3.3	G													
			Personnel															
			Testing Plan	3.3.2	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		33 09 53	SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	1.3	G														
			Manuals																
		33 11 00	SD-01 Preconstruction Submittals																
			Connections	3.1.1	G														
			SD-03 Product Data																
			Pipe, Fittings, Joints and	2.1.1	G														
			Couplings																
			Valves	2.1.2	G														
			Valve Boxes	2.1.2.3	G														
			Fire Hydrants	2.1.3.1	G														
			Pipe Restraint	2.2.1	G														
			Tapping Sleeves	2.2.2	G														
			Disinfection Procedures	3.2.2	G														
			SD-06 Test Reports																
			Backflow Preventer Tests	3.3.1.5	G														
			Bacteriological Samples	3.3.1.4	G														
			Hydrostatic Sewer Test	3.2.1.1.6															
			Leakage Test	3.3.1.3															
			Hydrostatic Test	3.3.1.1															
			SD-07 Certificates																
			Pipe, Fittings, Joints and	2.1.1															
			Couplings																
			Lining for Fittings	2.1.1.1.1.3															
			Valves	2.1.2															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		33 11 00	Fire Hydrants	2.1.3.1															
			SD-08 Manufacturer's Instructions																
			PVC Piping	2.1.1.1.1.1															
			PVCO Piping	2.1.1.1.1.2															
		33 40 00	SD-07 Certificates																
			Oil Resistant Gasket	2.2.1.1															
			Leakage Test	3.8.1.1															
			Hydrostatic Test on Watertight	2.5.1															
			Joints																
			Density	3.2.1.1															
			Frame and Cover or Gratings	2.4.4															
			Post-Installation Inspection	3.8.2.1.2															
			Report																
			SD-08 Manufacturer's Instructions																
			Placing Pipe	3.3															
			SD-11 Closeout Submittals																
			LID Verification Report	3.8.2.2	G														
		33 46 16	SD-04 Samples																
			Geotextile	2.2															
			Pipe and Pipe Fittings	2.1															
			SD-07 Certificates																
			Geotextile	2.2															
			Pipe and Pipe Fittings	2.1															
			Cleanout Risers	3.2															
		33 52 23.15	SD-01 Preconstruction Submittals																
			Welding Procedure Specification	1.9.1	G														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 52 23.15	Procedure Qualification Record	1.9.2	G													
			Welder Performance Qualification	1.9.3.1	G													
			Weld Plan	1.7.5	G													
			SD-02 Shop Drawings															
			POL Service Piping	1.2.16	G													
			Pigging Plan	3.7.1	G													
			SD-06 Test Reports															
			Weld Log	1.8.2	G													
			Examinations, Inspections and Tests	3.2	G													
			SD-07 Certificates															
			Weld Inspector Certificate	1.9.6.2	G													
			Independent Test Organization	1.9.5	G													
			In-Process Weld Inspector Certificates	1.9.6.3	G													
			Weld Examiner Certificate	1.9.6.4	G													
		33 52 43.11	SD-02 Shop Drawings															
			Hydrant Outlet Pits	2.7	G													
			Hydrant Valve	2.4	G													
			Hydrant Isolation Valve	2.5	G													
			High Point Vent Pits	2.8	G													
			SD-03 Product Data															
			Hydrant Valve	2.4	G													
			Hydrant Isolation Valve	2.5	G													
			SD-07 Certificates															
			System Supplier	1.4	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		33 52 43.11	SD-10 Operation and Maintenance																
			Data																
			Hydrant Valve	2.4	G														
			Hydrant Isolation Valve	2.5	G														
		33 52 43.13	SD-01 Preconstruction Submittals																
			Contractor Qualifications	1.4.2	G														
			SD-03 Product Data																
			Stainless Steel Piping	2.2.1	G														
			Protective Coatings for Buried	2.2.2.1	G														
			Stainless Steel Piping																
			Protective Coatings for Buried	3.6.2	G														
			Stainless Steel Piping																
			Fittings	2.2.3	G														
			Isolating Gasket Kits	2.2.3.3	G														
			Flange Protectors	2.2.3.4	G														
			Lightning Surge Arrester	2.2.3.3	G														
			Nuts and Bolts	2.2.4	G														
			Gaskets	2.2.5	G														
			Ball Valves	2.3.1	G														
			Plug (Double Block and Bleed)	2.3.2	G														
			Valves																
			Thermal Relief Valves	2.4	G														
			Strainers	1.2	G														
			Strainers	2.5.2	G														
			Pigging Accessories	2.5.4	G														
			SD-05 Design Data																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 52 43.13	Pipeline Inventory	1.4.1.1	G													
			SD-06 Test Reports															
			Pneumatic Test	3.8.1														
			Hydrostatic Test	3.8.1.2														
			SD-07 Certificates															
			Stainless Steel Piping	2.2.1														
			Protective Coatings for Buried	2.2.2.1														
			Stainless Steel Piping															
			Protective Coatings for Buried	3.6.2														
			Stainless Steel Piping															
			Fittings	2.2.3														
			Isolating Gasket Kits	2.2.3.3														
			Lightning Surge Arrester	2.2.3.3														
			Nuts and Bolts	2.2.4														
			Gaskets	2.2.5														
			Ball Valves	2.3.1														
			Plug (Double Block and Bleed)	2.3.2														
			Valves															
			Thermal Relief Valves	2.4														
			Strainers	1.2														
			Strainers	2.5.2														
			Pigging Accessories	2.5.4														
			Survey Final Elevations	3.4.7														
			Pipeline Pigging Verification	3.9	G													
			SD-10 Operation and Maintenance															
			Data															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		33 52 43.13	Operation and Maintenance	1.2	G														
			Manuals																
			Ball Valves	2.3.1	G														
			Plug (Double Block and Bleed)	2.3.2	G														
			Valves																
			Strainers	1.2	G														
			Strainers	2.5.2	G														
			Isolating Gasket Kits	2.2.3.3	G														
		33 52 80	SD-01 Preconstruction Submittals																
			Contract Errors, Omissions, and	1.5.1															
			Other Discrepancies																
			Corrective Action Procedures	1.5.2.1															
			Corrective Action Request (CAR)	1.5.2.2															
			Form																
			Coatings Work Plan	1.5.3															
			Inspection Report Forms	3.6.1.2															
			SD-03 Product Data																
			External Pipe Coating	2.1.1															
			Internal Pipe Coating	2.1.2															
			Field-Applied External Pipe	2.2															
			Coating																
			SD-05 Design Data																
			Containment System	1.5.4.1															
			SD-06 Test Reports																
			Inspection Report Forms	3.6.1.2															
			Daily Inspection Reports	3.6.1.3															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		33 52 80	Coatings Qualification Test	1.5.5.1															
			Reports																
			Non-Metallic Abrasive	1.5.5.2															
			Qualification Test Reports																
			Coating Field Test Reports	3.1.3															
			Abrasive Field Test Reports	3.1.4															
			SD-07 Certificates																
			Contract Errors, Omissions, And	1.5.1															
			Other Discrepancies																
			Corrective Action Procedures	1.5.2.1															
			Coatings Work Plan	1.5.3															
			Qualifications of Certified	1.5.6.1															
			Industrial Hygienist (CIH)																
			Qualifications of Pipe Coating	1.5.6.2															
			Shop																
			Qualifications of Certified	1.5.6.3															
			Protective Coatings Specialist																
			(PCS)																
			Qualifications of Coatings	1.5.6.4															
			Inspection Company																
			Qualifications of Quality	1.5.6.5															
			Assurance Coatings Inspector																
			Qualifications of Coatings	1.5.6.6															
			Contractors for Field Coating																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 52 80	Qualifications of Individuals	1.5.6.7														
			Performing Abrasive Blasting for															
			Field Coating															
			Qualifications of Individuals	1.5.6.8														
			Performing Coating Application for															
			Field Coating															
			Qualifications of Testing	1.5.6.9														
			Laboratory for Coatings															
			Qualifications of Testing	1.5.6.10														
			Laboratory for Abrasive															
			Coating Materials Certificate of	1.5.6.11														
			Conformance															
			Non-Metallic Abrasive Certificate	1.5.6.12														
			of Conformance															
			SD-08 Manufacturer's Instructions															
			Coating System Instructions	1.6.1														
			SD-11 Closeout Submittals															
			Disposal of Used Abrasive Shop	3.4.1.5														
			Applied Coating															
			Disposal of Used Abrasive Field	3.5.1.6														
			Applied Coating															
			Inspection Logbook	3.6.1.4														
			Corrective Action Log	1.5.2.3	G													
		33 71 02	SD-02 Shop Drawings															
			Precast Underground Structures	1.5.1	G													
			SD-03 Product Data															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 71 02	Medium Voltage Cable	2.5	G													
			Medium Voltage Cable Joints	2.7	G													
			Medium Voltage Cable Terminations	2.6	G													
			Precast Concrete Structures	2.13.2.1	G													
			Sealing Material	2.13.2.4														
			Pulling-In Irons	3.5.3														
			Manhole Frames and Covers	2.13.3	G													
			Handhole Frames and Covers	2.13.4	G													
			Frames and Covers for Airfield Facilities	2.13.5	G													
			Ductile Iron Frames and Covers for Airfield Facilities	2.13.6	G													
			Composite/Fiberglass Handholes	2.13.8	G													
			Cable Supports	2.14	G													
			SD-06 Test Reports															
			Medium Voltage Cable Qualification and Production Tests	2.18.2	G													
			Field Acceptance Checks and Tests	3.18.1	G													
			Arc-proofing Test	2.18.1	G													
			Cable Installation Plan and Procedure	3.3	G													
			SD-07 Certificates															
			Cable splicer/terminator	1.5.2	G													
			Cable Installer Qualifications	1.5.3	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		33 71 02	Certificate of Conformance	1.5.4	G														
		33 82 00	SD-02 Shop Drawings																
			Telecommunications Outside	1.5.1.1	G														
			Plant																
			Telecommunications Entrance	1.5.1.2	G														
			Facility Drawings																
			SD-03 Product Data																
			Wire and Cable	2.8	G														
			Cable Splices, and Connectors	2.5	G														
			Closures	2.3	G														
			Building Protector Assemblies	2.2.1	G														
			Protector Modules	2.2.2	G														
			Cross-Connect Terminal	2.4	G														
			Cabinets																
			Spare Parts	1.7.2	G														
			SD-06 Test Reports																
			Pre-installation Tests	3.5.1	G														
			Acceptance Tests	3.5.2	G														
			Outside Plant Test Plan	1.5.3	G														
			SD-07 Certificates																
			Telecommunications Contractor	1.5.2.1	G														
			Key Personnel	1.5.2.2	G														
			Manufacturer's Qualifications	1.5.2.3	G														
			SD-08 Manufacturer’s Instructions																
			Building Protector Assembly	2.2.1	G														
			Installation																

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
P-012 North Aircraft Parking Ramp

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 82 00	Cable Tensions	3.1.8.1	G													
			Fiber Optic Splices	3.1.10.2	G													
			SD-09 Manufacturer's Field															
			Reports															
			Factory Reel Test Data	2.15.1	G													
			SD-10 Operation and Maintenance															
			Data															
			Telecommunications Outside	1.5.1.1	G													
			Plant (OSP)															
			SD-11 Closeout Submittals															
			Record Documentation	1.7.1	G													
		34 73 16	SD-02 Shop Drawings															
			As-Built Drawings	1.3	G													
			SD-06 Test Reports															
			Tests	3.2														
			SD-07 Certificates															
			Grounding Rods	2.2														
			Copper Conductors	2.3														
			Grounding Connectors	2.4														

SECTION 01 33 29

SUSTAINABILITY REQUIREMENTS AND REPORTING
02/21, CHG 1: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. For references without a year, use the current published version.

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)

HPSB Guiding Principles	Guiding Principles for Sustainable Federal Buildings and Determining Compliance with the Guiding Principles for Sustainable Federal Buildings

INTERNATIONAL CODE COUNCIL (ICC)

ICC IgCC	(2018) International Green Construction Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

FSRIA 9002	Farm Security and Rural Investment Act Section 9002 (USDA BioPreferred Program)

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-02	(2020; Change 2, 2022) High Performance and Sustainable Building Requirements
UFC 3-600-01	(2016; with Change 6, 2021) Fire Protection Engineering for Facilities

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	Energy Star Energy Efficiency Labeling System (FEMP)
FEMP	Federal Energy Management Program (FEMP) Energy-Efficient Product Procurement

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 SUMMARY

This section includes requirements for Sustainability documentation and reporting submittals per the federally mandated High Performance and Sustainable Building (HPSB) or HPSB "Guiding Principles" (GP), and Third-Party Certification (TPC) requirements, in accordance with

UFC 1-200-02 High Performance and Sustainable Building Requirements, and other identified requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preliminary High Performance and Sustainable Building Checklist; G

Sustainability Action Plan; G

Preliminary Sustainability eNotebook; G

SD-11 Closeout Submittals

Final High Performance and Sustainable Building Checklist; G

Final Sustainability eNotebook; G

1.4 GUIDING PRINCIPLES VALIDATION (GPV)

Guiding Principles Validation (GPV) is the project delivery team's self-assessment of UFC 1-200-02 compliance requirements, which includes meeting Federally-required tracking and reporting requirements, in order to report a sustainable Federal building. The use of a third-party certification is an additional and separate requirement.

Provide the following sustainability activities and documentation to verify achievement of HPSB Guiding Principles Validation (GPV):

a. Analysis of each Guiding Principle Requirement and how project complies. Include final government approved narrative(s) in the HPSB Checklist submittal. Multiple checklists indicate multiple buildings that require individual HPSB Checklist tracking.

b. No changes to the HPSB Checklist are allowed without approval from the Contracting Officer, in accordance with Section 01 33 00 SUBMITTAL REQUIREMENTS. Immediately bring to the attention of the Contracting Officer any project changes that impact meeting the approved HPSB Guiding Principles Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.

c. Documentation of all work required to incorporate the applicable HPSB Guiding Principles requirements indicated on the HPSB Checklist and in this contract, including all "S" submittals.

d. Sustainability Action Plan.

e. Construction related documentation for the project Sustainability eNotebook and keep updated with regularly-scheduled Construction Quality Control Meetings. Include construction related documentation

containing the following components:

(1) HPSB Checklist(s)

(2) Sustainability Action Plan

(3) Documentation illustrating HPSB Guiding Principles Requirements compliance, including "S" submittals

1.4.1 Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

a. Analysis of each HPSB Guiding Principles Requirement and how project will comply. Final government approved narrative(s) must be included in the HPSB Checklist submittal.

b. Name and contact information for: Contractor's Point of Contact (POC) ensuring sustainability goals are accomplished and documentation is assembled. For TPC that include on-site visit by third party representative, provide list of required attendees.

c. Indoor Air Quality plan.

1.4.2 Calculations

Provide all calculations, product data, labels and product certifications required in this specification to demonstrate compliance with the HPSB Guiding Principles Requirements.

1.5 SUSTAINABILITY SUBMITTALS

Provide HPSB Checklist and other documentation in the Sustainability eNotebook to indicate compliance with the sustainability requirements of the project.

1.5.1 High Performance Sustainable Building (HPSB) Checklist

Provide construction documentation that provides proof of, and supports compliance with, the completed HPSB Checklist.

1.5.1.1 HPSB Checklist Submittals

Submit updated HPSB Checklist with each Sustainability eNotebook submittal. Include the final HPSB Checklist(s) with the interim DD1354 Real Property Record Submittal.

1.5.2 "S" Submittals for Sustainability Documentation

"S" submittals are the sustainability documentation requirements cited in the various sections of this contract. Submit the GPV sustainability documentation required in this section as "S" submittals in all affected UFGS Sections.

a. Highlight GPV compliance data in "S" submittal.

b. Add "S" submittals to the Sustainability eNotebook only after submittal approval, and bookmark them as required in paragraph SUSTAINABILITY ENOTEBOOK below.

c. Ensure all approved "S" submittals are included in each Sustainability eNotebook submittal.

1.5.3 Sustainability eNotebook

The Sustainability eNotebook is an electronic organizational file that serves as a repository for all required sustainability submittals. To support documentation of compliance with an approved HPSB and TPC checklist, provide and maintain a comprehensive and current Sustainability eNotebook. Include all required data in Sustainability eNotebook, to support full compliance with the HPSB Guiding Principles Requirements, including:

a. HPSB checklist

b. Sustainability Action Plan

c. Calculations

d. Labels

e. "S" submittals

f. Certifications, assessments, or validations and compliance report

g. TPC documentation required in paragraph THIRD-PARTY CERTIFICATION (TPC).

1.5.3.1 Sustainability eNotebook Format

Provide Sustainability eNotebook in the form of an Adobe PDF file; bookmark each HPSB Guiding Principles Requirement, and each TPC requirement, and sub-bookmark at each document. Match format to HPSB Guiding Principles numbering system indicated herein. Maintain up-to-date information, such as spreadsheets, templates, with each current submittals. For TPC projects, provide a second Table of Contents using TPC numbering system, for maintaining documentation unique to TPC.

Contracting Officer may deduct from the monthly progress payment accordingly if Sustainability eNotebook information is not current and on track per project goals.

1.5.3.2 Sustainability eNotebook Submittal Schedule

Provide Sustainability eNotebook Submittals at the following milestones of the project:

a. Preliminary Sustainability eNotebook

b. Submit preliminary Sustainability eNotebook with updated Preliminary High Performance and Sustainable Building Checklist at the first post award meeting in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

c. Construction Quality Control Meetings.

d. Provide up-to-date GP documentation in the Sustainability eNotebook

for each meeting.

e. Final Sustainability eNotebook

f. Submit updated Sustainability eNotebook with updated Final High Performance and Sustainable Building Checklist at Beneficial Occupancy Date (BOD). Final progress payment retainage may be held by Contracting Officer until Final Sustainability construction phase documentation is complete.

1.6 DOCUMENTATION REQUIREMENTS

a. Incorporate each of the following HPSB Guiding Principles requirements into project and provide documentation that proves compliance with each listed requirement. Items below are organized by HPSB Guiding Principles. For life-cycle cost analysis requirements, one document with all analyses is acceptable, with Contracting Officer approval.

b. For each of the following paragraphs that require the use of products listed on Government-required websites, provide documentation of the process used to select products, or process used to determine why listed products do not meet project performance requirements.

1.6.1 Energy Efficient Products

Provide only energy-using products that are Energy Star Certified by the Environmental Protection Agency (EPA) or that meet or exceed the efficiency standard designated by the Federal Energy Management Program (FEMP). Where Energy Star or FEMP requirements have not been established, provide most efficient products that are life-cycle cost-effective. Provide only energy using products that meet FEMP requirements for low standby power consumption. Energy efficient products can be found at: https://www.energystar.gov/.

For construction submittal documentation, provide proof that product is labeled energy efficient and complies with the cited requirements.

1.6.2 Building-level Power Metering

Provide building-level meters for electricity, natural gas, and steam where applicable.

1.6.2.1 Construction Submittal Documentation

Provide documentation of meter communication with the base-wide meter monitoring system, and manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

1.6.3 Indoor Water Use

Provide Construction Documentation proof that fixtures are labeled EPA WaterSense, for products available with EPA WaterSense labeling; for all other fixtures, proof they comply with EPA WaterSense efficiency requirements.

1.6.4 Indoor Water Metering

Provide building-level meters for potable water use. Provide the

requirements cited in the following paragraphs:

1.6.4.1 Construction Submittal Documentation

Provide documentation of meter communication with the base-wide meter monitoring system, and manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

1.6.5 Outdoor Water Use

When there is no permanent irrigation system beyond plant establishment period, this element is met.

Where new irrigation is required beyond plant establishment period, provide only non-potable sources. Provide meters. Provide the requirements cited in the following paragraphs:

1.6.5.1 Construction Submittal Documentation

Provide documentation of meter communication with the base-wide meter monitoring system, and manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

1.6.6 Outdoor Water Meters

Provide meters for outdoor systems that use potable water. Provide the requirements cited in the following paragraphs:

1.6.6.1 Construction Submittal Documentation

Provide documentation of meter communication with the base-wide meter monitoring system, and manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

1.6.7 Moisture Control

Provide the following:

1.6.7.1 Construction Submittal Documentation

Ensure construction materials are separated and protected in accordance with other sections in this contract document, with adequate humidity controls during construction. In accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, includes plan for ongoing building moisture control.

1.6.8 Reduce Volatile Organic Compounds (VOC) (Low-Emitting Materials)

Meet the requirements of Table 3-1 at the end of this specification.

For Construction submittal documentation, provide certifications or labels that demonstrate compliance with cited requirements, based on the attached TABLE 3-1.

1.6.9 Indoor Air Quality During Construction

Prior to construction, create indoor air quality plan. Develop and implement an IAQ construction management plan during construction and flush building air before occupancy.

Provide documentation showing that after construction ends and prior to occupancy, HVAC filters were replaced and building air was flushed out in accordance with the cited standard.

1.6.10 Recycled Content

Comply with 40 CFR 247. Refer to: https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program for assistance identifying products cited in 40 CFR 247. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements.

1.6.10.1 Construction Submittal Documentation

a. Provide manufacturers' documents stating the recycled content by material, or written justification for claiming one of the exceptions allowed on the cited website.

b. Substitutions: Submit for Government approval for proposed alternative products or systems that provide equivalent performance and appearance and have greater contribution to project recycled content requirements. For all such proposed substitutions, submit with the Sustainability Action Plan accompanied by product data demonstrating equivalence.

c. In order to complete compliance with FAR 52.223-9 Estimate of Percentage of Recovered Material Content for EPA Designated Items, refer to submittal requirement for recycled/recovered material content in Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.11 Bio-Based Products

Provide products and materials composed of the highest percentage of bio-based materials (including rapidly renewable resources and certified sustainably harvested products), consistent with FSRIA 9002 USDA BioPreferred Program, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user and when available at a reasonable cost. Use only supplies and materials of a type and quality that conform to applicable specifications and standards.

Comply with FSRIA 9002 USDA BioPreferred Program. Refer to www.biopreferred.gov for the product categories and BioPreferred Catalog. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements. Provide the following documentation:

a. USDA BioPreferred label for each product; for bio-based products used on project but not listed with BioPreferred program, provide bio-based content and percentage.

b. In order to complete compliance with FAR 52.223-1 Biobased Product Certification, refer to submittal requirement for biobased products in Section 01 78 00 CLOSEOUT SUBMITTALS, paragraphs CERTIFICATION OF EPA DESIGNATED ITEMS and CERTIFICATION OF USDA DESIGNATED ITEMS.

1.6.12 Waste Material Management (Recycling – Construction)

Divert demolition and construction debris in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 SUSTAINABILITY COORDINATION

Provide sustainability focus and coordination at all meetings to achieve sustainability goals. Coordinate meeting requirements with other UFGS Sections meeting requirements in this project. Ensure the designated sustainability professional responsible for GP documentation participates in these meetings to coordinate documentation completion. Review GP sustainability requirements, HPSB Checklist documentation, Sustainability Action Plan, and completeness status of Sustainability eNotebook at the following meetings:

a. Pre-Construction Conference

b. Construction Quality Control Meetings

c. Facility Turnover Meetings

d. Conduct review no later than 60 days before final turnover and identify any outstanding issues that affect correct completion of all documentation, and actions that will achieve requirements. Conduct corrective actions prior to turnover, to ensure all requirements are achieved.

3.2 TABLE 3-1 VOLATILE ORGANIC COMPOUNDS (VOC) (LOW EMITTING MATERIALS) REQUIREMENTS

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Adhesives and Sealants	**CDPH/EHLB/Standard method V1.1 (California Section 01350)** (Use "office" or "classroom" space limits for all applications)	or	Adhesives (carpet, resilient, wood flooring; base cove; ceramic tile; drywall and panel; primers) Sealants (acoustical; firestop; HVAC Air duct; primers) Caulks	**SCAQMD Rule 1168** (Use "other" category for HVAC duct sealant) (for firestop adhesive, UFC 3-600-01 overrides conflicting requirements)
			Aerosol adhesives	**Section 3 of Green Seal Standard GS-36** (except: cleaners, solvent cements, and primers used with plastic piping and conduit in plumbing, fire suppression, and electrical systems; HVAC air duct sealants when the application space air temp is less than 40 F (4.5 C).

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Paints and Coatings	**CDPH/EHLB/Standard method V1.1 (California Section 01350)** (Use "office" or "classroom" space limits for all applications)	or	Flat and nonflat, nonflat high-gloss, specialty, basement specialty, fire-resistive, floor, low-solids, rust preventative, wood, reflective wall coatings; concrete/masonry sealers; primers; sealers; undercoaters; shellacs (clear and opaque); stains; varnishes; conjugated oil varnish; lacquer; clear brushing lacquer	**Green Seal Standard GS-11**

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Paints and Coatings	**CDPH/EHLB/Standard method V1.1 (California Section 01350)** (Use "office" or "classroom" space limits for all applications)	or	Concrete curing compounds; dry fog, faux finishing, graphic arts (sign paints), industrial maintenance, mastic texture, metallic pigmented, multicolor, recycled coatings; pretreatment wash primers, reactive penetrating sealers; specialty primers, wood preservatives, and zinc primers	**California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings** or **SCAQMD Rule 1113r**
Paints and Coatings	**CDPH/EHLB/Standard method V1.1 (California Section 01350)** (Use "office" or "classroom" space limits for all applications)	or	High-temperature coatings; stone consolidants; swimming-pool coatings; tub- and tile-refining coatings; and waterproofing membranes	**California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings**

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	**EMISSIONS REQUIREMENT**		**MATERIALS WITH ADDED VOC REQUIREMENT**	**EMISSIONS REQUIREMENTS**
Floor Covering Materials	For carpet, all locations: **CDPH/EHLB/Standard Method V1.1 (California Section 01350)** or label for **Section 9** of **CDPH/EHLB/Standard Method V1.1 (California Section 01350)**		none	none
Insulation	**CDPH/EHLB/Standard method V1.1** (California Section 01350) (Use "office" or "classroom" space limits for all applications)		none	none

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Composite Wood, Wood Structural Panel, and Agrifiber Products, no added urea-formaldehyde resins including laminating adhesives for composite wood and agrifiber assemblies - particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, door cores	Third-party certification (approved by CARB) of **California Air Resource Board's (CARB) regulation**, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products	or	none	**CDPH/EHLB/Standard method V1.1** (California Section 01350) (Use "office" or "classroom" space limits for all applications) (except: Structural panel components such as plywood, particle board, wafer board, and oriented strand board identified as "EXPOSURE 1," "EXTERIOR," or "HUD-APPROVED" are considered acceptable for interior use.)
Office Furniture Systems and Seating installed prior to occupancy	**ANSI/BIFMA X7.1 ANSI/BIFMA X7.1:** (95-percent of installed office furniture system workstations and seating units) **Section 7.6.2 of ANSI/BIFMA e3** (50-percent of office furniture system workstations and seating units)		none	none

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Ceiling and Wall assemblies and systems including: acoustical treatments; ceiling panels and tiles; tackable wall panels and coverings; wall coverings; wall and ceiling paneling and planking	**CDPH/EHLB/Standard method V1.1 (California Section 01350)** (Use "office" or "classroom" space limits for all applications)		none	none

-- End of Section --

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

General Information

Federal Requirements Complete

AJJY183012	Project ID (e.g. ABCD12345)
000000000000000000	Real Property Unique ID (RPUID)
P-012	Facility Number
MCAF North Aircraft Parking Ramp-Joint Region Marianas (JRM)	Building Name
Joint Region Marianas-Guam-Andersen	Installation
Guam	City
Guam	State
No	CONUS
0	MAJCOM
USACE	Construction Agent
Curtis Nagata	AFCEC DM/CM (Last Name, First Name)
$411,000,000.00	PA
1,507	Building Size (SF)
2024	Program Year (FY####)
Design Complete	Project Phase
02/01/20	Design Started (MM/DD/YY)
11/01/24	BOD (MM/DD/YY)
Not Certifying	Guiding Principles Compliance Certification Method
	Date Project Registered (MM/DD/YY)
	Date Project Certified (MM/DD/YY)
100%	HPSB Compliant
23%	Energy Efficiency Achieved (% below ANSI/ASHRAE/IESNA Standard 90.1-2013)
2017V1	Scoresheet version

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

Color Coding: See Instructions Tab for more detail	
Drop-Down Box	Yes or N/A
No Entry Required	No
Custom Entry	Recommended not Required

90.1-2013

HPSB I: Employ Integrated Design Principles (UFC 1-200-02 para 2-2)

Total Points 2 — Possible Points 2

Yes	HPSB I.1	**Integrated Design**	1
Yes	HPSB I.2	**Commissioning**	1

HPSB II: Optimize Energy Performance (UFC 1-200-02 para 2-3)

Total Points 5 — Possible Points 5

Yes	HPSB II.1	**Energy Efficiency**		1
		Yes	Reduce energy use 30% below ANSI/ASHRAE/IESNA Standard 90.1-2013 or IECC, or if not - achieve maximum energy efficiency that is lifecycle cost effective	
		23.0%	Insert percentage below ANSI/ASHRAE/IESNA Standard 90.1-2013 or IECC, in terms of energy use (e.g. 32)	
		41.2	Insert building energy intensity (kBtu/yr-sqft) calculated IAW 10 CFR 433	
		Yes	Roof Attributes (Recommended)	
		1	Select roof types (Check below)	
			☑ Cool roof ☐ Solar electric ☐ Solar Passive ☐ Green roof ☐ Solar thermal	
		Energy Efficient Products		1
		Yes		
N/A	HPSB II.2	**On-site Renewable Energy**		1
		N/A	Installed renewable energy elements or projects were not lifecycle cost effective	
			Renewable energy types (check below)	
			☐ Solar PV ☐ Geothermal ☐ Hydro ☐ Waste to Energy ☐ Solar CP ☐ GSHP ☐ Wind ☑ Renewables were not lifecycle cost effective ☐ Solar Thermal Electric	
		0.0	Insert generation capacity (kW)	
		0.0%	Insert percentage of total building	
N/A	HPSB II.3	**On-site Renewable Energy - Solar Hot Water Heater System**		1
		N/A	Installed solar hot water heater system or found installation not lifecycle cost effective	
		0.0	Insert generation capacity (MMBtu/yr)	
		0.0%	Insert percentage of demand	
Yes	HPSB II.4	**Metering**		1
		Yes	Electric Metering: Select N/A if no service	
		Yes	Natural Gas Metering: Select N/A if no service	
		N/A	Steam Metering: Select N/A if no service	

HPSB III: Protect and Conserve Water (UFC 1-200-02 para 2-4)

Total Points 6 — Possible Points 6

Yes	HPSB III.1	**Indoor Water**		1
Yes		**Indoor Water Metering**		1
Yes	HPSB III.2	**Outdoor Water**		1
N/A		**Outdoor Water Metering**		1
N/A	HPSB III.3	**Alternative Water**		1
Yes	HPSB III.4	**Stormwater Management (LID Documentation per UFC 3-210-10)**		1
		TBD	Change in Impervious Area (SF)	
		$0.00	Pre-Award Cost Estimate ($)	
		Yes	Project addressed EISA 438	
		0	EISA Technical Constraints	
			☐ Retaining stormwater impact receving water flow ☐ Shallow bedrock, contaminated soil, high ground water table, underground utilities ☐ Soil infiltration capacity limited ☐ Site too small to infiltrate significant volume ☐ Non-potable water demand to small ☐ Structural, plumbing, and other mods not feasible ☐ State or local restrict water harvesting ☐ State or local restrict use of green ☐ Other	
			Percent Increase in Stormwater Runoff for 95 Percentile Storm (%) - or- Percent Increase in Stormwater Runoff from continuous simulation model, published data, studies, or other established tools (Reference UFC 3-210-10 Figure 2-1 Implementation of EISA Section 438)	
		On-Site	LID Features Locations	
		3	Integrated Management Practices Employed	

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

☑ Bio-Retention ☐ Dry Wells ☐ Filter Strips ☑ Grassed Swells
☐ Infiltration Trench ☐ Inlet Pollution Removal Device ☐ Permeable Pavement/Pavers ☐ Rain Barrels/Cisterns
☐ Soil Amendments ☐ Tree Box Filters ☐ Vegetated Buffers ☐ Vegetated Roof
☑ Other

	Final LID Construction Cost ($)
	Post Construction Analysis (Name of DOR)

HPSB IV: Enhance Indoor Environmental Quality (UFC 1-200-02 para 2-5)				
Total Points	**8**		Possible Points	8
Yes	HPSB IV.1	**Thermal Comfort**		1
Yes	HPSB IV.2	**Ventilation**		1
Yes	HPSB IV.3	**Daylighting**		1
Yes	HPSB IV.4	**Moisture Control**		1
Yes	HPSB IV.5	**Low Emitting Materials**		1
Yes	HPSB IV.6	**Protect Indoor Air Quality during Construction**		1
Yes	HPSB IV.7	**Environmental Tobacco Smoke Control**		1
Yes	HPSB IV.8	**Occupant Health and Wellness**		1
HPSB V: Reduce Environmental Impact of Materials (UFC 1-200-02 para 2-6)				
Total Points	**5**		Possible Points	5
Yes	HPSB V.1	**Recycled Content**		1
Yes	HPSB V.2	**Biologically-based Products**		1
Yes	HPSB V.3	**Ozone Depleting Substances**		1
Yes	HPSB V.4	**Waste and Materials Management - Recycling**		1
Yes	HPSB V.5	**Waste and Materials Management - Divert 60% from Disposal**		1
		Yes	60% or greater diverted	
		60.0%	Insert percentage diverted from landfill	
HPSB VI: Address Climate Change Risk (UFC 1-200-02 para 2-7)				
Total Points	**1**		Possible Points	1
Yes	HPSB VI.1	**Address Climate Change Risk**		1
			Possible Points	**27**
27	**Federal Requirements - Yes or N/A**			
0	**Federal Requirements - No**			
100%	**Percentage of Federal Requirements Met**			

Federal Requirements for High Performance and Sustainable Buildings (HPSB) & UFC 1-200-02

Instructions: Provide a common or project specific justification for an element to be non-applicable, when completed, the Scoresheet tab will allow an N/A response.

Justification for Non-Applicable Answers		Common Justification	Project Specific Justification	Complete?
HPSB I: Employ Integrated Design Principles (UFC 1-200-02, 2-2)				
HPSB I.1	**Integrated Design**			Applicable
HPSB I.2	**Commissioning**			Applicable
HPSB II: Optimize Energy Performance (UFC 1-200-02, 2-3)				
HPSB II.1	**Energy Efficiency**			Applicable
HPSB II.1	**Energy Efficient Products**			Applicable
HPSB II.2	**On-site Renewable Energy**	NA LCCE		**Yes**
HPSB II.3	**On-site Renewable Energy - Solar Hot Water Heater System**	NA Location/Regional Restriction		**Yes**
HPSB II.4	**Metering**			
HPSB II.4	Electric Metering: Select N/A if no service			Applicable
HPSB II.4	Natural Gas Metering: Select N/A if no service			Applicable
HPSB II.4	Steam Metering: Select N/A if no service	NA Location/Regional Restriction		**Yes**
HPSB III: Protect and Conserve Water (UFC 1-200-02, 2-4)				
HPSB III.1	**Indoor Water**			Applicable
HPSB III.1	Indoor Water Metering: Select N/A if no service			Applicable
HPSB III.2	**Outdoor Water**			Applicable
HPSB III.2	Outdoor Water Metering: Select N/A if no service	NA Mission Restriction		**Yes**
HPSB III.3	**Alternative Water**	NA Mission Restriction		**Yes**
HPSB III.4	**Stormwater Management**			
HPSB III.4	Project addressed EISA 438			Applicable
HPSB IV: Enhance Indoor Environmental Quality (UFC 1-200-02, 2-5)				
HPSB IV.1	**Thermal Comfort**			Applicable
HPSB IV.2	**Ventilation**			Applicable
HPSB IV.3	**Daylighting**			Applicable
HPSB IV.4	**Moisture Control**			Applicable
HPSB IV.5	**Low Emitting Materials**			Applicable
HPSB IV.6	**Protect Indoor Air Quality during Construction**			Applicable
HPSB IV.8	**Occupant Health and Wellness**			Applicable
HPSB V: Reduce Environmental Impact of Materials (UFC 1-200-02, 2-6)				
HPSB V.1	**Recycled Content**			Applicable
HPSB V.2	**Biologically based products**			Applicable
HPSB V.3	**Ozone Depleting Substances**			Applicable
HPSB V.4	**Waste and Materials Management - Recycling**			Applicable
HPSB V.5	**Waste and Materials Management - Divert 60% from Disposal**			Applicable
HPSB VI: Adress Climate Change Riskd (UFC 1-200-02, 2-7)				
HPSB VI.1	**Address Climate Change Risk**			Applicable

NAVFAC HIGH PERFORMANCE AND SUSTAINABLE BUILDING CHECKLIST -- GOALS

PROJECT INFORMATION

Work Order No.: 1665555 FY 24 MILCON P No. / Customer Reference No.: P-012
Project Title: MCAF North Aircraft Parking Ramp - Joint Region Marianas (JRM)
Location UIC/Name: M00236/Andersen Air Force Base, Guam
NAVFAC Project Manager: Curtis Nagata Project Design Level: 100%
Facility Area: 1,507 U/M: SF Category Code: 218-712 Facility #: P-012
AE Contract # & T.O. N62742-20-D-0002 AE Firm Sustainability Coordinator: Araceli Chavez
AE Firm Name: Jacobs Government Services Company
Project Phase: ☑ Design Start / PDA ☐ Solicitation Documents Complete
Construction Contract Award Date (P): 02/01/20 BOD (P): 11/01/24

SUSTAINABILITY DATA - GUIDING PRINCIPLES for SUSTAINABLE DEVELOPMENT

Use this form to collect Design Goals information to be recorded on the Sustainable and Energy Tab in eProjects

NOTE: 1. Mark "N/A" only when at least one of the listed justifications is applicable, and mark those justifications. Otherwise, mark "Yes."
2. If project is for more than one building for which tracking is required, complete a separate form for each building.

PRELIMINARY PROJECT INFORMATION

1 How many buildings are included in this project? 1

2 New building or stand-alone addition >/=10,000 GSF

-OR-

Existing building renovation (including additions) >/=10,000 GSF, and with a cost >$3M and 50% Estimated Replacement Cost (ERC)? Yes ☐ No ☑

3 Identify the building to be tracked in this tab: Flightline Ma

DESIGN DEVELOPMENT - DOCUMENTATION OF COMPLIANCE WITH GUIDING PRINCIPLES

I. Employ Integrated Design Principles

1 Integrated Design Goals — In Compliance ☑ Yes ☐ N/A

N/A due to
☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

2 Commissioning Goals — In Compliance ☑ Yes ☐ N/A

N/A due to
☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

(i) Systems commissioned: Per IgCC 1001.3.1.2 (10.3.1.2) Project Commissioning

II. Optimize Energy Performance

3. Energy Efficiency Goals — In Compliance ☑ Yes ☐ N/A

N/A due to
☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

(i) Energy Savings Below Baseline %: 23.00

(ii) Energy Standard

- [x] ASHRAE 90.1-2013 (06NOV16+)
- [ ] ASHRAE 90.1-2016
- [ ] IECC
- [ ] OTHER:

C. Energy Efficient Products

Goals In Compliance [x] Yes [ ] N/A

N/A due to

- [ ] Mission preclusion
- [ ] Not LCCE
- [ ] Installation/region issue
- [ ] Building/site issue
- [ ] Renovation only: not part of scope

4. Renewable Energy

Goals In Compliance [ ] Yes [x] N/A

N/A due to

- [ ] Mission preclusion
- [ ] Not LCCE
- [x] Installation/region issue
- [ ] Building/site issue
- [ ] Renovation only: not part of scope

A. Renewable energy technology types

- [ ] Geothermal
- [ ] Ground Source Heat Pumps
- [ ] Solar Photovoltaic
- [ ] Solar Thermal - domestic hot water
- [ ] Solar Thermal - space conditioning
- [ ] Daylighting (quantified passive)
- [ ] Mechanical (i.e., direct water pumping)
- [ ] Micro-hydro
- [ ] Concentrating (sterling)
- [ ] Wind

(i) Annual % of total load _____

(ii) System size (kwatts) _____

B. Solar Hot Water Percentage - 30% target

Goals In Compliance [ ] Yes [x] N/A

N/A due to

- [ ] Mission preclusion
- [ ] Not LCCE
- [x] Installation/region issue
- [ ] Building/site issue
- [ ] Renovation only: not part of scope

(i) Annual % of total load _____

(ii) System size (kBTU/Year) _____

5. Meter (Energy)

Goals In Compliance [x] Yes [ ] N/A

N/A due to

- [ ] Mission preclusion
- [ ] Not LCCE
- [ ] Installation/region issue
- [ ] Building/site issue
- [ ] Renovation only: not part of scope

6. Energy Use Intensity kBTU/Sq Ft/Year

(i) Total Design Energy Use Intensity (EUI): kBTU/Sq Ft/Year 41.2

III. Protect and Conserve Water

7. Indoor Water Use

A. Water-Efficient Products

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

(i) Total Design Indoor Water Use Intensity (WUI): Gallons/Sq Ft/Year 3

B. Indoor Water Meter

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

8. Outdoor Water Use

A. Outdoor Water Meter (for 25,000 SF of irrigation)

(i) Is there a permanent irrigation system serving more than 25,000 SF of landscaping?

☐ Yes ☑ No

(ii) Water Meter

Goals In Compliance ☐ Yes ☑ N/A

N/A due to

☐ Mission preclusion ☑ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

B. Water-efficient landscape

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

9. Alternative Water Use (indoor or outdoor water)

Goals In Compliance ☐ Yes ☑ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☑ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

Methods Proposed:

☐ Air Handler Condensate Capture ☐ Reclaimed Water
☐ Grey Water ☐ Treated Wastewater
☐ Harvested Rainwater ☐ OTHER:

10. Stormwater Management - update the LID Data tab

IV. Enhance Indoor Environmental Quality

11. Ventilation and Thermal Comfort

A. Ventilation

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

B. Thermal Comfort

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue

☐ Not LCCE ☐ Renovation only: not part of scope

☐ Installation/region issue

12. Daylighting and Lighting Controls

A. Daylight

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue

☐ Not LCCE ☐ Renovation only: not part of scope

☐ Installation/region issue

B. Automatic dimming controls

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue

☐ Not LCCE ☐ Renovation only: not part of scope

☐ Installation/region issue

13. Indoor Air Quality

A. Moisture Control

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue

☐ Not LCCE ☐ Renovation only: not part of scope

☐ Installation/region issue

B. Low-Emitting Materials

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue

☐ Not LCCE ☐ Renovation only: not part of scope

☐ Installation/region issue

C. Indoor Air Quality during Construction

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue

☐ Not LCCE ☐ Renovation only: not part of scope

☐ Installation/region issue

14. Occupant Health and Wellness

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue

☐ Not LCCE ☐ Renovation only: not part of scope

☐ Installation/region issue

V. Reduce the Environmental Impact of Materials

15. Material Content and Performance

A. Resource Conservation and Recovery Act (RCRA) Section 6002 (recycled content)

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

B. Farm Security and Rural Investment Act (FSRIA) section 9002 (Biobased content)

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

16. Waste Management

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

17. Waste Diversion - 60% target

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

(i) Percent diverted 60

VI. Assess and Consider Climate Change Risks

18. Address Climate Change Risk

Goals In Compliance ☑ Yes ☐ N/A

N/A due to

☐ Mission preclusion ☐ Building/site issue
☐ Not LCCE ☐ Renovation only: not part of scope
☐ Installation/region issue

THIRD PARTY CERTIFICATION INFORMATION

Is this building pursuing Third Party Certification? ☐ Yes ☑ No

N/A due to ☐ Installation/region issue ☑ Mission preclusion ☐ Renovation only: not part of scope

Sustainability Third Party Certification Rating

Third Party Certification Rating System and Level

☐ USGBC LEED Certified
☐ USGBC LEED Silver
☐ USGBC LEED Gold
☐ USGBC LEED Platinum
☐ USGBC "Guiding Principles Assessment"
☐ OTHER
☐ GBI Green Globes 1 Globe
☐ GBI Green Globes 2 Globe
☐ GBI Green Globes 3 Globe
☐ GBI Green Globes 4 Globe
☐ GBI "Guiding Principles Compliance"

i. Third Party Certification Rating system - Other

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 35 13.04 30

FACILITY-RELATED CONTROL SYSTEMS (FRCS) PROCUREMENT FOR AIR FORCE CONTROL SYSTEMS
CES 01/25

PART 1 GENERAL

1.1 CONTROL SYSTEM APPLICABILITY

There is a single version of this Section associated with this project. This Section applies to all Facility-Related Control Systems (FRCS) associated with this project. For each Submittal and execution activity required under this Section, provide a separate document and activity for each system. In other words, each control system must have its own set of Submittals and activities to meet all requirements outlined in this Section.

1.2 RELATED SECTIONS

Related work specified elsewhere:

a. Section 25 05 11.26 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI)

b. Section 26 27 14.00 20 ELECTRICITY METERING

c. Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 800-37	(2018; Rev 2) Risk Management Framework (RMF) for Information Systems and Organizations: A System Life Cycle Approach for Security and Privacy
NIST SP 800-82	(2023; Rev 3) Guide to Operational Technology (OT) Security
NIST SP 800-53	(2020; Rev 5) Security and Privacy Controls for Information Systems and Organizations
NIST SP 800-171	(2024; Rev 3) Protecting Controlled Unclassified Information in Nonfederal Systems and Organizations

U.S. DEPARTMENT OF DEFENSE (DOD)

DoDI 8500.01	(2014; with Change 1, 2019) Cybersecurity

DoDI 8510.01	(2022) Risk Management Framework for DoD Systems
UFC 3-580-01	(2024) Information and Communications Technology Infrastructure Planning and Design
UFC 4-010-06	(2023) Cybersecurity of Facility-Related Control Systems
DFARS	(2024) Defense Federal Acquisition Regulation Supplement

U.S. AIR FORCE (USAF)

DAFGM 2024-32-01	(2024) Department of the Air Force Guidance Memorandum, Civil Engineer Control Systems Cybersecurity
MDMP	Air Force Meter Data Management Plan
CE CS	Civil Engineer Control Systems (CE CS) Cybersecurity Playbook

1.4 DEFINITIONS

The following list of definitions aligns with UFC 4-010-06 and applies to this Section and Sections referenced by this Section. See UFC 4-010-06 and Section 25 05 11.26 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI) for other Definitions not listed here.

1.4.1 5-LEVEL CONTROL SYSTEM ARCHITECTURE

A framework for describing the system architecture of any control system. This architecture allows distinctions to be made between portions of the control system that look like standard Information Technology (IT), and portions that do not look like standard IT.

This architecture is a general architecture suitable for a wide range of control systems and the intent of the architecture is to provide a common lexicon for defining systems and not to confine systems to a set definition.

1.4.1.1 Level 0

Non-networked devices which communicate using analog and binary signals. These include (“dumb”) sensors and actuators as well as non-networked controllers (including their dedicated sensors and actuators). These communicate with Level 1 via hardware I/O (analog and binary signals).

1.4.1.2 Level 1

The portion of the controls network which does not use the IP protocol. This includes both the controllers themselves and the network. Networked controllers not on an IP network use protocols such as, but not limited to, BACnet MS/TP, RS-485 (DNP, Modbus), and LonWorks TP/FT-10.

1.4.1.3 Level 2

The portion of the control system which uses IP but is not shared with any other system. “Shared” in this context primarily refers to physical equipment and media. Note the Level 2 IP network is typically contained within a single building but may span multiple buildings in support of a control system for a single (linear) facility.

Level 2 consists of networked controllers on an IP network and the IP network itself.

1.4.1.4 Level 3

The device which connects the dedicated Level 2 IP network with the Level 4 IP network.

See also Field Point of Connection (FPOC).

1.4.1.5 Level 4

Front End computers and the IP network which connects multiple Level 2 Field Control Networks.

1.4.1.6 Level 5

This portion of the system contains interfaces to “external” networks (IP networks other than the control system network). Additional hardware, software, and networking used to manage the control system, provide security functionality, user management, and external access. These are IT management and IT security functions, and don’t provide control system functionality.

1.4.2 Building Automation System (BAS)

The system consisting of a UMCS Front End, connected Building Control Systems which control building electrical and mechanical systems, and user interfaces for building control supervision. The BAS is a subsystem of the Utility Monitoring and Control System. This term is being phased out in favor of UMCS.

1.4.3 Building Control System (BCS)

A system that controls building electrical and mechanical systems such as HVAC (including central plants), lighting, vertical transport systems, and irrigation systems. Building Control Systems generally do not have a full-featured user interface; they may have “local display panels” but typically rely on the UMCS front end for full user interface functionality. BCS is a subsystem of the Utility Monitoring and Control System and is a class of Field Control System.

1.4.4 Control System (CS)

Control systems are a combination of special purpose controlling devices (controllers), control components (e.g. electrical, mechanical or pneumatic sensors and actuators), and generally (but not always) network infrastructure (which may contain standard IT components) that act together upon underlying mechanical and/or electrical equipment to achieve an objective. A control system (CS) typically consists of sensors and actuators connected to networked digital controllers, includes a user

interface, and is used to control and monitor equipment.

Some control systems are “monitor only” (they do not exercise control) but are still considered control systems.

1.4.5 Facility-Related Control System (FRCS)

A control system which controls equipment and infrastructure that is part of a DoD building, structure, or linear structure.

1.4.6 Field Control System (FCS)

A Building Control System, Utility Control System, Electronic Security System, etc. within the Facility and "downstream" of the FPOC.

1.4.7 Field Control Network (FCN)

The network used by the Building Control System, Utility Control System, etc., within a facility "downstream" of the FPOC. This includes IP, Ethernet, RS-485, TP/FT-10 and other network infrastructure that support control system(s) in a given facility.

1.4.8 Field Point of Connection (FPOC)

The FPOC is the point of connection between the Level 4 control system IP network and the Level 2 field control IP network. Note the Level 2 IP network here may consist entirely of a single patch cable from the FPOC to a Level 1-to-Level 2 device. The hardware which provides the connection at this location is an IT device such as a switch, IP router, or firewall.

1.4.9 Front End

The portion of the control system consisting primarily of IT equipment, such as computers and related equipment, intended to perform operational functions and run monitoring and control/engineering tool application software. The front end does not directly control physical systems; it interacts with them only through field control systems (FCS). The front end is a component of the UMCS, FCS, etc. infrastructure (see definition).

1.4.10 Utility Control System (UCS)

A type of field control system used for control of utility systems such as electrical distribution and generation, sanitary sewer collection and treatment, water generation and pumping, etc. Building controls are excluded from a UCS, however it is possible to have a Utility Control System and a Building Control System in the same facility, and for those systems to share components such as the FPOC. A UCS is a subsystem of a Utility Monitoring and Control System (UMCS) and is a class of Field Control System (FCS).

1.4.11 Utility Monitoring and Control System (UMCS)

The system consisting of one or more building control systems and/or utility control systems and the associated UMCS Infrastructure. In other words, it is the complete utility monitoring system – from the front end to the controllers. At the highest level the UMCS is composed of a UMCS Platform Enclave and UMCS Front End (jointly referred to as UMCS Infrastructure) and connected Field Control System(s). There are many different names for a UMCS – Energy Monitoring and Control System being a

common one – but regardless of the name systems that perform this function are a type of UMCS.

1.4.12 Industrial Control System (ICS)(ICS)

One type of control system. Most specifically a control system which controls an industrial (manufacturing) process. Sometimes also used to refer to other types of control systems, particularly utility control systems such as electrical, gas, or water distribution systems.

1.4.13 Network

network protocol. Network protocols must provide a method for addressing devices on the network; a communication method that does not provide an addressing scheme is not a networked form of communication. Devices that communicate using a method of communication that does not support device addressing are not using a network. Addresses may be other than IP addresses, and addressing may be at either Open Systems Interconnection (OSI) layer 2 or layer 3.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES and paragraph "DOCUMENTATION" and its subparagraphs in this section:

SD-01 Preconstruction Submittals

System Authorization Access Request (SAAR); G

ICS IA Addendum; G

Dod CYBER AWARENESS CHALLENGE Training; G

Privileged User Cybersecurity Responsibilities Training; G

CONTRACTOR PERSONNEL REQUIREMENTS; G

SAAR User Agreement; G

Pre-Construction Hardware List; G

Pre-Construction Software List; G

Pre-Construction Network Diagam; G

SD-03 Product Data

Media Converters; G

Uninterruptible Power Supply (UPS); G

Remote Terminal Unit (RTU); G

Intermediary Network Devices; G

Ethernet Switches; G

SD-10 Operation and Maintenance Data

Operator Manual; G

Sustainment Materials; G

Access Controls Summary; G

Auditing Controls Summary; G

Configuration Management Plan; G

Contingency Plan; G

Vulnerability Management Plan; G

Maintenance Plan; G

SD-11 Closeout Submittals; G

Technical Narrative; G

Systems Testing; G

Final Hardware List; G

Final Software List; G

Final Network Diagram; G

Security Features Guide; G

Documented Statements; G

Test Results; G

1.6 WORK COVERED BY CONTRACT DOCUMENTS

This work includes providing all FRCS equipment, network architectures, programming/configuration, testing, commissioning, and documentation to be assessed and authorized under the Risk Management Framework (RMF) process in accordance with NIST SP 800-37, NIST SP 800-53, NIST SP 800-82, DoDI 8500.01, DoDI 8510.01, UFC 3-580-01, UFC 4-010-06, MDMP, CE CS, DAFGM 2024-32-01, DFARS, and the most current versions of the other standards and regulations referenced in paragraph REFERENCES.

1.6.1 General Guidance

For all provided systems and parts of systems, the Government must be afforded the capability to seamlessly and efficiently understand, operate, test, maintain, secure from unauthorized access, diagnose and troubleshoot problems, and recover from run-time errors.

All provided equipment and software (to include Operating System, pre-requisite, and preinstalled software, i.e. database applications, web browsers, and java) must be currently marketed products, not currently scheduled for end of life or obsolescence within five years of installation or turnover to the Government, to ensure system

sustainability. Provide all hardware with the capability of receiving firmware updates and patches from the vendor with the latest firmware updates. Provide all software patched and updated with the latest updates released by the vendor. Where older versions of software are provided due to incompatibility concerns between different versions, provide the Government with the means (licenses, install disks, and any other installation materials) to fully update the provided software to the latest marketed version. Hardware and software products for systems networking should have been evaluated and accredited at a licensed/approved evaluation facility and listed as being in conformance to the Common Criteria for IT Security Evaluation (ISO Standard 15408, visit https://www.niap-ccevs.org for more information); products shown to be in the evaluation process for this purpose are acceptable. If multiple versions of hardware exists, devices supporting encryption will be considered first; if additional licenses are required for encryption, those licenses will be obtained as well. Products that fall under the scope of the Unified Capabilities Requirements must be listed in the Department of Defense Information Network (DoDIN) Approved Products List (APL) (https://aplits.disa.mil/apl). Operating systems and malware/antivirus protection application(s) must also be approved for use by the Department of the Air Force in the Air Force Evaluated Products Listing (EPL) https://usaf.dps.mil/teams/eao/lists/cotsgots%20software/all%20products.aspx

Legacy devices that are not required in the new system configuration must be disconnected, removed and turned over to the Government unless otherwise indicated.

1.7 PROTECTION OF SENSITIVE INFORMATION

To improve cybersecurity compliance and protect sensitive information, conduct all work in accordance with Defense Federal Acquisition Regulation Supplement (DFARS) 252.204-7012 Safeguarding Covered Defense Information and Cyber Incident Reporting and DFARS 252.204-7019 Notice of NIST SP 800-171 DoD Assessment Requirement.

PART 2 PRODUCTS

All products used on this project must meet the indicated requirements, but not all products specified here will be required by every project. Contact Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer for the most recent product equivalent list and equipment shall be approved by Andersen AFB 36 CES before procurement.

2.1 GENERAL PRODUCT REQUIREMENTS

Materials and equipment must be standard products of a manufacturer regularly engaged in the manufacturing of these and similar products. The standard products must be Trade Agreement Act (TAA) compliant. Items of the same type and purpose must be identical, including equipment, assemblies, parts and components.

2.2 SUPPLY CHAIN RISK MANAGEMENT (SCRM)

Receipt of gray market or counterfeit items poses a risk to the DoD systems and the accreditation of that system. Following SCRM practices during the procurement process reduces the risk associated with receipt of gray market or counterfeit equipment and components. Best practices of

SCRM must be implemented when procuring Information Technology (IT) equipment and components, including all FRCS products required for every project. Equipment and components must be procured through authorized Original Equipment Manufacturer (OEM) channels or authorized U.S. distributors. Vendors must guarantee that OEM equipment does not contain third-party parts or components.

2.3 PRODUCT DATA

Submittals must include the following:

- Manufacturer's name
- Place of manufacture
- Product Type
- Catalog model or number
- Operating System (if applicable)
- Firmware Version (if applicable)
- Serial Number (if available)
- Warranty Information
- SCRM Information

Provide manufacturer's product data sheets documenting compliance with product specifications for each product provided under this Section. Provide product data for all products in a single indexed compendium, organized by product type.

2.3.1 Ethernet Switches

Ethernet Switches must be compliant with product specifications under this Section and Section 25 05 11.26 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI).

2.3.1.1 Distribution and Core Switches

24-port Ethernet Distribution and Core switches must have the following characteristics:

a. Form Factor: Rack-mountable
b. Power Supply: Redundant (Primary and Backup)
c. Ports: 24x 1/10/25G Gigabit Ethernet + 4x 40/100G Uplink
d. Stackable: Yes
e. Advanced Switching: Layer 3
f. Manageable: Yes
g. Listed on DISA APL: Yes
h. Full compatibility with existing and future ICS/FRCS networks: Yes
i. Minimum Required Protocol Support: CDP, EIGRP
j. Software-Defined Access compatible
k. Trade Agreement Act (TAA) compliant

48-port Ethernet Distribution and Core switches must have the following characteristics:

a. Form Factor: Rack-mountable
b. Power Supply: Redundant (Primary and Backup)
c. Ports: 48 1/10/25G Gigabit Ethernet + 4x 40/100G Uplink
d. Stackable: Yes
e. Advanced Switching: Layer 3
f. Manageable: Yes

g. Listed on DISA APL: Yes
h. Full compatibility with existing and future ICS/FRCS networks: Yes
i. Minimum Required Protocol Support: CDP, EIGRP
j. Software-Defined Access compatible
k. Trade Agreement Act (TAA) compliant

2.3.1.2 Access Switches

24-port Ethernet access switches in climate-controlled environments must have the following characteristics:

a. Form Factor: Rack-mountable
b. Power Supply: Redundant (Primary and Backup)
c. Ports: 24 port Data + 8x 10G/1G uplinks
d. Stackable: Yes
e. Advanced Switching: Layer 3
f. Manageable: Yes
g. Listed on DISA APL: Yes
h. Full compatibility with existing and future ICS/FRCS networks: Yes
i. Minimum Required Protocol Support: CDP, EIGRP
j. Software-Defined Access compatible
k. Trade Agreement Act (TAA) compliant

48-port Ethernet access switches in climate-controlled environments must have the following characteristics:

a. Form Factor: Rack-mountable
b. Power Supply: Redundant (Primary and Backup)
c. Ports: 48 port Data + 8x 10G/1G Uplink
d. Stackable: Yes
e. Advanced Switching: Layer 3
f. Manageable: Yes
g. Listed on DISA APL: Yes
h. Full compatibility with existing and future ICS/FRCS networks: Yes
i. Minimum Required Protocol Support: CDP, EIGRP
j. Software-Defined Access compatible
k. Trade Agreement Act (TAA) compliant

2.3.1.3 Industrial Rated Switches

Ethernet switches located in non-climate-controlled environments must have the following characteristics:

a. Power supply Wattage: minimum 170W power supply
b. Power supply Rated nominal input operating range: DC 12-54VDC/23A
c. Ports: 8 10/100/1000 RJ45 Copper ports + 2 100/1000 SFP ports
d. Expansion module: 8 Copper (RJ45) ports
e. Operating Temp: -40C to +75C
f. Humidity: 5% to 95% Relative Humidity (Non-condensing)
g. Alarm: two alarm inputs to detect dry contact open or closed, one alarm output relay
h. Form Factor: DIN rail (Provide DIN rail mount for switch installation)
i. Advanced Switching: Layer 3
j. Manageable: Yes
k. Listed on DISA APL: Yes
l. Full compatibility with existing and future ICS networks: Yes
m. Minimum Required Protocol Support: CDP, EIGRP
n. Software-Defined Access compatible
o. Trade Agreement Act (TAA) compliant

2.3.2 Media Converters

Media Converters located in climate controlled environments must have the following characteristics:

a. Operating Environment: 0C to 50C
b. Standards: IEEE 802.3
c. 10/100/1000Base-T (RJ-45) 328ft to 100/1000Base-X SFP Slot (empty)
d. Full compatibility with existing and future ICS network(s)/switch(es): Yes
e. Trade Agreement Act (TAA) compliant

2.3.3 Uninterruptible Power Supply (UPS)

Standalone, rack-mounted Uninterruptible Power Supply (UPS) located in climate controlled environments must have the following characteristics:

a. Run Time: minimum 30minutes for 1100W load
b. Power: Must be compatible with available circuits
c. Form Factor: Rack-mountable
d. Surge Protection: minimum 340 Joules
e. Input: NEMA 5-20P
f. Output: (1) L5-20R, (6) NEMA 5-20R
g. Compatible with ICS/FRCS switch(es)
h. Trade Agreements Act (TAA) compliant

2.3.4 Remote Terminal Unit (RTU)

Remote Terminal Unit (RTU) or gateway devices required for IP network connection must have the following characteristics:

a. Must have physical infrastructure (CAT6 or SM fiber) connection back to ICS cabinet, i.e. not wireless
b. Connect using MODBUS/TCP
c. Maintain registers for cumulative water consumption (gallons)
d. Maintain registers for peak flow (gpm)
e. Integrates with Andersen AMI system
f. Trade Agreement Act (TAA) compliant

2.3.5 Intermediary Network Devices

Intermediary Network Devices, such as multimode small form-factor pluggable (SFP) transceiver modules =.

Multimode SFP transceiver modules (used with the media converters) and located in climate controlled environments must have the following characteristics:

- Operating Environment: 0C to 70C
- Standards: IEEE 802.3
- 1000Base-SX
- Port Type: 1300nm Ext. multimode (LC) 1.2mi
- Full compatibility with existing and future ICS network(s)/switch(es): Yes
- Trade Agreement Act (TAA) compliant

Single mode SFP transceiver modules (used with the media converters) and located in climate controlled environments

must have the following characteristics:

- Operating Environment: 0C to 70C
- Standards: IEEE 802.3
- 1000Base-LX
- Port Type: 1310nm Ext. single mode (LC) 1.2mi
- Full compatibility with existing and future ICS network(s)/switch(es): Yes
- Trade Agreement Act (TAA) compliant

PART 3 EXECUTION

3.1 CONTRACTOR PERSONNEL REQUIREMENTS

Individuals engaged in systems design, programming, and configuration activities, must possess at least five years of documented experience in implementing similar systems, specific project experience that is relevant to the type of work being done on the system, and manufacturer training in the use and programming of any controls devices being installed. Individuals installing or interacting with new or existing systems equipment will be required to submit documentation showing compliance with the following requirements:

a. Fill out, sign, and submit the System Authorization Access Request (SAAR) (DD Form 2875) form and the SAAR User Agreement
b. Fill out, sign, and submit the ICS IA Addendum
c. Complete and submit the latest DoD CYBER AWARENESS CHALLENGE training (https://public.cyber.mil/training/) certification within the current fiscal year that it's availble
d. Complete and submit the latest Privileged User Cybersecurity Responsibilities Training (https://cdse.usalearning.gov/course/view.php?id=626) training certificate within the current fiscal year that it's available

3.1.1 Security Background Check

Personnel installing or interacting with new or existing systems hardware and software are required to be United States citizens. Personnel requesting access to existing Air Force systems for the purpose of installing new software, programming/configuring software, or modifying code for existing software are required to have a favorable Tier 3 security background check in accordance with IT-II Position of Trust Designation.

Provide a Facility Security Officer (FSO) who can initiate background checks and investigations. A DD Form 254, Contract Security Classification Specification, must be issued on the contract to achieve and maintain the FSO requirements. Security Background checks must be initiated by the Contractor’s FSO immediately after award to ensure that background checks are completed and confirmed with Andersen AFB 36 CES (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer prior to scheduled installation. Andersen AFB 36 CES confirmation will be conducted via required submittal(s) of Systems Access Authorization Requests (SAAR) forms.

3.1.2 Controlled Unclassified Information (CUI)

Information used in the course of systems implementation must be designated "Controlled Unclassified Information" (CUI) and must not be

disseminated without written authorization from the Contracting Officer.

3.2 INSTALLATIONS REQUIREMENTS

The Government must be afforded the ability to monitor and witness all installation, testing, and on-site configuration/programming work. Existing systems must remain operable and services must not be interrupted during the construction process to the greatest extent possible unless otherwise indicated. Coordinate construction phasing in the project schedule and connection or tie-in plan and safety plan with the Government System Operator for approval prior to start of construction.

3.2.1 System Access

a. Systems may be located within controlled access areas. Access request procedures and requirements for access must be followed for these locations. Escorts may be necessary in many if not all circumstances. Coordinate access and escorts with the Government.
b. Due to rigorous network security requirements, access to existing systems is not permitted without the approved SAAR form and SAAR User Agreement.
c. In general, do not install applications on Government systems without an explicit request and approval from the Government. Use of or installation of hardware or software "back doors" to permit remote access is prohibited. Use of flash memory devices (including USB "thumb" drives) on Government equipment is also prohibited.

3.3 PROGRAMMING AND CONFIGURATION REQUIREMENTS

a. For installations that do not intend to integrate new FRCS with any existing FRCS with an Authorization to Operate (ATO), or where new FRCS needs to be programmed prior to integration, contractor laptops may be used but must be validated, scanned for vulnerabilities, and approved by Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer prior to usage.

b. For any new FRCS that need to be configured while already integrated to an existing FRCS with an ATO, a Government laptop belonging to the accreditation boundary of that existing FRCS must be utilized for programming and configuration. Coordinate with Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer to check-out appropriate laptop.

c. For programmable or configurable interfaces, coordinate requirements with the system operator and submit draft interface diagrams (and mimic diagrams as applicable) and descriptions for Government approval to ensure compliance with system operator requirements.

d. Configure all provided systems and parts of systems in accordance with this Section and Section 25 05 11.26 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI).

e. For ease of understanding in troubleshooting or adapting, document and provide annotations within the code structure of all programmed code and scripts developed under this project in accordance with industry best practices. Indicate all compilers used to develop code within the documentation. Organize code in clearly defined, logical sections,

with comments indicating the function of each section, including any expected inputs, outputs, and calling functions. Properly annotate any modifications to existing code, including date of change, reason for change, and any changes to be expected for inputs and outputs. Provide all code in both compiled and uncompiled formats along with custom application programming interfaces (API) or packages used. Deliver all scripts and source in readable format as part of close-out submittals. Conduct code reviews at regular intervals to ensure quality and reduce the likelihood of errors and security vulnerabilities. Document the results of this process and provide for Government review upon request.

f. Configure systems with programmable interfaces to bear resemblance to actual equipment and process layouts for operators to easily view and understand all available data and system conditions. Configure interfaces to the satisfaction of the Government and the system operators. Provide a graphical interface for network analysis and network status to troubleshoot and verify network conditions. Accurately convey fault conditions such as when network connectivity for particular devices has been lost and do not display false information on programmable interfaces. Configure and secure all programmable interfaces in accordance with the Application Security Development Security Technical Implementation Guide available at https://public.cyber.mil/stigs/.

g. Conduct all code programming and script development in a secure environment in accordance with all REFERENCES.

h. Retainment of code modified or produced under this contract is prohibited only while under a sustainment or support contract with the Government. Use of code modified or produced under this contract is only prohibited for the purpose described within the contract unless expressly authorized in writing by Andersen AFB 36 CES ISO/ISSM. Dispose of code modified or produced under this contract in accordance with the Non-disclosure and Data Handling agreement.

3.3.1 Technical Narrative

Provide a technical narrative to include detailed programmer certification and training requirements, and a plan describing how code reviews will be conducted and documented for Government review in a way that is verifiable. Automated code review tools with summary report printouts are recommended. Describe software development practices and standards applied to control system software and firmware that is written by the offeror or any planned subcontractors. Provide detailed information about quality assurance programs that are in place for the provided control system software and firmware, as well as quality control testing methods and results, also including unresolved vulnerabilities and recommended mitigation measures. Quality control testing should include fuzz testing, static testing, dynamic testing, and penetration testing, as well as use of positive and appropriate negative tests to verify that the procured product operates in accordance with requirements and without extra functionality, as well as monitoring for unexpected or undesirable behavior during these tests. Indicate approach and capability to remediate newly reported zero-day vulnerabilities.

3.4 TESTING AND COMMISSIONING REQUIREMENTS

a. Provide Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer

with the Pre-construction Hardware List, Pre-construction Software List, and Pre-construction Network Diagram within 60 calendar days of award to receive approval of suggested hardware and software prior to procurement. Upon approval of hardware and software, coordinate with Andersen AFB 36 CES ISO/ISSM via the Contracting Officer to create a draft System Assessment Plan (SAP) in which applicable testing methods will be determined prior to installation.

b. Facilitate Government testing of the system via vulnerability scans, Security Template Implementation Guide (STIG) testing, Security Content Automation Protocol (SCAP) scans, Cyber Hygiene Checklist(s), and provide support for interpreting scan and STIG test results as needed. The STIG Viewer User Guide is available at https://public.cyber.mil/stigs/. A link to an instruction video is also available. Demonstrate to the satisfaction of the Government that all provided system components are in compliance with the SAP and Security Controls documentation prior to commissioning.

c. Conduct systems testing and verification, witnessed by the Government and its system operator as each system component is brought online and commissioned. Systems testing and verification must show via operator interface(s) that system statuses and measurements are reported accurately, controls are fully operable, and programming/configuration conforms to statement of work and operator requirements. Notify the Contracting Officer forthwith of any equipment or system malfunctions encountered before or during testing that are outside the scope of work. Provide Systems Testing documentation with detailed test procedures, results, date and time, witnessing personnel, and other conditions as applicable.

3.5 TRAINING REQUIREMENTS

a. Provide on-site training for the length of time as indicated in Section 25 05 11.26 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI) or 8 hours, whichever is longer. Provide on-site training for 15 Government personnel or Government representatives to show how to operate, maintain, troubleshoot, repair, and reconfigure/reprogram the systems. Include hands-on training during the on-site training.

Develop and provide an operator manual with step-by-step instructions (w/screenshots) showing how to perform key operational & maintenance/troubleshooting tasks.

Develop and provide a systems administration manual for IT components with step-by-step instructions (w/screenshots) showing how to perform key operational & maintenance/troubleshooting tasks such as user account maintenance, controlled startup/shutdown procedures, backup/restore procedures, software license maintenance, and database maintenance tasks.

Modify the operator and systems administration manuals based on feedback received as a result of the training session.

3.6 DOCUMENTATION

Provide five sets of CD-ROM containing native (editable) file formats. All software licenses are required to be in the name of the Department of the Air Force.

3.6.1 Operator Manual

Provide bound hard copies as indicated for training purposes. Provide final Operator Manuals (including modifications based upon feedback) in conjunction with OMSI submittals for all installed equipment in accordance with specification 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI). All documents must be submitted in native (editable) and PDF formats on CD-R or DVD-R in the quantities indicated.

3.6.2 Sustainment Materials

Provide the following for every Level 1-4 device, organized by device and delivered on an external hard drive in conjunction with OMSI submittals:

a. Original firmware

b. Original firmware hash

c. SOP for application of firmware updates/patches

d. POC or website for firmware updates/patches

e. Count of interfaces and types

f. Protocols in use, per interface (specify upstream and downstream devices)

g. Configuration file

h. SOPs for each device configuration

i. SOPs for standard systems maintenance tasks

- User account maintenance

- Software license maintenance

- Database maintenance

j. Baseline image

3.6.3 Security Controls Documents

Edit existing documentation where applicable; otherwise provide new documentation as described. Provide Pre-Construction Hardware Lists, Pre-Construction Software Lists, Pre-Construction Network Diagrams, Access Controls Summary, Auditing Controls Summary, Configuration Management Plan, Contingency Plan, Security Features Guide, Vulnerability Management Plan, and Maintenance Plan documents, as well as Documented Statements along with all formal design submittals, complete with all information available at the time of the submittal. Provide a document changelog and outline or mark sections of documents that have been changed from originals and from each previous submittal. Provide Final Hardware List, Final Software List, and Final Network Diagram documents in conjunction with As-Builts submittals. Request editable templates for hardware and software lists from the Government, as well as an example network diagram for use as guidance. Hardware and software lists must be in formats

editable via Microsoft Excel 2016 or the latest supported version. Network diagrams for the purpose of RMF submittals must be in formats editable via Microsoft Visio 2016 or the latest supported version. All documents must be submitted in native (editable) and PDF formats on external hard drive(s) and all submittals must be legible.

3.6.3.1 Pre-Construction Hardware List

Submit the Pre-Construction Hardware List within 60 calendar days of award. Coordinate with Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer to receive an editable template for the Hardware List. Provide the Pre-Construction Hardware list with the following information for each Level 0-4 device:

a. Manufacturer
b. Product line
c. Model (and specific variant if applicable)
d. Product type
e. Location (installation, special area, building name, floor, room)
f. Key technical ratings (e.g. memory)
g. Operating system software (cross reference with Pre-Construction Software List)
h. Application software (cross reference with Pre-Connstruction Software List)
i. Network connections and types (cross reference with Pre-Construction Network Diagram)
j. Common Criteria EAL status
k. DADMS entry number
l. OS/IOS/Firmware version(s)

3.6.3.2 Pre-Construction Software List

Submit the Pre-Construction Software List within 60 calendar days of award. Coordinate with Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer to receive an editable template for the Pre-Construction Software List. Provide the Pre-Construction list with the following information:

a. Manufacturer
b. Version (and subversion if applicable)
c. Location (installation, special area, building name, floor, room)
d. Used ports, protocols, services
e. Common Criteria EAL status
f. DADMS entry number
g. OS/IOS/Firmware version(s)

3.6.3.3 Pre-Construction Network Diagam

All connected devices that are part of the system must be included within the Authorization Boundary, to include Level 0 devices when known and feasible.

The Pre-Construction Network Diagram must be layered within the Visio file submittal to remove sensitive information such as IP addresses, VLAN, Port Protocols Service, Building number in support of sanitization when sharing.

Submit a Pre-Construction Network Diagram within 60 calendar days of award. The Pre-Construction Network Diagram must include a dataflow table mapped to a directional dataflow label between each component to clearly identify all Port, Protocols, and Services (PPS) used. Coordinate with

Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer to receive a Purdue Model Topology template. Provide a Pre-Construction Network Diagram with the following information:

a. Date of creation or last update
b. Delineation of the Authorization Boundary
c. Location (installation, special area, building name, floor, room)
d. Name
e. Hostname
f. Model (and specific variant if applicable)
g. OS/IOS/Firmware version
h. VLAN (if used)
i. Identify any connections to other systems, networks, or enclaves
    (1) Identify connection type (e.g., dedicated point-to-point, etc.)
    (2) Identify the organization type (e.g., DoD, federal agency, contractor, etc.)

3.6.3.4 Final Hardware List

Provide the Final Hardware List with the following information for each Level 0-4 device:

a. Manufacturer
b. Product line
c. Model (and specific variant if applicable)
d. Product type
e. Location (installation, special area, building number, building name, floor, room)
f. Key technical ratings (e.g. memory)
g. Serial number
h. MAC Address
i. IP Address
j. Unique Navy Identifier or barcode (if assigned)
k. Operating system software (cross reference with Final Software List)
l. Application software (cross reference with Final Software List)
m. Network connections and types (cross reference with Final Network Diagram)
n. Common Criteria EAL status
o. DADMS entry number
p. OS/IOS/Firmware version(s)
q. Warranty Information

3.6.3.5 Final Software List

Provide the Final Software List with the following information:

a. Manufacturer
b. Version (and subversion if applicable)
c. Location (installation, special area, building number, building name, floor, room)
d. Used ports, protocols, services
e. Common Criteria EAL status
f. DADMS entry number
g. OS/IOS/Firmware version(s)
h. Warranty Information

3.6.3.6 Final Network Diagram

The Final Network Diagram must be layered within the Visio file submittal to remove sensitive information such as IP addresses, VLAN, Port Protocols Service, Building number in support of sanitization when sharing.

The Final Network Diagram must include a dataflow table mapped to a directional dataflow label between each component to clearly identify all Port, Protocols, and Services (PPS) used. Coordinate with Andersen AFB 36 CES ISO/ISSM (36ces.cen.andersenafbprojects@us.af.mil) via the Contracting Officer to receive a Purdue Model Topology template. Provide the Final Network Diagram with the following information:

a. Date of creation or last update
b. Delineation of the Authorization Boundary
c. Device Location (installation, special area, building name, floor, room)
d. Device Name
e. Device Hostname
f. Device Model (and specific variant if applicable)
g. Device OS/IOS/Firmware version
h. Device IP Address
i. VLAN (if used)
j. Identify any connections to other systems, networks, or enclaves
    (1) Identify connection type (e.g., dedicated point-to-point, etc.)
    (2) Device IP Address
    (3) Identify the organization type (e.g., DoD, federal agency, contractor, etc.)

3.6.3.7 Access Controls Summary

a. Information on software access controls, port control, and protection.

b. System user roles implemented by application and access privileges assigned by default to each role. Specify if privileges can be added to
or removed from a role.

c. Details on system logon, including denial after three invalid attempts, how to delay subsequent logons.

d. Details on privileged accounts - who should have them and when are they used.

e. Details on kinds of accounts, their associated privileges, which roles should have access, and so on - servers, wireless, equipment, meters.

f. User ID/password requirements or PKI requirements including details on shadowing, enforcement of password strength, encryption of passwords.

g. Details of system library structure and what roles should be allowed what access privileges to library components.

h. Details on remote (wireless) access by laptops or servers to meter and radio data.

3.6.3.8 Auditing Controls Summary

a. Details on auditing controls and auditing (creation of system audit trail for user accountability).

3.6.3.9 Configuration Management Plan

a. Vendor configuration management plan.

b. Information required to verify and test all patches and upgrades prior

to deployment, including resources, capabilities, and coordination as required with any test procedures run at vendor labs.

3.6.3.10 Contingency Plan

a. Backup and Restoration Procedures - Guidance on backing up and restoring vendor software & hardware including guidance to help determine priority for backup and restoration.

b. Startup & Shutdown Procedures - Details of system initialization, shutdown/aborts designed to ensure secure system state.

c. Safe Mode, Fail Safe, Fail Secure Capability - Document device capability with respect to safe mode, fail safe, and/or fail secure. For devices that are capable of supporting safe mode, fail safe, or fail secure, document procedures to initiate the process and to return devices to a normal functioning state.

3.6.3.11 Security Features Guide

a. List and discussion of all security features of Vendor hardware and software.

b. Document use of mobile code (e.g. scripts, such as Java) and protections in place to prevent malicious content from using associated runtime systems.

c. Documented FIPS 140-3 validated cryptography (or equivalent) compliance.

3.6.3.12 Vulnerability Management Plan

a. Information required to verify and test all patches and upgrades prior to deployment, including resources, capabilities, and coordination as required with any test procedures run at vendor labs.

b. Operational issues associated with implementation and maintenance of the application.

c. Cybersecurity POC for resolution of Cybersecurity issues during the warranty period.

3.6.3.13 Maintenance Plan

a. Names and other required information of personnel who will be authorized to perform maintenance in accordance with the warranty and maintenance agreement.

3.6.3.14 Documented Statements

a. Declaration that public domain software (e.g., freeware, shareware) is not used in the system.

b. Information on Common Criteria or National Information Assurance Partnership (NIAP) or Federal Information Processing Standards (FIPS) evaluation status of hardware and software.

3.6.3.15 Test Results

a. All Security Technical Implementation Guide (STIG) checklist (.ckl)

files as identified in the SAP, complete and filled out to acceptable standards.

b. All applicable Cyber Hygiene Checklist files as identified in the SAP, complete and filled out to acceptable standards.

c. All raw scan results (e.g. SCAP, Nessus)

-- End of Section --

SECTION 01 35 26

GOVERNMENTAL SAFETY REQUIREMENTS
05/24, CHG 1: 05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.2	(2017) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ANSI/ASSP A10.34	(2021) Protection of the Public on or Adjacent to Construction Sites
ANSI/ASSP A10.44	(2020) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ANSI/ASSP Z490.1	(2016) Criteria for Accepted Practices in Safety, Health, and Environmental Training

ASTM INTERNATIONAL (ASTM)

ASTM D6245	(2012) Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation
ASTM D6345	(2010) Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air
ASTM F855	(2020) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1048	(2016) Guide for Protective Grounding of Power Lines
IEEE C2	(2023) National Electrical Safety Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z89.1	(2014; R 2019) American National Standard for Industrial Head Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 51B	(2024) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code
NFPA 70E	(2024) Standard for Electrical Safety in the Workplace
NFPA 241	(2022; ERTA 22-1) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 306	(2024) Standard for the Control of Gas Hazards on Vessels

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 008	(2007) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

The following definitions are for the convenience of the reader. If there is a referenced document in the text of this specification section, that is the document that should define terms for that paragraph. If further clarification is needed, contact the Contracting Officer.

1.2.1 Site Safety and Health Officer (SSHO)

A Contractor Employee that is responsible for overseeing and ensuring implementation of the prime Contractor's Safety and Occupational Health (SOH) program according to the Contract, EM 385-1-1, applicable federal, state, and local requirements.

1.2.1.1 Level One SSHO

A designated employee with full-time SOH responsibility that meets and follows the requirements of EM 385-1-1.

1.2.1.2 Level Two SSHO

A designated employee with Level Two SSHO responsibility that meets and follows the requirements of EM 385-1-1. Level Two SSHOs cannot be assigned to projects that have a residual Risk Assessment Code (RAC) of high or extremely high.

1.2.1.3 Level Three SSHO

A designated Qualified Person or Competent Person with SOH responsibility that meets and follows the requirements of EM 385-1-1. Level 3 SSHOs cannot be assigned to projects that have a residual RAC of high or extremely high.

1.2.1.4 Alternate SSHO

An employee that meets the definition of the contract-required level SSHO, but is not the primary SSHO.

1.2.2 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are unsanitary, hazardous, or dangerous to personnel, and who has authorization to take prompt corrective measures to eliminate them.

1.2.3 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

1.3 SUBMITTALS

Government Acceptance or Approval does not remove responsibility from the Contractors for their actions or liability.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G

Indoor Air Quality (IAQ) Management Plan; G

SD-06 Test Reports

Accident Reports; G

LHE Inspection Reports

Monthly Exposure Reports; G

SD-07 Certificates

Activity Hazard Analysis (AHA); G

Certificate of Compliance

Contractor Safety Self-Evaluation Checklist

Hot Work Permit

License Certificates

Portable Gauge Operations Planning Worksheet; G

Radiography Operation Planning Work Sheet; G

Standard Lift Plan; G

Critical Lift Plan; G

1.4 PUBLIC HEALTH EMERGENCIES

In the event of a declared public health emergency, follow safety precautions as required by the Occupational Safety and Health Administration (OSHA) www.osha.gov, the Centers for Disease Control and Prevention (CDC) www.cdc.gov, and as required by federal, state and local requirements.

1.5 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report by the fifth day of each month for the previous month. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the progress payment.

1.6 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the preconstruction conference. Complete the checklist monthly and submit with each request for payment voucher. This submission is required monthly even when a payment voucher is not requested. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90 may result in retention of up to 10 percent of the voucher. The Contractor Safety Self-Evaluation checklist can be found on

the Whole Building Design Guide website at www.wbdg.org/dod/ufgs/ufgs-01-35-26

1.7 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this Contract, comply with the most recent edition of USACE EM 385-1-1, and the following federal, state, and local laws, ordinances, criteria, rules and regulations at the date of the Solicitation for this Contract. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.8 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

1.8.1 Site Safety and Health Officer (SSHO)

1.8.1.1 Qualifications of SSHO

All SSHOs will have met the training, experience requirements identified in the EM 385-1-1 and this Contract.

1.8.1.2 Duties of SSHO

All SSHOs will carry out the roles and responsibilities as identified in this Contract and the EM 385-1-1. All SSHOs will be designated on an ENG Form 6282, provided by the Contracting Officer. Superintendent, QC Manager, and SSHO are subject to dismissal if their required duties are not being effectively carried out. If either the Superintendent, QC Manager, or SSHO are dismissed, project work will be stopped and will not be allowed to resume until a suitable replacement is approved and the above duties are again being effectively carried out.

1.8.1.3 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors at the project location. The SSHO, supervisors, or foremen must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.8.2 Roles and Responsibilities of Prime Contractor and SSHO

The Prime Contractor and SSHO must ensure that the requirements of all applicable OSHA and EM 385-1-1 are met for the project. The Prime Contractor must ensure an SSHO or an equally qualified Alternate SSHO(s) is at the worksite at all times to implement and administer the Contractor's safety program and Government accepted Accident Prevention Plan. If the required SSHO has to temporarily (that is, up to 24 hours / 1 day) leave the site of work due to unforeseen or emergency situations, a Level One, Two, or Three SSHO may be used in the interim and must be on

the site of work at all times when work is being performed.

If the SSHO must be off-site for a period longer than 24 hours / 1 day, a qualified alternate that meets the contract requirements must be onsite.

a. Prime contractor must ensure all SSHOs will:

(1) Are designated on an ENG Form 6282.

(2) Meet minimum training and experience requirements identified in EM 385-1-1.

(3) Execute roles and responsibilities identified in EM 385-1-1.

1.8.3 Additional Requirements

The Level One SSHO must not serve as the Quality Control Manager. The One SSHO must not serve as the Superintendent.

The SSHO must have completed a 40-hour contract safety awareness course based on the content and principles of EM 385-1-1, and instructed in accordance with the guidelines of ANSI/ASSP Z490.1, by a trainer meeting the qualifications of paragraph QUALIFIED TRAINER REQUIREMENTS. If the SSHO does not have a current certification, certification must be obtained within 60 days, maximum, of Contract award.

1.8.4 Contract Site Safety And Health Officer(s)(SSHOs) Minimum Requirements

Provide a minimum of one Level One SSHO that meets the requirements of EM 385-1-1 for this project.

1.8.5 Contract Site Safety and Health Officer(s)(SSHOs) Minimum Requirements for Projects with Multiple Shifts,.

Provide a separate full-time Level One SSHO at each of the following worksites:

a. P-012 North Ramp Level One SSHO

The SSHOs for the worksites listed above must each have the required training, experience, and qualifications in accordance with EM 385-1-1.

Each SSHO is responsible for implementing and managing the Safety and Occupational Health (SOH) program at the worksite indicated, while ensuring that the 29 CFR 1926, EM 385-1-1, Contracts, and all applicable federal, state, and Local requirements are met.

1.8.6 Dredging Contract Site Safety and Health Officer(s)(SSHOs) Requirements

1.8.7 Competent Person for Confined Space Entry

Provide a CP for Confined Space Entry who meets the requirements of EM 385-1-1 and herein. The CP for Confined Space Entry must supervise the entry into each confined space in accordance with EM 385-1-1.

Since this work involves operations that handle combustible or hazardous materials, this person must have the ability to understand and follow

through on the air sampling, Personal Protective Equipment (PPE), and instructions of a Marine Chemist, Coast Guard authorized persons, or Certified Industrial Hygienist. Confined space and enclosed space work must comply with NFPA 306, 29 CFR 1915, "Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment," or as applicable in 29 CFR 1910 for general industry, 29 CFR 1926 for construction.

1.8.8 Qualified Trainer Requirements

Individuals qualified to instruct the 40-hour contract safety awareness course, or portions thereof, must meet the definition of a Competent Person Trainer as defined in the EM 385-1-1, and, at a minimum, possess a working knowledge of the following subject areas: EM 385-1-1, Electrical Standards, Lockout/Tagout, Fall Protection, Confined Space Entry for Construction; Excavation, Trenching and Soil Mechanics, and Scaffolds in accordance with 29 CFR 1926.

Instructors are required to:

a. Prepare class presentations that cover construction-related safety requirements and include topics covered in the NAVFAC Construction Safety Hazard Awareness Course for Contractors.

b. Ensure that all attendees attend all sessions by using a class roster signed daily by each attendee. Maintain copies of the roster for at least 5 years. This is a certification class and must be attended 100 percent. In cases of emergency where an attendee cannot make it to a session, the attendee can make it up in another class session for the same subject.

c. Update training course materials whenever an update of the EM 385-1-1 becomes available.

d. Provide a written exam of at least 50 questions. Students are required to answer 80 percent correctly to pass.

e. Request, review and incorporate student feedback into a continuous course improvement program.

1.8.9 Preconstruction Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction conference. This includes the project superintendent, Site Safety and Occupational Health Officer, quality control manager, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the Contract. This list of proposed AHAs will be reviewed and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHAs to preclude project delays. The creation of the APP and Schedule will be created after being given Notice to Proceed.

c. Deficiencies in the submitted APP, identified during the Contracting Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin until an APP is established that is acceptable to the Contracting Officer.

1.8.10 Requirements for All Contractor Jobsite Personnel Holding H-1B or H-2B Visas

All Contractor jobsite workers holding an H-1B or H-2B visa must complete a minimum 16-hours of classroom training on the requirements of the latest version of EM 385-1-1 prior to their first day on the jobsite to include but not limited to the following topics: Sanitation; Medical and First Aid Requirements; Temporary Facilities; Personal Protective Equipment; Electrical; Hand and Power Tools; Material Handling and Storage; Motor Vehicles; Fall Protection; Work Platforms and Scaffoldings; Demolition; Safe Access, Ladders, Floor & Wall Openings, Stairs and Railing Systems; Excavations and Trenching; and Confined Spaces, prior to reporting to the jobsite.

Submit a list of workers who have completed the training to the Contracting Officer prior to them reporting to the jobsite. Update the list as additional workers are added. Maintain the updated list at the jobsite for review by the Government's designated authority. Include the name and qualifications of qualified trainer(s) that provided the training. Personnel who have taken the 40-hour Construction Safety Hazard Awareness Training Course for Contractors or similar course that includes emphasis on EM 385-1-1 compliance, are not required to take the 16-hours of classroom training on the requirements of the latest version of the EM 385-1-1. The 16-hours classroom training may be provided by the Guam Contractors Association (GCA), Trades Academy, or other qualified trainers as outlined in paragraph QUALIFIED TRAINER REQUIREMENTS.

1.9 ACCIDENT PREVENTION PLAN (APP)

1.9.1 Accident Prevention Plan (APP)

Submit the Accident Prevention Plan (APP) for review and acceptance by the Government at least 15 calendar days prior to the start, after being given Notice to Proceed. A competent person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, ENG Form 6293, and herein. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and occupational health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors. The Government considers the Prime Contractor to be the "controlling employer" for all worksite safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the Contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed in accordance with the APP and ENG Form 6293 Accident Prevention Plan Worksheet. The SSHO must provide and maintain the APP and a log of

signatures by each subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments will be enforced as part of the Contract. Disregarding the provisions of this Contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Continuously review and amend the APP, as necessary, throughout the life of the Contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and Quality Control Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e., imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ANSI/ASSP A10.34), and the environment.

1.9.2 Names and Qualifications

Provide plans in accordance with the requirements outlined in EM 385-1-1, including the following:

a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated Site Safety and Health Officer and other competent and qualified personnel to be used. Specify the duties of each position.

b. As a minimum, designate and submit qualifications of Competent Persons (CP) for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance. Designate and submit qualifications for additional CPs as applicable to the work performed under this Contract.

1.9.3 Plans

Provide plans in the APP in accordance with the requirements outlined in EM 385-1-1, including the following:

1.9.3.1 Lead, Cadmium, and Chromium Compliance Plan

Identify the safety and health aspects of work involving lead, cadmium and chromium, and prepare in accordance with Section 02 83 00 LEAD REMEDIATION.

1.9.3.2 Asbestos Hazard Abatement Plan

Identify the safety and health aspects of asbestos work, and prepare in accordance with Section 02 82 00 ASBESTOS REMEDIATION.

1.9.3.3 Site Demolition Plan

Identify the safety and health aspects, and prepare in accordance with Section 02 41 00 DEMOLITION and referenced sources. Include engineering survey as applicable.

1.10 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 working days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

1.10.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

1.10.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOW must review the AHA for that work and sign a signature log specifically maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

1.11 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

1.12 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment in accordance with EM 385-1-1. The Government has no responsibility to provide emergency medical treatment.

1.13 NOTIFICATIONS AND REPORTS

1.13.1 Accident Notification

Notify the Contracting Officer in accordance with the EM 385-1-1 Accident Reporting Timeline.

Table
Accident Reporting Required Timeline

Accident Type	Notify KO or COR	Complete Final Accident Report on ENG 3394 and provide to KO or COR
Fatality, in-patient hospitalization, amputation, eye loss, or property damage over $600,000.	Immediately, no later than (NLT) 8 Hours	Within 7 Days
All other accidents and near misses	Immediately, no later than (NLT) 24 Hours	Within 7 Days

Within notification include Contractor name; Contract title; type of Contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (for example, type of construction equipment used and PPE used). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any accident or near miss.

1.13.2 Accident Reports

a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable NAVFAC Contractor Incident Reporting System (CIRS), and electronically submit via the NAVFAC Enterprise Safety Applications Management System (ESAMS). Complete and submit an accident investigation report in ESAMS within 7 days for accidents as defined by EM 385-1-1. Complete the investigation report within 30 days. Accidents must include a written report submitted as an attachment in ESAMS using the following outline:

(1) Summary description to include:

(a) process

(b) findings

(c) outcomes

(2) Root Cause

(3) Direct Factors

(4) Indirect and Contributing Factors

(5) Corrective Actions

(6) Recommendations

All accidents are reportable, regardless of whether or not it is recordable.

a. Near Misses: For Navy Projects, complete the applicable documentation in NAVFAC Contractor Incident Reporting System (CIRS), and electronically submit via the NAVFAC Enterprise Safety Applications Management System (ESAMS). Near miss reports are considered positive and proactive Contractor safety management actions.

b. Conduct an accident investigation for any load handling equipment accident (including rigging accidents) to establish the root cause(s) of the accident. Complete the Load Handling Equipment (LHE) Accident Report (Crane and Rigging Accident Report) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the Contracting Officer. The Contracting Officer will provide a blank copy of the accident report form.

1.13.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

1.13.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

1.13.4.1 Certificate of Compliance

Provide a Certificate of Compliance for LHE utilized to perform work under this Contract in accordance with Section 16-7 of the EM 385-1-1. Post completed certificate on the crane.

1.13.4.2 Pre-Lift Plans

Develop either a Standard Lift Plan (SLP) or Critical Lift Plan (CLP) as required in accordance with EM 385-1-1. Utilize the Standard Lift Plan ENG Form 6203 for routine crane lifts and use the Critical Lift Plan ENR Form 6213 for non-routine crane lifts requiring more detailed planning and additional safety precautions, as defined by Section 16-2j of the EM 385-1-1. Submit lift plans to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

1.14 HOT WORK PERMIT

1.14.1 Permit and Personnel Requirements

Submit and obtain a written permit prior to performing "Hot Work" (i.e., welding or cutting) or operating other flame-producing/spark producing devices, from the Fire Division. A permit is required from the Explosives

Safety Office for work in and around where explosives are processed, stored, or handled. Contractors are required to meet all criteria before a permit is issued. Provide at least two 20 pound 4A:20 BC rated extinguishers for normal "Hot Work". The extinguishers must be current inspection tagged, and contain an approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch must be trained in accordance with NFPA 51B and remain on-site for a minimum of 1 hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. Report any fire, no matter how small, to the responsible Fire Division immediately.

1.14.2 Work Around Flammable Materials

Obtain permit approval from a NFPA Certified Marine Chemist, or Certified Industrial Hygienist for "Hot Work" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in EM 385-1-1.

1.15 RADIATION SAFETY REQUIREMENTS

Submit License Certificates, employee training records, and Leak Test Reports for radiation materials and equipment to the Contracting Officer and Radiation Safety Office (RSO), and Contracting Oversight Technician (COT) for all specialized and licensed material and equipment proposed for use on the construction project (excludes portable machine sources of ionizing radiation including moisture density and X-Ray Fluorescence (XRF)). Maintain on-site records whenever licensed radiological materials or ionizing equipment are on Government property.

Protect workers from radiation exposure in accordance with 10 CFR 20, ensuring any personnel exposures are maintained As Low As Reasonably Achievable.

1.15.1 Radiography Operation Planning Work Sheet

Submit a Gamma and X-Ray Radiography Operation Planning Work Sheet to Contracting Officer 14 days prior to commencement of operations involving radioactive materials or radiation generating devices. For portable machine sources of ionizing radiation, including moisture density and XRF, use and submit the Portable Gauge Operations Planning Worksheet instead. The Contracting Officer and COT will review the submitted worksheet and provide questions and comments.

Contractors must use primary dosimeters process by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

1.15.2 Site Access and Security

Coordinate site access and security requirements with the Contracting Officer for all radiological materials and equipment containing ionizing radiation that are proposed for use on a government facility. The authorized representative will meet the Contractor at a designated location outside the Installation, ensure safety of the materials being transported, and will escort the Contractor and return upon completion of the work.

Provide a copy of all calibration records, and utilization records for radiological operations performed on the site.

1.15.3 Loss or Release and Unplanned Personnel Exposure

Loss or release of radioactive materials, and unplanned personnel exposures must be reported immediately to the Contracting Officer, RSO, and Base Security Department Emergency Number.

1.15.4 Site Demarcation and Barricade

Properly demark and barricade an area surrounding radiological operations to preclude personnel entrance, in accordance with EM 385-1-1, Nuclear Regulatory Commission, and Applicable State regulations and license requirements, and in accordance with requirements established in the accepted Radiography Operation Planning Work Sheet.

Do not close or obstruct streets, walks, and other facilities occupied and used by the Government without written permission from the Contracting Officer.

1.15.5 Security of Material and Equipment

Properly secure the radiological material and ionizing radiation equipment at all times, including keeping the devices in a properly marked and locked container, and secondarily locking the container to a secure point in the Contractor's vehicle or other approved storage location during transportation and while not in use. While in use, maintain a continuous visual observation on the radiological material and ionizing radiation equipment. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, make no assumptions as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, position a fully instructed employee inside the building or area to prevent exiting while external radiographic operations are in process.

1.15.6 Transportation of Material

Comply with 49 CFR 173 for Transportation of Regulated Amounts of Radioactive Material. Notify Local Fire authorities and the site Radiation Safety Officer (RSO) of any Radioactive Material use.

1.15.7 Schedule for Exposure or Unshielding

Actual exposure of the radiographic film or unshielding the source must not be initiated until after 5 p.m. on weekdays.

1.15.8 Transmitter Requirements

Adhere to the base policy concerning the use of transmitters, such as radios and cell phones. Obey Emissions control (EMCON) restrictions.

1.16 CONFINED SPACE ENTRY REQUIREMENTS

Confined space entry must comply with EM 385-1-1, 29 CFR 1926, 29 CFR 1910, and Directive CPL 2.100. Any potential for a hazard in the confined space requires a permit system to be used.

1.16.1 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

1.17 CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

Submit an IAQ Management Plan not less than 10 calendar days before the preconstruction conference. Revise and resubmit Plan as required by the Contracting Officer. Make copies of the final plan available to all workers on site. Include provisions in the Plan to meet the requirements specified below and to ensure safe, healthy air for construction workers and building occupants.

1.17.1 Requirements During Construction

Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D6245. Provide for evaluation of volatile organic compounds (VOCs) in indoor air in accordance with ASTM D6345. Use filters with a Minimum Efficiency Reporting Value (MERV) of 8 in permanently installed air handlers during construction.

1.17.1.1 Control Measures

Meet or exceed the requirements of ANSI/SMACNA 008 to help minimize contamination of the building from construction activities. The five requirements of this manual which must be adhered to are described below:

a. HVAC protection: Isolate return side of HVAC system from surrounding environment to prevent construction dust and debris from entering the duct work and spaces.

b. Source control: Use low emitting paints and other finishes, sealants, adhesives, and other materials as specified. When available, cleaning products must have a low VOC content and be non-toxic to minimize building contamination. Utilize cleaning techniques that minimize dust generation. Cycle equipment off when not needed. Prohibit idling motor vehicles where emissions could be drawn into building. Designate receiving/storage areas for incoming material that minimize IAQ impacts.

c. Pathway interruption: When pollutants are generated use strategies such as 100 percent outside air ventilation or erection of physical barriers between work and non-work areas to prevent contamination.

d. Housekeeping: Clean frequently to remove construction dust and debris. Promptly clean up spills. Remove accumulated water and keep

work areas dry to discourage the growth of mold and bacteria. Take extra measures when hazardous materials are involved.

e. Scheduling: Control the sequence of construction to minimize the absorption of VOCs by other building materials.

1.17.1.2 Moisture Contamination

a. Remove accumulated water and keep work dry.

b. Use dehumidification to remove moist, humid air from a work area.

c. Do not use combustion heaters or generators inside the building.

d. Protect porous materials from exposure to moisture.

e. Remove and replace items which remain damp for more than a few hours.

1.17.2 Requirements After Construction

After construction ends and prior to occupancy, conduct a building flush-out or test the indoor air contaminant levels. Flush-out must be a minimum 2 weeks with MERV-13 filtration media as determined by ASHRAE 52.2 at 100 percent outside air. Air contamination testing must be consistent with EPA's current Compendium of Methods for the Determination of Air Pollutants in Indoor Air. After building flush-out or testing and prior to occupancy, replace filtration media. Filtration media must have a MERV of 13 as determined by ASHRAE 52.2.

1.18 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must comply with the applicable Storm Plan and:

a. Secure outside equipment and materials and place materials that could be damaged in protected areas.

b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

c. Ensure that temporary erosion controls are adequate.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

Comply with EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety

glasses must be worn or carried/available on each person. Mandatory PPE includes:

a. Head Protection that meets ANSI/ISEA Z89.1

b. Long Pants

c. Appropriate Safety Footwear

d. Appropriate Class Reflective Vests

3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e., cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment. Develop an employee check-in/check-out communication procedure to ensure employee safety.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this Contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

3.1.3 Unforeseen Hazardous Material

Contract documents identify materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e., 29 CFR Part 1910.1000). If material(s) that can be hazardous to human health upon disturbance are encountered during demolition, repair, renovation, or construction operations, stop portions of work that would disturb the material and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification.

3.2 UTILITY OUTAGE REQUIREMENTS

Advance notification of outages to be coordinated as stated in Section 01 14 00 WORK RESTRICTIONS. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill

energy isolation requirements in accordance with EM 385-1-1. In accordance with EM 385-1-1, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

These activities include, but are not limited to, a review of Hazardous Energy Control Program (HECP) and HEC procedures, as well as applicable Activity Hazard Analyses (AHAs). In accordance with EM 385-1-1 and NFPA 70E, work on energized electrical circuits must not be performed without prior Government authorization. Government permission is considered through the permit process and submission of a detailed AHA. Energized work permits are considered only when de-energizing introduces additional or increased hazard or when de-energizing is infeasible.

3.3 OUTAGE COORDINATION MEETING

After the utility outage request is approved and prior to beginning work on the utility system requiring shut-down, conduct a pre-outage coordination meeting in accordance with EM 385-1-1. This meeting must include the Prime Contractor, the Prime and subcontractors performing the work, the Contracting Officer, and the Public Utilities representative. All parties must fully coordinate HEC activities with one another. During the coordination meeting, all parties must discuss and coordinate on the scope of work, HEC procedures (specifically, the lock-out/tag-out procedures for worker and utility protection), the AHA, assurance of trade personnel qualifications, identification of competent persons, and compliance with HECP training in accordance with EM 385-1-1. Clarify when personal protective equipment is required during switching operations, inspection, and verification.

3.4 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1, 29 CFR 1910, 29 CFR 1915, ANSI/ASSP A10.44, NFPA 70E.

3.4.1 Safety Preparatory Inspection Coordination Meeting with the Government or Utility

For electrical distribution equipment that is to be operated by Government or Utility personnel, the Prime Contractor and the subcontractor performing the work must attend the safety preparatory inspection coordination meeting, which will also be attended by the Contracting Officer's Representative, and required by EM 385-1-1. The meeting will occur immediately preceding the start of work and following the completion of the outage coordination meeting. Both the safety preparatory inspection coordination meeting and the outage coordination meeting must occur prior to conducting the outage and commencing with lockout/tagout procedures.

3.4.2 Lockout/Tagout Isolation

Where the Government or Utility performs equipment isolation and lockout/tagout, the Contractor must place their own locks and tags on each energy-isolating device and proceed in accordance with the HECP. Before any work begins, both the Contractor and the Government or Utility must perform energy isolation verification testing while wearing required PPE detailed in the Contractor's AHA and required by EM 385-1-1. Install personal protective grounds, with tags, to eliminate the potential for

induced voltage in accordance with EM 385-1-1.

3.4.3 Lockout/Tagout Removal

Upon completion of work, conduct lockout/tagout removal procedure in accordance with the HECP. In accordance with EM 385-1-1, each lock and tag must be removed from each energy isolating device by the authorized individual or systems operator who applied the device. Provide formal notification to the Government (by completing the Government form if provided by Contracting Officer's Representative), confirming that steps of de-energization and lockout/tagout removal procedure have been conducted and certified through inspection and verification. Government or Utility locks and tags used to support the Contractor's work will not be removed until the authorized Government employee receives the formal notification.

3.5 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with EM 385-1-1.

3.5.1 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific Fall Protection and Prevention Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 and 29 CFR 1926.

3.5.1.1 Additional Personal Fall Protection Measures

In addition to the required fall protection systems, other protective measures such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

3.5.1.2 Personal Fall Protection Equipment

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabineers must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 lbs in all directions. Use webbing,

straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. Equip all full body harnesses with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1.

3.6 USE OF EXPLOSIVES

Explosives must not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval does not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, must be only where directed and in approved storage facilities. These facilities must be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

3.7 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1.

3.7.1 Electrical Work

As described in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety footwear, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.

3.7.2 Qualifications

Electrical work must be performed by QP with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials

consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State, Local requirements applicable to where work is being performed.

3.7.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

3.7.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous and effective path to ground unless otherwise noted by EM 385-1-1.

3.7.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 35 29.13

HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES
11/15, CHG 1: 08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z358.1	(2014; R 2020) American National Standard for Emergency Eyewash and Shower Equipment

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 85-115	(1985) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response

1.2 PRECONSTRUCTION SAFETY CONFERENCE

Conduct a preconstruction safety conference prior to the start of site activities and after submission of the Accident Prevention Plan/Site Safety and Health Plan (APP/SSHP). The objective of the meeting is to discuss health and safety concerns related to the impending work, discuss project health and safety organization and expectations, review and answer comments and concerns regarding the APP/SSHP or other health and safety concerns. Ensure that those individuals responsible for health and safety at the project level are available and attend this meeting.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Work Zones; G

Decontamination Facilities; G

SD-03 Product Data

Amendments to the APP/SSHP; G

G-RAM/LLRW Exposure Monitoring/Air Sampling Program; G

Site Control Log

SSHO's Daily Inspection Logs

SD-07 Certificates

Certificate Of Worker/Visitor Acknowledgement

Certification Of 40 Hour Radiation Safety Officer Training; G

SD-11 Closeout Submittals

Safety And Health Phase-Out Report; G

1.4 ACCIDENT PREVENTION PLAN/SITE SAFETY AND HEALTH PLAN (APP/SSHP)

Develop and implement a Site Safety and Health Plan in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, and attach to the Accident Prevention Plan (APP) as an appendix (APP/SSHP). Address all occupational safety and health hazards (traditional construction as well as contaminant-related hazards) associated with cleanup operations within the APP/SSHP. Cover each SSHP element in accordance with in Chapter 6, Hazardous or Toxic Agents and Environments and Chapter 36, Hazardous Waste Operations and Emergency Response, of EM 385-1-1. SSHP appendix elements that overlap with APP elements need not be duplicated in the APP/SSHP provided each safety and occupational health (SOH) issue receives adequate attention and is documented in the APP/SSHP. The APP/SSHP is a dynamic document, subject to change as project operations/execution change. Modify the APP/SSHP to address changing and previously unidentified health and safety conditions. Ensure that the APP/SSHP is updated accordingly. Submit amendments to the APP/SSHP to the Contracting Officer as the APP/SSHP is updated. For long duration projects resubmit the APP/SSHP to the Contracting Officer annually for review. The APP/SSHP must contain all updates.

1.4.1 Acceptance and Modifications

Prior to submittal, the APP/SSHP must be signed and dated by the Safety

and Health Manager and the Site Superintendent. Submit for review 14 days prior to the Preconstruction Safety Conference. Deficiencies in the APP/SSHP will be discussed at the preconstruction safety conference, and must be revised to correct the deficiencies and resubmitted for acceptance. Onsite work must not begin until the plan has been accepted. Maintain a copy of the written APP/SSHP onsite. Changes and modifications to the APP/SSHP must be made with the knowledge and concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Bring to the attention of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer any unforeseen hazard that becomes evident during the performance of the work, through the Site Safety and Health Officer (SSHO) for resolution as soon as possible. In the interim, take necessary action to re-establish and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted APP/SSHP is cause for stopping work until the matter has been rectified.

1.4.2 Availability

Make available the APP/SSHP in accordance with 29 CFR 1910.120, (b)(1)(v) and 29 CFR 1926.65, (b)(1)(v).

1.5 STAFF ORGANIZATION, QUALIFICATION AND RESPONSIBILITIES

Provide hazardous waste operations and emergency response organization in accordance with EM 385-1-1, Section 36.

1.5.1 Safety and Health Manager

Retain a Safety and Health Manager. Safety and Health Manager must be an Industrial Hygienist certified by the American Board of Industrial Hygiene, a safety professional certified by the Board of Certified Safety Professionals, or a health physicist certified by the American Board of Health Physicists. This can be a collateral position.

Apply the following in conjunction with the required qualifications and responsibilities stated in EM 385-1-1, Section 33.C.01.

1.5.1.1 Additional Qualifications

The Safety and Health Manager must have the following qualifications:

a. A minimum of 5 years' experience in developing and implementing safety and occupational health programs at HTRW sites or environmental cleanup sites.

b. Documented experience in supervising professional and technician level personnel.

c. Documented experience in developing worker exposure assessment programs and air monitoring programs and techniques.

d. Documented experience in managing personal protective equipment (PPE) programs and conducting PPE hazard evaluations for the types of activities and hazards likely to be encountered on the project.

e. Working knowledge of state and Federal occupational safety and health regulations.

1.5.1.2 Responsibilities and Duties

a. Development, implementation, oversight, and enforcement of the APP/SSHP.

b. Provide onsite consultation as needed to ensure the APP/SSHP is fully implemented.

c. Conduct initial site-specific training.

d. Be present onsite during the first 3 days of remedial or cleanup activities (e.g., PFAS-impacted soil activities, G-RAM/LLRW management activities) and at the startup of each new major phase of PFAS or G-RAM/LLRW work. Be available for consultation until the hazards are mitigated or eliminated.

e. Be available for emergencies.

f. Coordinate any modifications to the APP/SSHP with the Site Superintendent, the SSHO, and the Contracting Officer.

g. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.

h. Provide continued support for upgrading/downgrading of the level of personal protection.

i. Serve as a member of the quality control staff.

j. Review accident reports and results of daily inspections.

k. Sign and date the APP/SSHP prior to submittal.

1.5.2 Site Safety and Health Officer

Designate an individual and one alternate as the Site Safety and Health Officer (SSHO). Include the name, qualifications (education and training summary and documentation), and work experience of the Site Safety and Health Officer and alternate in the APP/SSHP.

Apply the following in conjunction with the required qualifications and responsibilities stated in EM 385-1-1.

1.5.2.1 Qualifications

The following requirements are in addition to those in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

a. A minimum of 3 year experience in implementing SOH programs at HTRW sites or environmental cleanup sites.

b. Meet 29 CFR 1910.120/29 CFR 1926.65 requirements for 40-hour initial and 8-hour supervisor training and, maintain 8-hour refresher training requirements.

c. Specific training in personal and respiratory protective equipment, confined space entry and in the proper use of air monitoring instruments and air sampling methods including monitoring for ionizing

radiation.

d. Documented experience in construction techniques and construction safety procedures.

e. Working knowledge of Federal and state occupational SOH regulations.

1.5.2.2 Responsibilities and Duties

The following requirements are in addition to those in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

a. Assist and represent the Safety and Health Manager in onsite training and the day to day onsite implementation and enforcement of the accepted APP/SSHP.

b. Be assigned to the site on a full time basis for the duration of field activities. The SSHO will have no duties other than SOH related duties. If operations are performed during more than 1 work shift per day, a site Safety and Health Officer must be present for each shift and when applicable.

c. Have authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.

d. Have authority to ensure site compliance with specified SOH requirements, Federal, state and OSHA regulations and all aspects of the APP/SSHP including, but not limited to, activity hazard analyses, air monitoring, monitoring for ionizing radiation, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily SOH inspection and documenting results on the Daily Safety Inspection Log in accordance with 29 CFR 1904.

e. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

f. Consult with and coordinate any modifications to the APP/SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer.

g. Conduct daily safety inspection and document SOH findings into the Daily Safety Inspection Log. Track noted SOH deficiencies to ensure that they are corrected.

h. Conduct accident investigations and prepare accident reports.

i. Serve as a member of the quality control staff on matters relating to SOH.

1.5.3 Radiation Safety Officer (RSO)

Retain a Radiation Safety Officer (RSO) to ensure the safe use, handling, and management of G-RAM, LLRW, radioactive materials, and radiation-producing equipment. The RSO must develop and implement

radiation safety programs, monitor radiation levels, and ensure compliance with all relevant regulations. The RSO must be onsite during the construction activities, including screening, managing, handling, packaging, storage, and disposal of G-RAM and LLRW. The RSO must complete the 40 Hour Radiation Safety Officer Training. Submit the certification of 40 Hour Radiation Safety Officer Training.

1.5.4 Occupational Physician

Utilize the services of a licensed physician, who is certified in occupational medicine by the American Board of Preventative Medicine, or who, by necessary training and experience is Board eligible. The physician must be familiar with the site's hazards and the scope of this project. Include the medical consultant's name, qualifications, and knowledge of the site's conditions and proposed activities in the APP/SSHP. The physician is responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910.120, (f) and 29 CFR 1926.65, (f) and paragraph MEDICAL SURVEILLANCE PROGRAM.

1.5.5 Persons Certified in First Aid and CPR

At least two persons who are currently certified in first aid and CPR by the American Red Cross or other approved agency must be onsite at all times during site operations. They must be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030. These persons may perform other duties but must be immediately available to render first aid when needed.

1.5.6 Safety and Health Technicians

For each work crew in the exclusion zone, one person, designated as a Safety and Health technician, must perform activities such as air monitoring, decontamination, and safety oversight on behalf of the SSHO. They must have appropriate training equivalent to the SSHO in each specific area for which they have responsibility and report to and be under the supervision of the SSHO.

1.6 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

Develop and implement an Emergency Response Plan, that meets the requirements of EM 385-1-1, 29 CFR 1910.120, and 29 CFR 1926.65, as a section of the APP/SSHP. In the event of any emergency associated with remedial action, without delay, alert all onsite employees and as necessary offsite emergency responders that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Contracting Officer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Train employees that are required to respond to hazardous emergency situations to their level of responsibility according to 29 CFR 1910.120 (q) and 29 CFR 1926.65 (q) requirements. Rehearse the plan regularly as part of the overall training program for site operations. Review the plan periodically and revised as necessary to reflect new or changing site conditions or information. Provide copies of the Emergency Response Portion of the accepted APP/SSHP to the affected local emergency response agencies. Address, as a minimum, the following elements in the plan:

a. Pre-emergency planning. Coordinate with local emergency response

providers during preparation of the Emergency Response Plan. At a minimum, coordinate with local fire, rescue, hazardous materials response teams, police and emergency medical providers to assure all organizations are capable and willing to respond to and provide services for on-site emergencies. Ensure the Emergency Response Plan for the site is compatible and integrated with the local fire, rescue, medical and police security services available from local emergency response planning agencies.

b. Personnel roles, lines of authority, communications for emergencies.

c. Emergency recognition and prevention.

d. Site topography, layout, and prevailing weather conditions.

e. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

f. Route maps to nearest pre-notified medical facility. Site-support vehicles must be equipped with maps. At the beginning of project operations, drivers of the support vehicles must become familiar with the emergency route and the travel time required.

g. Specific procedures for decontamination and medical treatment of injured personnel.

h. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies; as well as Safety and Health Manager, the Site Superintendent, the Contracting Officer and their alternates).

i. Criteria for initiating community alert program, contacts, and responsibilities.

j. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate government agencies must be immediately notified. In addition, verbally notify the Contracting Officer and the local district safety office immediately and submit a written notification within 24 hours. Include within the report the following items:

(1) Name, organization, telephone number, and location of the Contractor.

(2) Name and title of the person(s) reporting.

(3) Date and time of the incident.

(4) Location of the incident, i.e., site location, facility name.

(5) Brief summary of the incident giving pertinent details including type of operation ongoing at the time of the incident.

(6) Cause of the incident, if known.

(7) Casualties (fatalities, disabling injuries).

(8) Details of any existing chemical hazard or contamination.

(9) Estimated property damage, if applicable.

(10) Nature of damage, effect on contract schedule.

(11) Action taken to ensure safety and security.

(12) Other damage or injuries sustained, public or private.

k. Procedures for critique of emergency responses and follow-up.

1.7 CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGEMENT

A copy of a certificate of worker/visitor acknowledgement must be completed and submitted for each visitor allowed to enter contamination reduction or exclusion zones, and for each employee, following the Example Certificate Of Worker/Visitor Acknowledgement at the end of this section.

1.8 INSPECTIONS

Attach to and submit with the Daily Quality Control reports the SSHO's Daily Inspection Logs. Include with each entry the following: date, work area checked, employees present in work area, PPE and work equipment being used in each area, special SOH issues and notes, and signature of preparer.

1.9 SAFETY AND HEALTH PHASE-OUT REPORT

Submit a Safety and Health Phase-Out Report in conjunction with the project close out report, prior to final acceptance of the work. Include the following minimum information:

a. Summary of the overall performance of SOH (e.g., accidents or incidents including near misses, unusual events, lessons learned).

b. Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and on site facilities.

c. Summary of exposure monitoring and air sampling accomplished during the project.

d. Signatures of Safety and Health Manager and SSHO.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

Comply with EM 385-1-1, 29 CFR 1926.65, 29 CFR 1910.120, OSHA requirements in 29 CFR 1910 and 29 CFR 1926 with work performed under this contract, and state specific OSHA requirements where applicable. Submit to the Contracting Officer for resolution matters of interpretation of standards before starting work. The most stringent requirements apply where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary.

2.2 PERSONAL PROTECTIVE EQUIPMENT

2.2.1 Site Specific PPE Program

Provide onsite personnel exposed to contaminants with appropriate personal protective equipment. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat stress potential and safety hazards. Use only respirators approved by NIOSH.

Keep protective equipment and clothing clean and well maintained. Include site-specific procedures to determine PPE program effectiveness and for onsite fit-testing of respirators, cleaning, maintenance, inspection, cartridge change out, and storage of PPE within the PPE section of the APP/SSHP.

2.2.2 Levels of Protection

The Safety and Health Manager must establish and evaluate as the work progresses the levels of protection for each work activity. Also establish action levels for upgrade or downgrade in levels of PPE. Describe in the SSHP the protocols and the communication network for changing the level of protection. Address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, and individual medical considerations within the PPE evaluation protocol.

2.2.2.1 PPE Components

The PPE components and requirements must be determined and indicated in the APP/SSHP.

2.3 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

Maintain, as a minimum, the following items onsite and available for immediate use:

a. First aid equipment and supplies approved by the consulting physician.

b. Emergency eyewashes and showers that comply with ANSI/ISEA Z358.1.

PART 3 EXECUTION

3.1 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

3.1.1 Project/Site Conditions

Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS AND Section 02 61 13 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL for the known Installation Restoration Program (IRP) Site, PFAS-Contaminated Areas, and potential General Radioactive Material (G-RAM)/Low-Level Radioactive Waste (LLRW) Area.

3.2 TASK SPECIFIC HAZARDS, INITIAL PPE, HAZWOPER MEDICAL SURVEILLANCE AND TRAINING APPLICABILITY

Task specific occupational hazards, task specific HAZWOPER medical

surveillance and training applicability and task specific initial PPE requirements for the project are listed on the Task Hazard and Control Sheets at the end of this section. Reevaluate occupational safety and health hazards as the work progresses and to adjust the PPE and onsite operations, if necessary, so that the work is performed safely and in compliance with occupational safety and health regulations.

All personnel performing duties with potential for exposure to onsite contaminants (e.g., PFAS, G-RAM/LLRW) must have the 40-hour HAZWOPER Training. After concerns or risks related to PFAS-contaminated material and G-RAM/LLRW are eliminated or mitigated, HAZWOPER-trained personnel will not be required.

3.3 TRAINING

In conjunction with EM 385-1-1, Sections 6 and 36, meet the training program requirements for workers performing cleanup operations and who will be exposed to contaminants (e.g., PFAS, G-RAM/LLRW). All personnel performing duties with potential for exposure to onsite contaminants must have the 40-hour HAZWOPER Training.

3.3.1 Pre-Entry Briefing

Prior to commencement of onsite field activities, all site employees, including those assigned only to the Support Zone, must attend a site-specific SOH training session. This session will be conducted by the Safety and Health Manager and the Site Safety and Health Officer to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment. Thoroughly discuss procedures and contents of the accepted APP/SSHP and Sections 01.B.02 and 28.D.03 of EM 385-1-1 . Each employee must sign a training log to acknowledge attendance and understanding of the training. Notify the Contracting Officer at least 5 days prior to the initial site-specific training session so government personnel involved in the project may attend.

3.3.2 Periodic Sessions

Conduct periodic onsite training by the SSHO at least daily for personnel assigned to work at the site during the following day. Address SOH procedures, work practices, any changes in the APP/SSHP, activity hazard analyses, work tasks, or schedule; results of previous week's air monitoring, review of safety discrepancies and accidents. Convene a meeting prior to implementation of the change should an operational change affecting onsite field work be made, to explain SOH procedures. Conduct a site-specific training sessions for new personnel, visitors, and suppliers by the SSHO using the training curriculum outlines developed by the Safety and Health Manager. Each employee must sign a training log to acknowledge attendance and understanding of the training.

3.3.3 Other Training

Site specific training for sites where radioactive wastes (e.g., G-RAM, LLRW) are to be screened, handled, stored, and cleaned up include:

a. Site specific procedures for handling and storing radioactive materials;

b. Health and safety hazards associated with exposure to the radioactive

material that will be cleaned up or otherwise handled and the purpose and function of protective devices and precautions used to minimize exposures;

c. Elements of the APP/SSHP and company specific procedures intended to provide protection from G-RAM/LLRW radiation exposure;

d. Worker responsibility to report any unsafe acts which might result in exposure to G-RAM/LLRW;

e. Appropriate worker response procedures to events that may result in worker exposure to G-RAM/LLRW;

f. Worker rights and responsibilities with respect to G-RAM/LLRW exposure.

3.4 MEDICAL SURVEILLANCE PROGRAM

Meet all requirements of 29 CFR 1910.120/29 CFR 1926.65 medical surveillance program and EM 385-1-1 for workers performing cleanup operations and who will be exposed to contaminants. Ensure the Occupational Physician or the physician's designee performs the physical examinations and reviews examination results. Participation in the medical surveillance program is without cost to the employee, without loss of pay and at a reasonable time and place.

3.5 G-RAM/LLRW EXPOSURE MONITORING/AIR SAMPLING PROGRAM

Prepare and implement by the Safety and Health Manager a radiation exposure monitoring in order to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel. Include action levels for upgrading/downgrading PPE in the program. Submit personnel exposure monitoring/sampling results.

3.5.1 Ionizing Radiation Sampling and Dosimetry

The APP/SSHP must include monitoring equipment and methods for the G-RAM/LLRW radiation exposure.

3.5.1.1 Evaluation

Radiation dosimetry must be evaluated by an individual or company holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP). Electronic dosimetry may be used to assign external dose if approved by the Contracting Officer. Internal intake assessment and applicable monitoring must be evaluated by the Certified Health Professional (CHP).

3.5.1.2 Documentation

Document employee exposure to external radiation. Include reviewing each employee's radiation exposure history in accordance with 10 CFR 20 Section .2104, for compliance with exposure standards prior to allowing the employee access to a restricted area. If the employee has no exposure history, the employee must provide a signed written statement to that effect.

3.5.1.3 Reporting

Furnish reports of exposure to ionizing radiation to the Contracting

Officer as soon as available and to each employee annually, upon termination, and within 30 days of any personal request.

3.6 HEAT STRESS MONITORING AND MANAGEMENT

Document in the APP/SSHP and implement the procedures and practices in accordance with EM 385-1-1 to monitor and manage heat stress.

3.7 SPILL AND DISCHARGE CONTROL

Develop and implement written spill and discharge containment/control procedures. Address radioactive wastes, shock sensitive wastes, laboratory waste packs, material handling equipment, as well as drum and container handling, opening, sampling, shipping and transport. Describe prevention measures, such as building berms or dikes; spill control measures and material to be used (e.g. booms, vermiculite); location of the spill control material; personal protective equipment required to cleanup spills; disposal of contaminated material; and who is responsible to report the spill. Storage of contaminated material or hazardous materials must be appropriately bermed, diked and contained to prevent any spillage of material on uncontaminated soil. If the spill or discharge is reportable, or human health or the environment are threatened, notify the National Response Center, the state, and the Contracting Officer as soon as possible. Provide control as required by Section 01 57 19 TEMPORARY ENVIRONMENT CONTROLS. Reporting requirements must be in accordance with Section 02 61 13 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL.

3.8 SITE CONTROL MEASURES

Coordinate site control measures with Section 01 57 19 TEMPORARY ENVIRONMENT CONTROLS and Section 02 61 13 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL.

3.8.1 Work Zones

Initial anticipated work zone boundaries (exclusion zone, contamination reduction zone, support zone, all access points and decontamination areas) are to be clearly delineated on the site drawings. Base delineation of work zone boundaries on the contamination characterization data and the hazard/risk analysis to be performed as described in EM 385-1-1. As work progresses and field conditions are monitored, work zone boundaries may be modified (and site drawings modified) with approval of the Contracting Officer. Clearly identify work zones and mark in the field (using fences, tape, or signs). Submit and post a site map, showing work zone boundaries and locations of decontamination facilities in the onsite office. Work zones must consist of the following:

3.8.1.1 Exclusion Zone (EZ)

The exclusion zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Control entry into this area and exit may only be made through the Contamination Reduction Zone (CRZ).

3.8.1.2 Contamination Reduction Zone (CRZ)

The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas must be separate and unique areas located in the CRZ.

3.8.1.3 Support Zone (SZ)

The Support Zone is defined as areas of the site, other than exclusion zones and contamination reduction zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from HTRW operations. Secure the Support Zone against active or passive contamination. Site offices, parking areas, and other support facilities must be located in the Support Zone.

3.8.2 Site Control Log

A log of personnel visiting, entering, or working on the site must be maintained. Include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the exclusion zone (if applicable). Before visitors are allowed to enter the Contamination Reduction Zone or Exclusion Zone, they must show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the tasks to be performed) and fill out a Certificate of Worker or Visitor Acknowledgment. Record this visitor information, including date, in the log.

3.8.3 Communication

Provide and install an employee alarm system that has adequate means of on and off site communication in accordance with 29 CFR 1910 Section .165. The means of communication must be able to be perceived above ambient noise or light levels by employees in the affected portions of the workplace. The signals must be distinctive and recognizable as messages to evacuate or to perform critical operations.

3.8.4 Site Security

Install polyethylene mesh safety fencing or equivalent along the known contaminated areas and potential G-RAM/LLRW area. Print signs in bold large letters on contrasting backgrounds. Signs must be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

3.9 PERSONAL HYGIENE AND DECONTAMINATION

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed to hazardous chemical vapors, gases, liquids, or contaminated solids must decontaminate themselves and their equipment prior to exiting the contamination reduction zone (CRZ) and entering the support zone. Consult Chapter 10.0 of NIOSH 85-115 when preparing decontamination procedures. Submit a detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers as part of the APP/SSHP. Train employees in the procedures and enforce the procedures throughout site operations.

3.9.1 Decontamination Facilities

Submit drawings showing the layout of the personnel and equipment decontamination areas.

3.9.2 Personnel Decontamination

Initially set up a decontamination line in the CRZ. Employees must exit the exclusion zone through the CRZ and implement the decontamination procedures and techniques identified in the APP/SSHP. It is the Site Safety and Health Officer's responsibility to recommend techniques to improve personnel decontamination procedures.

3.9.3 Equipment Decontamination

Decontaminate the vehicles and equipment used in the EZ in the CRZ prior to leaving the EZ.

3.9.3.1 Facilities for Equipment and Personnel

Provide a vehicle/equipment decontamination station within the CRZ for decontaminating vehicles and equipment leaving the EZ.

3.9.3.2 Procedures

Procedures for equipment decontamination must be developed and utilized to prevent the spread of contamination into the SZ and offsite areas. These procedures must address disposal of contaminated products and spent materials used on the site, including, as a minimum, containers, fluids, and oils. Assume any item taken into the EZ to be contaminated and perform an inspection and decontaminate. Vehicles, equipment, and materials must be cleaned and decontaminated prior to leaving the site. Handle construction material in such a way as to minimize the potential for contaminants being spread or carried offsite. Prior to exiting the site, vehicles and equipment must be monitored to ensure the adequacy of decontamination.

Task Hazard and Control Requirements Sheet	
Task	
Initial Anticipated Hazards	
Initial PPE	
Initial Controls	
Initial Exposure Monitoring	
(Yes) (No)	HAZWOPER Medical Surveillance Required
(Yes) (No)	HAZWOPER Training Required

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS
05/24

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g., ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

ALUMINUM ASSOCIATION (AA)
1400 Crystal Drive
Suite 430
Arlington, VA 22202
Ph: 703-358-2960

Internet: https://www.aluminum.org/

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
555 12th Street NW, Suite 1000
Washington, DC 20004
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: https://www.transportation.org/

AMERICAN CONCRETE INSTITUTE (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331-3439
Ph: 248-848-3800
Fax: 248-848-3701
Internet: https://www.concrete.org/

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
3640 Park 42 Drive
Cincinnati, OH 45241
Ph: 513-742-2020
Fax: 513-742-3355
Email: customerservice@acgih.org
Internet: https://www.acgih.org/

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
130 East Randolph, Suite 2000
Chicago, IL 60601
Ph: 312-670-2400
Fax: 312-670-5403
Steel Solutions Center: 866-275-2472
E-mail: solutions@aisc.org
Internet: https://www.aisc.org/

AMERICAN PETROLEUM INSTITUTE (API)
200 Massachusetts Avenue NW Suite 1100
Washington, DC 20001-5571
Ph: 202-682-8000
Internet: https://www.api.org/

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)
1201 Dublin Road Suite G04

Columbus, OH 43215-1045
Ph: 800-222-2768 or 614-274-6003

E-mail: customersupport@asnt.org
Internet: https://www.asnt.org/

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191
Ph: 800-548-2723; 703-295-6300
Email: customercare@asce.org
Internet: https://www.asce.org/

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
180 Technology Parkway NW
Peachtree Corners, GA 30092
Ph: 404-636-8400 or 800-527-4723
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: https://www.ashrae.org/

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
Two Park Avenue
New York, NY 10016-5990
Ph: 800-843-2763
Fax: 973-882-1717
E-mail: customercare@asme.org
Internet: https://www.asme.org/

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)
520 N. Northwest Highway
Park Ridge, IL 60068
Ph: 847-699-2929
E-mail: customerservice@assp.org
Internet: https://www.assp.org/

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
18927 Hickory Creek Drive, Suite 220
Mokena, IL 60448
Ph: 708-995-3019

Fax: 708-479-6139
Internet: http://www.asse-plumbing.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 W. Quincy Avenue
Denver, CO 80235 USA
Ph: 303-794-7711 or 800-926-7337
Fax: 303-347-0804
Internet: https://www.awwa.org/

AMERICAN WELDING SOCIETY (AWS)
8669 NW 36 Street, #130
Miami, FL 33166-6672
Ph: 800-443-9353
Email: customercare@aws.org
Internet: https://www.aws.org/

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
Internet: http://www.awpa.com

ANDERSEN AIR FORCE BASE, GUAM
Internet: https://www.andersen.af.mil/

ASPHALT INSTITUTE (AI)
2696 Research Park Drive
Lexington, KY 40511-8480
Ph: 859-288-4960 or 1-866-540-9577
Fax: 859-288-4999
E-mail: info@asphaltinstitute.org
Internet: http://www.asphaltinstitute.org

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

P.O. Box 58130
Washington, DC 20037
Ph: 205-257-3839
Fax: 205-257-2540
Internet: https://aeic.org/

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9500
Fax: 610-832-9555
E-mail: service@astm.org
Internet: https://www.astm.org/

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)
1600 Clifton Road
Atlanta, GA 30329-4027
Ph: 800-232-4636
TTY: 888-232-6348
Internet: https://www.cdc.gov

COMPOSITE PANEL ASSOCIATION (CPA)
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176
Ph: 703-724-1128
Fax: 703-724-1588
Internet: https://www.compositepanel.org/

COMPRESSED GAS ASSOCIATION (CGA)
8484 Westpark Drive Suite 220
McLean, Virginia 22102
Ph: 703-788-2700
Fax: 703-961-1831
E-mail: cga@cganet.com
Internet: https://www.cganet.com/

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
933 North Plum Grove Road
Schaumburg, IL 60173-4758
Ph: 847-517-1200
Email: crsi@crsi.org
Fax: 847-517-1206
Internet: http://www.crsi.org/

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)
722 Jackson Place
Washington DC 20506
Internet: https://www.whitehouse.gov/administration/eop/ceq

ENERGY INSTITUTE (EI)
Publications Team
Energy Institute
61 New Cavendish Street
London
W1G 7AR, UK
Ph: +44 (0)20 7467 7100
Fax: +44 (0)20 7255 1472
E-mail: pubs@energyinst.org.uk
Internet: https://publishing.energyinst.org/

EUROPEAN UNION (EU)
European Commission
Rue de la Loi 200
1000 Bruxelle
Belgium
Ph: +32 2 299 96 96
Internet: https://commission.europa.eu/index_en

FM GLOBAL (FM)
270 Central Avenue
Johnston, RI 02919-4949
Ph: 401-275-3000
Fax: 401-275-3029
Internet: https://www.fmglobal.com/

FOREST STEWARDSHIP COUNCIL (FSC)
1441 Woodmont Ln NW #539
Atlanta, GA 30318
Ph: 612-353-4511
E-mail: info@us.fcs.org

Internet: https://us.fsc.org/

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)
USC Foundation Office
Universityh of Southern California
1150 South Olive Street, Suite 1700
Los Angeles, CA 90015
Ph: 866-545-6340
Fax: 213-740-8399
E-mail: fccchr@usc.edu
Internet: https://fccchr.usc.edu/

GREEN SEAL (GS)
601 13th St NW 12th Floor
Washington, DC 20005
Ph: 202-872-6400
Fax: 202-872-4324
E-mail: greenseal@greenseal.org
Internet: https://www.greenseal.org/

GUAM ADMINISTRATIVE RULES AND REGULATIONS (GAR)
Internet: https://epa.guam.gov/statutes/

GUAM CODE ANNOTATED (GCA)
Internet: https://guamcourts.gov/compileroflaws/gca.html

ILLUMINATING ENGINEERING SOCIETY (IES)
120 Wall Street, Floor 17
New York, NY 10005-4001
Ph: 212-248-5000
Fax: 212-248-5018
E-mail: membership@ies.org
Internet: https://www.ies.org/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 and 501 Hoes Lane
Piscataway, NJ 08854-4141
Ph: 732-981-0060 or 800-701-4333
Fax: 732-981-9667
E-mail: onlinesupport@ieee.org
Internet: https://www.ieee.org/

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 493
Miamitown, OH 45041-9998
E-mail: info@icea.net
Internet: https://www.icea.net/

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
800 Place Victoria
PO Box 113
Montréal, Quebec, H4Z 1M1
Ph: 514-390-6726 or 800-716-6326
Fax: 514-874-9659
E-mail: custserv@iata.org
Internet: https://www.iata.org/

INTERNATIONAL CODE COUNCIL (ICC)
200 Massachusetts Ave, NW Suite 250
Washington, DC 20001
Ph: 800-786-4452 or 888-422-7233
Fax: 202-783-2348
E-mail: order@iccsafe.org
Internet: https://www.iccsafe.org/

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Old Centre Ave. Suite 101
Portage, MI 49024
Ph: 269-488-6382 or 1-888-300-6382
Fax: 269-488-6383
Internet: https://www.netaworld.org/

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
3, rue de Varembe, 1st floor
P.O. Box 131
CH-1211 Geneva 20, Switzerland
Ph: 41-22-919-02-11
Fax: 41-22-919-03-00
E-mail: info@iec.ch
Internet: https://www.iec.ch/

INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Internet:
https://www.imo.org/en/ourwork/safety/pages/dangerousgoods-default.aspx

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
ISO Central Secretariat
BIBC II
Chemin de Blandonnet 8
CP 401 - 1214 Vernier, Geneva
Switzerland
Ph: 41-22-749-01-11
E-mail: central@iso.ch
Internet: https://www.iso.org

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)
1101 Wilson Blvd, Suite 1425
Arlington, VA 22209-1762
Ph: 703-525-1695
Fax: 703-528-2148
Internet: https://safetyequipment.org/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
127 Park Street, NE
Vienna, VA 22180-4602
Ph: 703-281-6613
E-mail: info@msshq.org
Internet: http://msshq.org

MASTER PAINTERS INSTITUTE (MPI)
2800 Ingleton Avenue
Burnaby, BC CANADA V5C 6G7
Ph: 1-888-674-8937
Fax: 1-888-211-8708
E-mail: info@paintinfo.com or techservices@mpi.net

Internet: http://www.mpi.net/

METAL FRAMING MANUFACTURERS ASSOCIATION (MFMA)
330 N. Wabash Avenue
Chicago, IL 60611
Ph: 312-644-6610
E-mail: MFMAstats@smithbucklin.com
Internet: http://www.metalframingmfg.org/

NACE INTERNATIONAL (NACE)
15835 Park Ten Place
Houston, TX 77084
Ph: 281-228-6200
Fax: 281-228-6300
E-mail: firstservice@nace.org
Internet: https://www.ampp.org/home

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
800 Roosevelt Road, Bldg C, Suite 312
Glen Ellyn, IL 60137
Ph: 630-942-6591
Fax: 630-790-3095
E-mail: info@naamm.org
Internet: http://www.naamm.org

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
1201 Pennsylvania Ave. NW, Suite 1200
Washington, DC 20004
Ph: 202-991-6300
Fax: 202-217-4171
Internet: https://www.necanet.org/

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1300 North 17th Street, Suite 900
Arlington, VA 22209
Ph: 703-841-3200
Email: communications@nema.org
Internet: https://www.nema.org

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 800-344-3555
Fax: 800-593-6372
Internet: https://www.nfpa.org

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
Patriots Plaza 1
395 E Street, SW, Suite 9200
Washington, DC 20201
Ph: 800-232-4636
Fax: 513-533-8347
Internet: https://www.cdc.gov/niosh/

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)
100 Bureau Drive
Gaithersburg, MD 20899
Ph: 301-975-2000
Internet: https://www.nist.gov/

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)
Manager, Customer Service
66 Canal Center Plaza, Suite 250
Alexandria, VA 22314
Ph: 703-706-4800
Fax: 703-706-4809
E-mail: jjenkins@nrmca.org (Jacques Jenkins)
Internet: https://www.nrmca.org/

NAVAL FACILITIES ENGINEERING COMMAND MARIANAS, JOINT REGION MARIANAS, GUAM
Internet:
https://pacific.navfac.navy.mil/Facilities-Engineering-Commands/NAVFAC-Mariana

NSF INTERNATIONAL (NSF)
789 North Dixboro Road
P.O. Box 130140
Ann Arbor, MI 48105
Ph: 734-769-8010 or 800-NSF-MARK
Fax: 734-769-0109
E-mail: info@nsf.org
Internet: http://www.nsf.org

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)
2, rue Andre Pascal
75775 Paris Cedex 16, France
Ph: + 33 1 45 24 82 00
Fax: 33 1 45 24 85 00
Internet: http://www.oecd.org
U.S. Contact Center
OECD Washington Center
1776 I Street, NW, Suite 450
Washington, DC 20006
Ph: 202-785-6323
E-mail: washington.contact@oecd.org

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
4201 Lafayette Center Drive
Chantilly, VA 20151-1219
Ph: 703-803-2980
Fax: 703-803-3732
Internet: https://www.smacna.org/

SOCIETY FOR PROTECTIVE COATINGS (SSPC)
800 Trumbull Drive
Pittsburgh, PA 15205
Ph: 877-281-7772 or 412-281-2331
Fax: 412-444-3591
E-mail: customerservice@sspc.org
Internet: http://www.sspc.org

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)
400 Commonwealth Drive
Warrendale, PA 15096
Ph: 877-606-7323 or 724-776-4841
Fax: 724-776-0790

E-mail: customerservice@sae.org
Internet: https://www.sae.org/

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)
140 Philips Road
Exton, PA 19341-1318
Ph: 800-542-5040 or 610-363-6888
Fax: 610-884-7237
E-Mail: info@scte.org
Internet: https://www.scte.org/

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
1320 North Courthouse Rosd, Suite 200
Arlington, VA 22201
Ph: 703-907-7700
Fax: 703-907-7727
E-mail: marketing@tiaonline.org
Internet: https://www.tiaonline.org/

THE MASONRY SOCIETY (TMS)
105 South Sunset Street, Suite Q
Longmont, CO 80501-6172
Ph: 303-939-9700
Fax: 303-541-9215
E-mail: info@masonrysociety.org
https://masonrysociety.org/

U.S. AIR FORCE (USAF)
E-mail: usaf.pentagon.saf-aa.mbx.AFDPO-PPL@mail.mil
Internet: https://www.e-publishing.af.mil/

U.S. ARMY CORPS OF ENGINEERS (USACE)
CRD-C DOCUMENTS available on Internet:
http://www.wbdg.org/ffc/army-coe/standards
Order Other Documents from:
Official Publications of the Headquarters, USACE
E-mail: hqpublications@usace.army.mil
Internet: http://www.publications.usace.army.mil/
or
https://www.hnc.usace.army.mil/Missions/Engineering-Directorate/TECHINFO/

U.S. DEFENSE LOGISTICS AGENCY (DLA)
Andrew T. McNamara Building
8725 John J. Kingman Road
Fort Belvoir, VA 22060-6221
Ph: 877-352-2255
E-mail: dlacontactcenter@dla.mil
Internet: http://www.dla.mil

U.S. DEPARTMENT OF AGRICULTURE (USDA)
Order AMS Publications from:
AGRICULTURAL MARKETING SERVICE (AMS)
Seed Regulatory and Testing Branch
801 Summit Crossing Place, Suite C
Gastonia, NC 28054-2193
Ph: 704-810-8884
E-mail: PA@usda.gov
Internet: https://www.ams.usda.gov/
Order Other Publications from:

USDA Rural Development
Rural Utilities Service
STOP 1510, Rm 5135
1400 Independence Avenue SW
Washington, DC 20250-1510
Phone: (202) 720-9540
Internet:
https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service

U.S. DEPARTMENT OF DEFENSE (DOD)
Order DOD Documents from:
Room 3A750-The Pentagon
1400 Defense Pentagon
Washington, DC 20301-1400
Ph: 703-571-3343
Fax: 215-697-1462
E-mail: customerservice@ntis.gov
Internet: https://www.ntis.gov/
Obtain Military Specifications, Standards and Related Publications from:
Acquisition Streamlining and Standardization Information System (ASSIST)
Department of Defense Single Stock Point (DODSSP)
Document Automation and Production Service (DAPS)
Building 4/D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: 215-697-6396 - for account/password issues
Internet: https://assist.dla.mil/online/start/; account registration required
Obtain Unified Facilities Criteria (UFC) from:
Whole Building Design Guide (WBDG)
National Institute of Building Sciences (NIBS)
1090 Vermont Avenue NW, Suite 700
Washington, DC 20005
Ph: 202-289-7800
Fax: 202-289-1092
Internet:
https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc

U.S. DEPARTMENT OF ENERGY (DOE)
1000 Independence Avenue Southwest
Washington, D.C. 20585
Ph: 202-586-5000
Fax: 202-586-4403
E-mail: The.Secretary@hq.doe.gov
Internet: https://www.energy.gov/

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)
HUD User
P.O. Box 23268
Washington, DC 20026-3268
Ph: 800-245-2691 or 202-708-3178
TDD: 800-927-7589
Fax: 202-708-9981
E-mail: helpdesk@huduser.gov
Internet: https://www.huduser.gov

U.S. DEPARTMENT OF TRANSPORTATION (DOT)
1200 New Jersey Ave., SE
Washington, DC 20590
Ph: 202-366-4000
Internet: https://www.transportation.gov/

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-564-4700
Internet: https://www.epa.gov
--- Some EPA documents are available only from:
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6060 or 1-800-363-2068
Fax: 703-605-6880
TDD: 703-487-4639
E-mail: info@ntis.gov
Internet: https://www.ntis.gov/

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)
Order for sale documents from:
Superintendent of Documents
U.S. Government Publishing Office (GPO)
732 N. Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/
Order free documents from:
U.S. Department of Transportation
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591
Ph: 866-835-5322
Internet: https://www.faa.gov/

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)
1200 New Jersey Ave., SE
Washington, DC 20590
Ph: 202-366-4000
E-mail: ExecSecretariat.FHWA@dot.gov
Internet: https://highways.dot.gov/
Order from:
Superintendent of Documents
U.S. Government Publishing Office (GPO)
732 N. Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/

U.S. GENERAL SERVICES ADMINISTRATION (GSA)
General Services Administration
1800 F Street, NW
Washington, DC 20405
Ph: 1-844-472-4111
Internet: https://www.gsaelibrary.gsa.gov/ElibMain/home.do

Obtain documents from:
Acquisition Streamlining and Standardization Information System (ASSIST)
Internet: https://assist.dla.mil/online/start/; account registration required

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
Internet: https://www.archives.gov/
Order documents from:
Superintendent of Documents
U.S. Government Publishing Office (GPO)
732 N. Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/

U.S. NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND (NAVFAC)
1322 Patterson Ave. SE, Suite 1000
Washington Navy Yard, DC 20374-5065
Ph: 202-685-9387
Internet: http://www.navfac.navy.mil

UL SOLUTIONS (UL)
333 Pfingsten Road
Northbrook, IL 60062
Ph: 877-854-3577 or 360-817-5500
E-mail: CustomerExperienceCenter@ul.com
Internet: https://www.ul.com/
UL Directories available through IHS at https://accuristech.com/

VIBRATION ISOLATION AND SEISMIC CONTROL MANUFACTURERS ASSOCIATION (VISCMA)
994 Old Eagle School Road
Suite 1019
Wayne, PA 19087-1866
Ph: 610-971-4850
E-mail: info@viscma.com
Internet: http://www.viscma.com

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00

QUALITY CONTROL
08/23, CHG 3: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1077	(2024) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D3740	(2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E329	(2023) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E543	(2021) Standard Specification for Agencies Performing Non-Destructive Testing

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2025) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include all associated costs in the applicable Bid Schedule item.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance

with Section 01 33 00 SUBMITTAL PROCEDURES.

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G

SD-06 Test Reports

Verification Statement

1.4 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system that complies with FAR 52.246-12 Inspection of Construction. QC is comprised of plans, procedures, and organization necessary to produce an end product that complies with the Contract requirements. The QC system covers all construction operations, both onsite and offsite, and must be keyed to the proposed construction sequence. The Quality Control Manager, Superintendent, Site Safety and Health Officer (SSHO), and all on-site supervisors are responsible for the quality of work and are subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. The Quality Control Manager must maintain a physical presence at the work site at all times and is the primary individual responsible for all quality control.

1.5 QUALITY CONTROL (QC) PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, completion inspections, QC certifications, independent Special Inspections in accordance with Section 01 45 35 SPECIAL INSPECTIONS, and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations that comply with the requirements of this Contract. The QC program must cover on-site and off-site work and be keyed to the work sequence. No construction work or testing may be performed unless the QC Manager is on the work site. The QC Manager must report to an officer of the firm and not be subordinate to the Project Superintendent or the Project Manager. The QC Manager, Project Superintendent and Project Manager must work together effectively. Although the QC Manager is the primary individual responsible for quality control, all individuals will be held responsible for the quality of work on the job.

1.5.1 Meetings

1.5.1.1 Quality Control Plan Meeting

Prior to submission of the QC Plan, the Contractor may request a meeting with the Contracting Officer to discuss the QC Plan requirements of this Contract.

The purpose of this meeting is to develop a mutual understanding of the QC Plan requirements prior to plan development and submission and to agree on the Contractor's list of Definable Feature of Work (DFOW).

1.5.1.2 Coordination and Mutual Understanding Meeting

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor and the Government. Provide a copy of the signed minutes to all attendees and incorporate into the relevant QC Plan. At a minimum the Coordination and Mutual Understanding Meeting must be repeated when a new QC Manager is appointed. There can be other occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

1.5.1.2.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, Special Inspections, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor must explain in detail how three phases of control will be implemented for each DFOW, as well as how each DFOW will be affected by each management plan or requirement as listed below:

a. Waste Management Plan.

b. Procedures for noise and acoustics management.

c. Environmental Protection Plan.

d. Environmental regulatory requirements.

e. Special Inspections.

f. Indoor Air Quality (IAQ) Management Plan.

1.5.1.2.2 Coordination of Activities

Coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation. Schedule construction operations with consideration for indoor air quality as specified in the IAQ Management Plan.Coordinate Special Inspections.

1.5.1.2.3 Attendees

As a minimum, the Contractor's personnel required to attend include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, Alternate QC Manager, Special Inspector, Environmental Manager, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities must have a principal of the firm at the

meeting.

1.5.1.3 Quality Control (QC) Meetings

After the start of construction, conduct weekly QC meetings led by the QC Manager at the work site with the Project Superintendent, the Special Inspector, and the other personnel as necessary. The QC Manager is to prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. As a minimum, accomplish the following at each meeting:

a. Review the minutes of the previous meeting.

b. Review the schedule and the status of work and deficiencies/rework. Review the most current approved schedule (in accordance with schedule specification) and the status of work and deficiencies/rework.

c. Review the status of submittals and Request For Information (RFIs).

d. Review the work to be accomplished in the next 3 weeks as defined by the schedule section paragraph WEEKLY LOOK AHEAD in Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS) and all quality control documentation required for that work.

e. Review Testing Plan and Log including status of tests performed since last QC Meeting.

f. Resolve QC and production problems. Discuss status of pending change orders.

g. Address items that may require revising the QC Plan.

h. Review Accident Prevention Plan (APP) and effectiveness of the safety program.

i. Review environmental requirements and procedures.

j. Review Environmental Management Plan.

k. Review Waste Management Plan.

l. Review the status of training completion.

m. Review IAQ Management Plan.

1.5.2 Contractor Quality Control (CQC) Plan

Submit no later than 30 days after Contract Award, the CQC Plan proposed to implement the requirements FAR 52.246-12 Inspection of Construction. Construction will be permitted to begin only after acceptance of the CQC Plan and other Contract requirements

1.5.2.1 Content of Contractor Quality Control (CQC) Plan

Provide a CQC Plan, prior to start of construction that includes a table of contents, with major sections identified, pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing quality control during the construction of the project. The

CQC Plan must at a minimum include the following sections:

a. A description of the quality control organization and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified.

b. An organizational chart showing the quality control organization with individual names and job titles and lines of authority up to an executive of the company at the home office.

c. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, (including position titles and durations for qualifying experiences) for each person in the QC organization. Include the Construction Quality Management (CQM) for Contractors course certifications for the QC personnel as required by the paragraph CONSTRUCTION QUALITY MANAGEMENT TRAINING.

d. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

e. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

f. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager, and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work that is not in compliance with the Contract. Letters of direction are to be issued by the QC Manager to the Assistant QC Manager and all other QC Specialists or quality control representatives outlining their duties, authorities, and responsibilities. Include copies of the letters in the QC Plan.

g. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving, scheduling, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval. Provide the initial submittal of the Submittal Register as specified in Section 01 33 00 SUBMITTAL PROCEDURES.

h. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraph ACCREDITATION REQUIREMENTS, as applicable.

i. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, associated feature of work required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

j. Procedures to complete construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected. This phase is performed prior to beginning work on each definable feature of work, after all required plans, documents, materials are approved,

and after copies are at the work site.

k. Reporting procedures, including proposed reporting formats.

l. Procedures for submitting and reviewing design changes/variations prior to submission to the Contracting Officer.

m. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task. A DFOW is identified by different trades or disciplines, or it is work by the same trade in a different environment. A DFOW is by definition any item or activity on the construction schedule, and the schedule specification provides direction regarding how the DFOWs are to be structured. Include in the list of DFOWs for all activities on the Construction Schedule. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. Identify the specification section number and schedule activity ID for each DFOW listed. The DFOW list will be reviewed in coordination with the construction schedule and agreed upon during the Coordination and Mutual Understanding Meeting.

n. PROCEDURES FOR PERFORMING AND TRACKING THE THREE PHASES OF CONTROL: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each Definable Feature of Work (DFOW), a Preparatory and Initial phase checklist will be filled out during the Preparatory and Initial phase meetings. Conduct the Preparatory and Initial Phases and meetings with a view towards obtaining quality construction by planning ahead and identifying potential problems for each DFOW.

o. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Special Inspections Project Manual. Where the applicable code issued by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the Quality Control Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspections Project Manual requirements in the QC Plan.

p. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.

q. TRAINING PROCEDURES AND TRAINING LOG: Procedures for coordinating and documenting the training of personnel required by the Contract.

r. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications required for entities such as subcontractors, testing laboratories, suppliers, and personnel. The QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the Contract that the work is being performed.

1.5.3 Acceptance of the Quality Control (QC) Plan

The Contracting Officer's acceptance of the Contractor QC Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal or addition of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time to verify the submitted qualifications. All QC organization personnel are subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

1.5.4 Preliminary Construction Work Authorized Prior to Acceptance

The only construction work that is authorized to proceed prior to the acceptance of the QC Plan is mobilization of storage and office trailers, temporary utilities, and surveying with specific prior approval of the Contracting Officer.

1.5.5 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel. Proposed changes are subject to acceptance by the Contracting Officer.

1.5.6 Special Inspections

Perform all required Special Inspections per Section 01 45 35 SPECIAL INSPECTIONS, the statement of Special Inspections and the Schedule of Special Inspections.

1.6 QUALITY CONTROL (QC) ORGANIZATION

1.6.1 Quality Control (QC) Manager

1.6.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. The only duties and responsibilities of the QC Manager are to manage and implement the QC program on this Contract. The QC Manager must attend the partnering meetings, QC Plan Meetings, Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control except for those phases of control designated to be performed by QC Specialists, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract this contract, including the Fire Protection and Life Safety Duties described in paragraph Fire Protection and Life Safety Duties. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC Specialists, testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities. The QC manager is responsible for notifying the Special Inspector of activities which require their review. The QC manager is responsible for coordinating the Special Inspection activities, see paragraph CONTRACTOR'S QUALITY CONTROL (QC) MANAGER, in Section 01 45 35 SPECIAL INSPECTIONS. The QC manager is responsible for the quality control for Controlled Area perimeter construction.

1.6.1.1.1 Fire Protection and Life Safety Duties

a. Hydrants

(1) Perform visual inspections to verify the proper installation of underground service mains/laterals, thrust blocks and connection to aboveground piping for fire hydrants.

(2) Verify proper orientation of fire hydrants.

(3) Observe hydrostatic/leak test and system flushing of the underground lines per NFPA 24.

(4) Verify proper operation of fire hydrant and all control/isolation valves.

(5) Document all inspections and observations in field report to be submitted to the Government.

(6) Completed NFPA 24 Contractor's Material and Test Certificate for Underground Piping to be submitted to the Government.

1.6.1.2 Qualifications

The QC Manager must possess at least a Bachelor's degree in engineering, architecture, or construction management, with a current professional engineer registration and a minimum of 10 years construction experience as a Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction Contracts which included the major trades that are part of this Contract. The individual must have at least 4 years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification, safety compliance, and sustainability.

The QC Manager and all members of the QC organization must be capable of reading, writing, and conversing fluently in the English language.

1.6.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager Alternate QC Manager, Superintendent, QC Specialist, and DQCM must have completed the CQM for Contractors course. If the QC Manager does not have a current certification, obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Systems Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

The Construction Quality Management Training certificate expires after 5 years. If the QC Manager's certificate has expired, retake the course to remain current.

1.6.2 Organizational Changes

Maintain the QC staff with personnel as required by the specification section at all times. When it is necessary to make changes to the QC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

1.6.3 Alternate Quality Control (QC) Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed 2 weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager must be the same as for the QC Manager.

1.6.4 Assistant Quality Control (QC) Manager Duties and Qualifications

Provide a full-time assistant to the QC Manager at the work site to perform the three phases of control, perform submittal review, ensure testing is performed, and prepare QC certifications and documentation required by this Contract. The Assistant QC Manager must be on the work site during supplemental work shifts beyond the regular shift and perform the duties of the QC Manager during such supplemental shift work. The qualification requirements for the Assistant QC Manager must be meet the requirements of the QC Manager but with 2 years of minimum experience. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance.

The Assistant QC Manager must be capable of reading, writing, and conversing fluently in the English language.

1.6.5 Quality Control (QC) Specialists

Provide a separate QC Specialist at the work site for each of the areas as listed in the Matrix listed below, who must assist and report to the QC Manager and who may perform production related duties but must be allowed sufficient time to perform their assigned quality control duties. These individuals or specialized technical companies are directly employed by the Prime Contractor and cannot be employed by a supplier or subcontractor on this project. QC Specialists must be physically present at the work site with frequency as indicated in the Experience Matrix below, to participate in the QC Meetings, perform the three phases of control, including participation in Preparatory and Initial Phase meetings, and to perform and document Follow-up inspections as an extension of the QC Manager for each definable feature of work in their area of responsibility. QC Specialist must assist and be present for training events, and Critical System Acceptance inspections by the Government. Qualification, experience, Area of Responsibility, and frequency of QC surveillance are provided in Matrix listed herein.

Experience Matrix		
1. Area	2-1. Qualification 2-2. Experience	3-1. Area of Responsibility 3-2. Frequency
QC Manager	See Section 01 45 00, Paragraph 1.6.1.	3-1. Entire site 3-2. Frequency of QC will be daily during installation and including final inspection.

Experience Matrix		
1. Area	2-1. Qualification 2-2. Experience	3-1. Area of Responsibility 3-2. Frequency
Alternate QC Manager	See Section 01 45 00, paragraph 1.6.3	3-1. Entire site 3-2. Frequency of QC will be daily during installation and including final inspection.
Assistant QC Manager	See Section 01 45 00, paragraph 1.6.4	3-1. Entire site 3-2. Frequency of QC will be daily during installation and including final inspection.
Electrical	2-1. Graduate Electrical Engineer with a professional engineer registration 2-2. Person 5 years of experience supervising electrical features of work in the field with a construction company	3-1. Inspection of items in Division 26 Electrical 3-2. As specified in technical sections of specifications Division 26 Electrical. Periodic inspections when specified equipment is being installed.
Environmental	2-1. Graduate Environmental Engineer with a professional engineer registration 2-2. 3 years experience	3-1. Entire site 3-2. Daily during site prep and clearing
Submittals	2-1. Submittal Clerk 2-2. 1 year experience	3-1. Entire site 3-2. Frequency of QC will be daily during installation and including final inspection.
Electrical Inspector, International Conference of Building Officials (ICBO)	2-1. Building electrical systems and all there electrical systems not listed above for Licensed Electrical Engineer (PE) 2-2. 5 years experience minimum	3-1. Entire Site 3-2. Minimum one time a week during installation and full time during testing.
Concrete Construction	2-1. Certified by ACI as Concrete Construction Special Inspector	3-1. Entire Site 3-2. Inspection of Cast-in-place concrete operations. See section 03 30 00. Continues frequency

Experience Matrix		
1. Area	2-1. Qualification 2-2. Experience	3-1. Area of Responsibility 3-2. Frequency
Geotechnical Engineer/CQC Geotechnical Specialist	2-1. Civil engineer practicing in geotechnical engineering or geotechnical engineer, registered in the United States, the U.S. District of Columbia, or Guam.	3-1. Specifications Section 31 00 00; Section 32 11 23; Section 32 12 15.13; Section 32 13 14.13 3-2. The on site frequency of QC Geotechnical Engineer/CQC Geotechnical Specialist must be at the start of each related earthwork activity and periodically (minimum once every two weeks. during both earthwork and probing/grouting operations. Either the QC Geotechnical Engineer or the Geotechnical Field Representative must be full-time on site during all Earthwork and Probing/Grouting Operations.
Geotechnical Engineer/CQC Geotechnical Specialist (cont.)	2-2. At least 10 years of registered experience, of which at least 8 years must be in responsible charge involving excavating, shoring, dewatering, foundation and pavement excavation and backfilling, flexible and concrete pavement curing and placement, proof rolling, tank water surcharge testing, and survey settlement monitoring in residual, volcanic, and alluvial deposits.	
Geotechnical Engineer/CQC Geotechnical Specialist (cont.)	Responsible charge is defined as being in direct control or personal supervision of geotechnical earthwork and placement of flexible and concrete pavements. See Section 01 45 00, paragraph 1.6.6.1	
Geotechnical Field Representative (GFR)	2-1 & 2.2. Must be certified by ACI per responsibilities defined in 03 30 00, paragraph 1.6.7 and a current NICET Level II Certification in Construction Materials Testing Soils, see Section 31 00 00, paragraph 1.6.2, with a minimum of five years experience in site development, mass grading and foundation construction with similar subsurface materials for this Contract.	3-1. Specifications Section 31 00 00; Section 32 11 23; Section 32 12 15.13; Section 32 13 14.13 3-2. The GFR is required to be full-time on site during all Earthwork and Probing/Grouting Operations when the GE is not present.

Experience Matrix		
1. Area	2-1. Qualification 2-2. Experience	3-1. Area of Responsibility 3-2. Frequency
Quality Control Hydrogeologist Specialist	QCHS must be present during all karst mitigation work. Quality Control Hydrogeologist Specialist must be a degreed geologist with 10 years experience working as a hydrogeologist with experience with groundwater aquifers and GEPA "Protection of Sinkholes" requirements.	3-1. Specification Section 31 00 00, CG133, CG132
Telecommunications	2-1. Certified Registered Communications Distribution Designer (RCDD), and 2-2. Person 5 years of experience supervising telecommunications features of work in the field with construction company	3-1. Inspection of items in Division 27 and 33 82 00 3-2. Frequency as specified in technical sections of specification Outside Plant (OSP). Periodic inspections when specified equipment and infrastructure is being installed.
Fuels System Specialist		See paragraph QUALITY CONTROL FUELS SYSTEMS ENGINEER (QCFSE)
Quality Control Fuels Systems Engineer (QCFSE)	See Section 01 45 00, paragraph 1.5.8.1 Qualifications	See paragraph ROLES AND RESPONSIBILITIES
Project Geophysicist	See Section 31 00 00	3-1. Specification Section 31 00 00 3-2. At beginning of ERT work and periodically as requested by CO. Daily remote review of work.
QC Geophysicist	See Section 31 00 00	3-1. 3-1. Specification Section 31 00 00 3-2. On site when ERT is performed
Geophysical Survey Team Leader	See Section 31 00 00	3-1. Specification Section 31 00 00 3-2. On site when ERT is performed

Experience Matrix		
1. Area	2-1. Qualification 2-2. Experience	3-1. Area of Responsibility 3-2. Frequency
Hydrogeologist	2-1. Guam EPA approved credentials 2-2. Minimum 5 years experience	3-1. Entire Site 3-2. Daily

1.6.6 Special Inspector and Special Inspector of Record

The Special Inspector (SI) and Special Inspector of Record (SIOR) must be an independent third party hired directly by the Prime Contractor. The SI and SIOR must not be a company employee of the Contractor or any subcontractor performing the work to be inspected. The qualifications of the SI and SIOR are defined in Section 01 45 35 SPECIAL INSPECTION.

1.6.7 Submittal Reviewers Duties and Qualifications

Provide Submittal Reviewers, other than the QC Manager, qualified in the disciplines being reviewed, to review and certify that the submittals meet the requirements of this Contract prior to certification or approval by the QC Manager.

1.7 SUBMITTAL AND DELIVERABLES REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES. Procedures must include field verification of relevant dimensions and component characteristics by the QC organization prior to submittal being sent to the Contracting Officer. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the Contract.

1.8 THREE PHASES OF CONTROL

CQC enables the Contractor to ensure that the construction, including that of subcontractors and suppliers, complies with the requirements of the Contract. At least three phases of control must be conducted by the QC Manager to adequately cover both on-site and off-site work for each definable feature of the construction work as follows:

1.8.1 Preparatory Phase

Document the results of the preparatory phase actions by separate minutes prepared by the QC Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required to meet Contract specifications.

Notify the Contracting Officer at least 2 business days in advance of each preparatory phase meeting. The meeting will be conducted by the QC

Manager and attended by the QC Specialists, the Project Superintendent, the Special Inspector, the Special Inspector of Record, and the foreman responsible for the DFOW. When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman must attend the preparatory phase meeting. This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. Perform the following prior to beginning work on each DFOW:

a. Review each paragraph of the applicable specification sections, reference codes, and standards. Make available during the prepatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.

b. Review the Contract drawings.

c. Verify that field measurements are as indicated on construction or shop drawings or both before confirming product orders, to minimize waste due to excessive materials.

d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.

e. Review the testing plan and ensure that provisions have been made to provide the required QC testing.

f. Examine the work area to ensure that the required preliminary work has been completed and complies with the Contract and ensure any deficiencies/rework items in the preliminary work have been corrected and confirmed by the Contracting Officer.

g. Review coordination of product/material delivery to designated prepared areas to execute the work.

h. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data and are properly stored.

i. Check to assure that all materials and equipment have been tested, submitted, and approved.

j. Discuss specific controls to be used, construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW. Ensure any portion of the plan requiring separate Contracting Officer acceptance has been approved.

k. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Safety Data Sheets (SDS) are submitted.

l. Review Special Inspections required by Section 01 45 35 SPECIAL INSPECTION, the Statement of Special Inspections and the Schedule of Special Inspections.

1.8.2 Initial Phase

Notify the Contracting Officer at least 2 business days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the QC Specialists, the Project Superintendent, the Special Inspector, the Special Inspector of Record, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site when acceptable levels of specified quality are not being met. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases. Perform the following for each DFOW:

a. Check work to ensure that it is in full compliance with Contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full Contract compliance. Verify required control inspection and testing comply with the Contract.

c. Establish level of workmanship and verify that it meets the minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve any workmanship issues.

e. Ensure that testing is performed by the approved laboratory.

f. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.

g. Review project specific work plans (i.e., HAZMAT Abatement, Stormwater Management) to ensure all preparatory work items have been completed and documented.

h. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

1.8.3 Follow-Up Phase

Perform the following for on-going DFOW daily, or more frequently as necessary, until the completion of each DFOW. The Final Follow-Up for any DFOW will clearly note in the daily report the DFOW is completed, and all deficiencies/rework items have been completed in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST. Each DFOW that has completed the Initial Phase and has not completed the Final Follow-up must be included on each daily report. If no work was performed on that DFOW for the period of that daily report, it must be so noted. Document all Follow-Up activities for DFOWs in the daily CQC Report:

a. Ensure the work including control testing complies with Contract requirements until completion of that particular work feature. Record checks in the CQC documentation.

b. Maintain the quality of workmanship required.

c. Ensure that testing is performed by the approved laboratory.

d. Ensure that deficiencies/rework items are being corrected. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work.

e. Do not build upon nor conceal non-conforming work.

f. Assure manufacturers' representatives have performed necessary inspections if required and perform safety inspections.

g. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

1.8.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW has not started within 45 days of the initial preparatory meeting or has resumed after 45 days of inactivity, or if other problems develop.

1.8.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least 2 weeks prior to the start of the preparatory and initial phases.

1.8.6 Deficiency/Rework Items List

The QC Manager must maintain a list of work that does not comply with the Contract, identifying what items need to be corrected, the activity ID number associated with the item, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected.

The QC Manager reviews the list at each weekly QC Meeting:

a. There is no requirement to report a deficiency/rework item that is corrected the same day it is discovered.

b. No successor task may be advanced beyond the preparatory phase meeting until all deficiencies/rework items have been cleared by the QC Manager and concurred with by the Contracting Officer. This must be confirmed as part of the Preparatory Phase activities.

c. Attach a copy of the "Deficiency/Rework Items List" to the last daily CQC Report of each month.

d. The Contractor is responsible for including those items identified by the Contracting Officer.

e. All deficiencies/rework items must be confirmed as corrected by the QC Manager, and concurred by the Contracting Officer, prior to commencement of any completion inspections per paragraph COMPLETION INSPECTIONS unless specifically exempted by the Contracting Officer.

f. Non-Compliance with these requirements is grounds for removal in accordance with paragraph ACCEPTANCE OF THE QUALITY CONTROL (QC) PLAN.

g. All delays, concurrent or related to failure to manage, monitor, control, and correct deficiencies/rework items are entirely the responsibility of the Contractor and can not be made the subject, or any component of any request for additional time or compensation.

1.9 TESTING

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to Contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance tests when specified. Procure the services of an U.S. Army Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site or on Guam. Perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with Contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all test documentation requirements, have been prepared.

e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

1.9.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and must submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (ASTM E329, ASTM C1077, ASTM D3666, ASTM D3740, ASTM E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing must meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.9.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at https://www.nist.gov/nvlap, the American Association of State Highway and Transportation Officials

(AASHTO) Accreditation Program at http://www.aashtoresource.org/aap/overview, International Accreditation Services, Inc. (IAS) at https://www.iasonline.org/, U.S. Army Corps of Engineers Materials Testing Center (MTC) at https://www.erdc.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/476661/materials-testing-center/, the American Association for Laboratory Accreditation (A2LA) program at https://a2la.org/, the Washington Association of Building Officials (WABO) at https://www.wabo.org/ (Approval authority for WABO is limited to projects within Washington State), and the Washington Area Council of Engineering Laboratories (WACEL) at https://www.wacel.org/lab-accreditation-and-inspection-agency-audit-programs/laboratory-accreditation-program/(Approval authority by WACEL is limited to projects within Facilities Engineering Command (FEC) Washington geographical area).

1.9.3 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract. Laboratories utilized for testing soils, concrete, asphalt, and steel must meet criteria detailed in ASTM D3740 and ASTM E329.

1.9.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results must be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month, in accordance with paragraph DOCUMENTATION AND INFORMATION FOR THE CONTRACTING OFFICER.

1.9.5 Test Reports and Monthly Summary Report of Tests

Furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily CQC Report of each month.

1.10 COMPLETION INSPECTIONS

1.10.1 Punch-Out Inspection

Near the completion of all work or any increment thereof, established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager must conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications, and Contract. Include in the punch list any remaining items on the "Deficiency/Rework Items List", that were not corrected prior to the Punch-Out Inspection as approved by the Contracting Officer in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST.

Include within the punch list the estimated date by which the deficiencies will be corrected. Provide a copy of the punch list to the Contracting Officer.

The QC Manager, or staff, must make follow-on inspections to ascertain that all deficiencies have been corrected. All punch list items must be confirmed as corrected by the QC Manager and concurred by the Contracting Officer. Once this is accomplished, notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.10.2 Pre-Final Inspection

The Government and QC Manager will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Pre-Final Punch List" will be documented by the QC Manager as a result of this inspection. The QC Manager will ensure that all items on this list are corrected and concurred by the Contracting Officer prior to notifying the Government that a "Final" inspection with the Client can be scheduled. All items noted on the "Pre-Final" inspection must be corrected and concurred by the Contracting Officer in a timely manner and be accomplished before the Contract completion date for the work, or any increment thereof, if the project is divided into increments by separate completion dates unless exceptions are directed by the Contracting Officer.

1.10.3 Final Acceptance Inspection

Notify the Contracting Officer at least 14 calendar days prior to the date a final acceptance inspection can be held. State within the notice that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the date of the final acceptance inspection. The Contractor must be represented by the QC Manager, the Project Superintendent, and others deemed necessary. Attendees for the Government will include the Contracting Officer, other Government QA personnel, and personnel representing the Client. Failure of the Contractor to have all Contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the Contract Clause entitled "Inspection of Construction."

1.11 QUALITY CONTROL (QC) CERTIFICATIONS

1.11.1 Contractor Quality Control (CQC) Report Certification

Contain the following statement within the CQC Report: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used, and work performed during this reporting period is in compliance with the Contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.11.2 Completion Certification

Upon completion of work under this Contract, the QC Manager must furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract." Provide a copy of this final QC Certification for completion to the preparer of the Operation & Maintenance (O&M) documentation.

1.11.3 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current, coordinated and attesting that the work for which payment is requested, including stored material, complies with Contract requirements.

1.12 DOCUMENTATION AND INFORMATION FOR THE CONTRACTING OFFICER

1.12.1 Construction Documentation

Prepare a Construction Production Report and a Contractor Quality Control Report for each day that work is performed. Attach the Construction Production Report to the Contractor Quality Control Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities.

Account for each calendar day throughout the life of the Contract.

The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The reporting of work must be identified by terminology consistent with the construction schedule. In the "Remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, and meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.12.2 Quality Control Activities

CQC and Contractor Production reports will be prepared daily to maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

a. The name and area of responsibility of the Contractors and any subcontractors.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When a Network Analysis Schedule (NAS) is used, identify each item of work performed each day by NAS activity number.

d. Control phase activities performed. Preparatory, and Initial phase Checklists associated with the DFOW referenced to the construction schedule. Follow-up phase activities identified to the DFOW. If testing or specific QC Specialist activities are associated with the Follow-up phase activities for a specific DFOW note this and include those reports.

e. Test and control activities performed with results and references to

specifications and drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST.

f. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications and drawings requirements.

g. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.

h. Offsite surveillance activities, including actions taken.

i. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

j. Instructions given/received and conflicts in plans and specifications.

1.12.3 Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract.

Furnish the original and one copy of these records in report form to the Government by 10:00 AM the next working day after the date covered by the report. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the Contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the QC Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the QC Manager Report.

1.12.4 Reports from the Quality Control (QC) Specialist(s)

Document inspection results on a QC specialist report prepared each day work is performed in their area of responsibility. The report must include a description of the visual inspection or observation performed, a written summary of findings, a conclusion on compliance with the Contract documents, and signature of the QC Specialist. In person inspections must be documented with Video/photographs. Video/photographic documentation of deficiencies must include before and after conditions and physical measurements, as necessary. Forward the QC daily report to the QC Manager who must include the report with the submission of their daily QC Report to the Government each day. Every site visit by the QC Specialist must be documented on a QC Specialist daily report.

1.12.5 Quality Control Validation

Establish and maintain the following in an electronic folder. Divide folder into a series of tabbed sections as shown below. Ensure folder is updated at each required progress meeting.

a. CQC Meeting minutes in accordance with paragraph QUALITY CONTROL (QC) MEETINGS.

b. All completed Preparatory and Initial Phase Checklists, arranged by specification section, further sorted by DFOW referenced to the construction schedule. Submit each individual Phase Checklist the day the phase event occurs as part of the CQC daily report.

c. All milestone inspections, arranged by Activity Number referenced to the construction schedule.

d. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section referenced to the DFOW to which individual reports results are associated. Individual field test reports will be submitted within 2 working days after the test is performed in accordance with the paragraph QUALITY CONTROL ACTIVITIES.
Monthly Summary Report of Tests: Submit the report as an electronic attachment to the CQC Report at the end of each month.

e. Copies of all Contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

f. An up-to-date copy of the paragraph DEFICIENCY/REWORK ITEMS LIST.

g. Special Inspection reports.

h. Upon commencement of Completion Inspections of the entire project or any defined portion, maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and subcontractors and all punch lists issued by the Government in accordance with the paragraph COMPLETION INSPECTIONS.

1.12.6 Testing Plan and Log

As tests are performed, the QC Manager will record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Contracting Officer. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month. Provide a copy of the final "Testing Plan and Log" to the preparer of the Operation & Maintenance (O&M) documentation.

1.12.7 As-Built Drawings

The QC Manager must ensure the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. The as-built drawings document commences with the QC Manager ensuring all amendments, or changes to the Contract prior to Contract award are accurately noted in the initial document set creating the accurate baseline of the Contract prior to any work starting. Ensure each deviation has been identified with the appropriate modifying documentation (e.g., PC No., Modification No., Request for Information No.). The QC Manager must initial each revision. Upon completion of work, the QC Manager will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.13 NOTIFICATION ON NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected non-compliance with the Contract. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at

the work site, is deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of a claim for extension of time for excess costs or damages by the Contractor.

1.14 DELIVERY, STORAGE, AND HANDLING

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

P-012 SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

1. INSTRUCTIONS for FPQC Specialist:

Perform surveillance of fire protection system installation during construction and during pre-final and final acceptance inspections. Surveillance includes either visual inspections or observations performed by the FPQC as indicated in the following Schedule of Fire Protection System Inspections. Check boxes in the schedule indicate the inspections or observations that are applicable to this project, which must be performed and documented by the FPQC.

Surveillance of fire protection system inspections is divided into three phases:

Surveillance During Construction – Includes periodic on-site visits by the FPQC during construction

Pre-Final Acceptance Inspection – FPQC must be onsite during pre-final acceptance inspection

Final Acceptance inspection – FPQC must be onsite during final acceptance inspection

2. INSPECTION TYPE

VISUAL INSPECTION:

Perform on-site visual inspections as indicated in the Schedule of Fire Protection System Inspections as construction progresses to confirm work conforms with the contract requirements including but not limited to verifying proper installation of equipment and materials in accordance with applicable codes. Where work will be covered up by finished walls and ceilings, inspections must be scheduled and performed when work is still visible.

OBSERVATION:

Observe component and system testing in person on-site as indicated in the Schedule of Fire Protection System Inspections. Confirm testing is completed in accordance with applicable codes and that testing was successful.

DOCUMENTATION:

Document all inspections and observations in the FPQC Report in accordance with UFGS 01 45 00. Document any deficiencies and all work observed that has been successfully performed in accordance with the contract documents. Record deficiencies in the rework list.

P-012 SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

PERFORM SURVEILLANCE DURING CONSTRUCTION

~ FIRE SUPPRESSION SYSTEM ~

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☒	1. Verify proper installation of underground service main and service; laterals, thrust blocks, tie-rods and connection to above ground piping.	**VISUAL INSPECTION**	✓ Visually inspect materials ✓ Visually inspect installation
☒	2. Verify proper orientation of fire hydrants and fire department access	**VISUAL INSPECTION**	✓ Visually inspect installation and orientation
☐	3. Verify proper installation of interior and exterior attachments, coatings, and vortex plate prior to filling fire protection water tank	**VISUAL INSPECTION**	✓ Visually inspect fire protection water tank installation
☒	4. Hydrostatic/leak test for underground piping	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☐	5. Hydrostatic/leak test for above ground piping prior to ceiling installation	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☐	6. Underground system flush prior to connection to the riser	**OBSERVE**	✓ Verify system was properly flushed
☐	7. Forward flow test for Backflow preventer	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☐	8. Suction pipe flush prior to fire pump startup	**OBSERVE**	✓ Verify system was properly flushed
☐	9. Hydrostatic test fire pump suction and discharge piping	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☐	10. Fire pump startup	**OBSERVE**	✓ Confirm successful startup
☐	11. Verify proper installation of sprinkler piping prior to wall or ceiling installation	**VISUAL INSPECTION**	✓ Inspect pipe hangars, bracing, sprinkler heads ✓ Inspect for sprinkler obstructions; damaged, painted or covered heads ✓ Verify proper location of control valves, drains, vents, backflow, test header ✓ Verify proper component mounting heights
☒	12. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur ✓ Annotate deficiencies and satisfactory work observed ✓ Record rework items in FPQC report

P-012 SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

~ SPECIAL FIRE SUPPRESSION SYSTEM ~			
PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☐	1. Verify proper installation of gaseous fire suppression system	**VISUAL INSPECTION**	✓ Inspect gas cylinders, initiating controls, shutdowns, aborts, and visual warning
☐	2. Verify proper installation of IR hangar detector	**VISUAL INSPECTION**	✓ Inspect detector and nozzle layout ✓ Inspect for obstructions, abort stations ✓ Inspect riser piping
☐	3. Verify proper installation of elevator fire protection	**VISUAL INSPECTION**	✓ Inspect elevator recall functions ✓ Inspect two-way communication
☐	4. Verify proper installation of fire suppression in secure spaces	**VISUAL INSPECTION**	✓ Inspect location of sprinkler piping and sprinklers
☐	5. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur ✓ Document deficiencies and satisfactory work observed in FPQC Report ✓ Record deficiencies in rework list

~ PASSIVE FIRE PROTECTION SYSTEMS ~			
PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☐	1. Verify proper construction of fire rated assemblies	**VISUAL INSPECTION**	✓ Inspect partitions for proper fire rated construction per design ✓ Inspect doors and door hardware for proper fire rating ✓ Inspect glass for proper fire rating
☐	2. Verify proper installation of fireproofing	**VISUAL INSPECTION**	✓ Inspect for use of proper fireproofing materials ✓ Inspect for cracking, spalling or delaminating ✓ Inspect for proper application thickness
☐	3. Verify proper installation of firestopping	**VISUAL INSPECTION**	✓ Inspect to confirm firestopping system is UL tested or an engineering judgement has been obtained and submitted ✓ Inspect for use of proper firestopping materials ✓ Inspect penetrations through fire rated walls, partitions and ceilings ✓ Inspect construction joints and gaps

P-012 SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

☐	4. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur ✓ Document deficiencies and satisfactory work observed in FPQC Report ✓ Record deficiencies in rework list

~ FIRE ALARM SYSTEMS ~

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☐	1. Verify proper installation of fire alarm system after conduit is installed and wiring pulled, but before devices are installed	**VISUAL INSPECTION**	✓ Inspect conduit, wiring, conduit fill, wire type ✓ Inspect installation heights of back boxes
☐	2. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur ✓ Document deficiencies and satisfactory work observed in FPQC Report ✓ Record deficiencies in rework list

~ END OF SURVEILLANCE DURING CONSTRUCTION SECTION

PERFORM DURING PRE-FINAL ACCEPTANCE INSPECTION

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☐	1. Inspect all fire protection systems and all life safety features	**VISUAL INSPECTION**	✓ Verify proper installation of fire protection and life safety systems
☐	2. Witness functional testing of all fire protection and life safety systems	**OBSERVE**	✓ Verify proper testing is performed on fire protection and life safety systems
☐	3. Identify deficiencies that require correction	**VISUAL INSPECTION**	✓ Document deficiencies in FPQC Report and record in rework list
☐	4. Verify rework items have been corrected	**VISUAL INSPECTION**	✓ Record re-inspection results on FPQC Report
☐	5. Document results of pre-final inspection and photograph unsatisfactory conditions	**DOCUMENT**	✓ Document results of pre-final inspection in FPQC Report
☐	6. Certify installation and operation of all fire protection and life safety systems conform to the contract documents	**DOCUMENT**	✓ Provide separate letter certifying conformance with contract requirements

~ END OF PRE-FINAL INSPECTION SECTION

P-012 SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

PERFORM DURING FINAL ACCEPTANCE INSPECTION

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☐	1. Verify proper installation and operation of all fire protection systems and all life safety features	**VISUAL INSPECTION**	✓
☐	2. Note any deficiencies identified by Government FPE on deficiency list	**DOCUMENT**	✓ Document deficiencies identified by Government FPE on deficiency list
☐	3. Verify all deficiencies have been corrected	**VISUAL INSPECTION**	✓ Inspect rework to confirm all deficiencies have been corrected
☐	4. Certify that all deficiencies have been corrected	**DOCUMENT**	✓ Document inspection results on FPQC Report

~ END OF FINAL ACCEPTANCE INSPECTION SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 45 35

SPECIAL INSPECTIONS
05/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-22	(2022; Supp 1 2023; Supp 2 2023) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2024) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2023; with Change 4, 2025) Structural Engineering

1.2 GENERAL REQUIREMENTS

Perform Special Inspections in accordance with the Statement of Special Inspections, Schedule of Special Inspections, Chapter 17 of ICC IBC, and UFC 3-301-01. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the Prime Contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.

1.3 DEFINITIONS

1.3.1 Continuous Special Inspections

Continuous Special Inspections is the constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

1.3.2 Perform

Perform these tasks for each weld, fastener or bolted connection, and noted required verification.

1.3.3 Observe

Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Observe these Special

Inspections items on a periodic daily basis. Operations need not be delayed pending these inspections.

1.3.4 Special Inspector (SI)

A qualified person retained by the Contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

1.3.5 Associate Special Inspector (ASI)

A qualified person who assists the SI in performing Special Inspections but who must perform inspection under the direct supervision of the SI and who cannot perform inspections without the SI on site.

1.3.6 Third Party

A Special inspector must not be an employee of the Contractor or of any Sub-Contractor performing the work to be inspected.

1.3.7 Contracting Officer

The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).

1.3.8 Quality Control (QC) Manager

An individual retained by the Prime Contractor and qualified in accordance with the Section 01 45 00 QUALITY CONTROL having the overall responsibility for the Contractor's QC organization.

1.3.9 Structural Engineer of Record (SER)

A registered design professional contracted by the Government as an A/E responsible for the overall design and review of submittal documents prepared by others. The SER is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in the state in which the design professional works. The SER is also referred to as the Engineer of Record (EOR) in design documents.

1.3.10 Statement of Special Inspections (SSI)

A document developed by the SER identifying the materials, systems, components and work required to have Special Inspections. This statement is included at the end of this specification.

1.3.11 Schedule of Special Inspections (SSI)

A schedule which lists each of the required Special Inspections, the extent to which each Special Inspection is to be performed, and the required frequency for each in accordance with ICC IBC Chapter 17. This schedule is included at the end of this specification.

1.3.12 Designated Seismic Systems (DSS)

Those nonstructural components that require design in accordance with

ASCE 7-22 Chapter 13 and for which the component importance factor, Ip, is greater than 1.0. This designation applies to systems that are required to be operational following the Design Earthquake for RC I - IV structures. Designated Seismic Systems will be identified by Owner and will have an Importance Factor Ip = 1.5.

1.3.13 Definable Feature of Work (DFOW)

An inspection group that is separate and distinct from other inspection groups, having inspection requirements or inspectors that are unique.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Special Inspection Daily Reports

Special Inspection Biweekly Reports

SD-07 Certificates

AISC Certified Steel Fabricator

Certificate of Compliance

Special Inspector Qualifications; G

SD-11 Closeout Submittals

Comprehensive Final Report of Special Inspections; G

1.5 SPECIAL INSPECTOR QUALIFICATIONS

Submit qualifications for each special inspector according to the following certification requirements. The Government will consider alternate equivalent certification upon request. Without written acceptance deviations to the following qualifications are not approved.

1.5.1 Steel Construction and High Strength Bolting

1.5.1.1 Special Inspector

a. ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience.

b. Registered Professional Engineer with 3 years of related experience

1.5.1.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.2 Welding Structural Steel

1.5.2.1 Special Inspector

a. ICC Structural Welding Special Inspector certificate with one year of related experience.

b. AWS Certified Welding Inspector

1.5.2.2 Associate Special Inspector

AWS Certified Associate Welding Inspector

1.5.3 Nondestructive Testing of Welds

1.5.3.1 Special Inspector

NDT Level III Certificate

1.5.3.2 Associate Special Inspector

NDT Level II Certificate plus one year of related experience

1.5.4 Concrete Construction

1.5.4.1 Special Inspector

a. ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or

b. ACI Concrete Construction Special Inspector, or

c. Registered Professional Engineer with 3 years of related experience

1.5.4.2 Associate Special Inspector

a. ACI Concrete Construction Special Inspector-in-Training, or

b. Engineer-In-Training with one year of related experience

1.5.5 Verification of Site Soil Condition, Fill Placement and Load-Bearing Requirements

1.5.5.1 Special Inspector

a. ICC Soils Special Inspector Certificate with one year of related experience, or

b. National Institute for Certification in Engineering Technologies (NICET) Soils Technician Level II Certificate in Construction Material Testing, or

c. Geologist-In-Training with 3 years of related experience, or

d. Registered Professional Engineer with 3 years of related experience

1.5.5.2 Associate Special Inspector

a. NICET Soils Technician Level I Certificate in Construction Material

Testing with one year of related experience, or

b. Engineer-In-Training with one year of related experience

PART 2 PRODUCTS

2.1 SPECIAL INSPECTION OF FABRICATED ITEMS

Special Inspection of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the following certification to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

AISC Certified Steel Fabricator.

At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special Inspections, stating that the materials supplied and work performed by the fabricator are in accordance with the construction documents.

PART 3 EXECUTION

3.1 RESPONSIBILITIES

3.1.1 Quality Control Manager

a. Supervise all Special Inspectors required by the Contract Documents and the IBC.

b. Verify the qualifications of all the Special Inspectors.

c. Verify the qualifications of all fabricators.

d. Maintain a 3-ring binder for the Special Inspector's special inspection daily reports and special inspection biweekly reports. This binder must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the SER.

e. Maintain a rework items list that includes discrepancies noted on the Special Inspector's daily report.

3.1.2 Special Inspectors

a. Inspect all elements of the project which the special inspector is qualified to inspect and which are identified in the Schedule of Special Inspections.

b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) which the Special Inspector is qualified to inspect.

c. Submit a copy of the special inspection daily reports to the QC Manager.

d. Report discrepancies that are observed during Special Inspections to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed

discrepancies must be documented in the daily report.

e. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following:

(1) A brief summary of the work performed during the reporting time frame.

(2) Changes from and discrepancies with the drawings, specifications and mechanical or electrical component certification that were observed during the reporting period.

(3) Discrepancies which were resolved or corrected.

(4) A list of nonconforming items requiring resolution.

(5) All applicable test result, including nondestructive testing reports.

f. At the completion of the project, submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed and dated and it must indicate the certification of the Special Inspector qualifying them to conduct the inspection.

3.2 DEFECTIVE WORK

Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Contracting Officer to accept the defective work or materials.

-- End of Section --

SCHEDULE OF SPECIAL INSPECTIONS – Equipment Yard Screenwall

Reference UFGS 01 45 35 for all requirements not noted as part of this schedule.

INSPECTION DEFINITIONS:

PERFORM: Perform these tasks for each weld, fastener or bolted connection, and required verification.

OBSERVE: Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.

DOCUMENT: Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

PERIODIC: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

The Seismic Design Category for this project is: ☐ A, ☐ B, ☐ C, ☒ D, ☐ E, ☐ F (check appropriate box)

A. STRUCTURAL STEEL – WELDING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

STEEL INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-1 and Table C-N5.4-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	**PERFORM**	
2. Verify manufacturer certifications for welding consumables are available	**PERFORM**	
3. Verify material identification	**PERFORM**	Type and grade.
4. Verify use of qualified welders	**PERFORM**	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

5. Welder Identification System	OBSERVE	✓ Fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. ✓ Die stamping of members subjected to fatigue shall be prohibited unless approved by the engineer of record.
6. Fit-up of groove welds (including joint geometry)	OBSERVE	✓ Joint preparation ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location) ✓ Backing type and fit (if applicable)
7. Fit-up of CJP groove welds of HSS T-, Y-, and K-connections without backing (including joint geometry	**PERFORM**	✓ Joint preparations ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
8. Configuration and finish of access holes	OBSERVE	
9. Fit-up of fillet welds	OBSERVE	✓ Dimensions (alignment, gaps at root) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
STEEL INSPECTION <u>DURING</u> WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-2 and Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
10. Control and handling of welding consumables	OBSERVE	✓ Packaging ✓ Electrode atmospheric exposure control
11. No welding over cracked tack welds	OBSERVE	
12. Environmental conditions	OBSERVE	✓ Wind speed within limits ✓ Precipitation and temperature
STEEL INSPECTION <u>DURING</u> WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-2 and Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
13. Welding Procedures Specification followed	OBSERVE	✓ Settings on welding equipment ✓ Travel speed ✓ Selected welding materials ✓ Shielding gas type/flow rate ✓ Preheat applied ✓ Interpass temperature maintained (min./max.) ✓ Proper position (F, V, H, OH) ✓ Intermix of filler metals avoided
14. Welding techniques	OBSERVE	✓ Interpass and final cleaning ✓ Each pass within profile limitations ✓ Each pass meets quality requirements
STEEL INSPECTION <u>AFTER</u> WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-3 and Table C-N5.4-3		
TASK	INSPECTION TYPE[1]	DESCRIPTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

15. Welds cleaned	OBSERVE	✓
16. Verify size, length, and location of all welds	**PERFORM**	✓ Size, length, and location of all welds conform to the requirements of the construction drawings.
17. Verify welds meet visual acceptance criteria	**PERFORM AND DOCUMENT**	✓ Crack prohibition ✓ Weld/base-metal fusion ✓ Crater cross section ✓ Weld profiles ✓ Weld size ✓ Undercut ✓ Porosity
18. Check for arc strikes	**PERFORM**	
19. Visually inspect *k*-area	**PERFORM**	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 in. (75 mm) of the weld
20. Verify backing removed, weld tabs removed and finished, and fillet welds added where required	**PERFORM**	
21. Repair activities	**PERFORM AND DOCUMENT**	
22. Acceptance or rejection of welded joint or member	**PERFORM AND DOCUMENT**	
23. No prohibited welds have been added without the approval of the engineer of record	OBSERVE	

END SECTION

DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

B. STRUCTURAL STEEL – BOLTING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.6-1 and Table C-N5.6-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify manufacture's certifications available for fastener materials	**PERFORM**	
2. Fasteners marked in accordance with ASTM requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Pre-installation verification testing for each fastener assembly performed by installation personnel, carefully observing and documenting the installation methods.	OBSERVE	Check if the fastener assemblies and the installation methods are capable of achieving 105%, or more, of the minimum required bolt pretension.
7. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.6-2 and Table C-N5.6-2		
TASK	INSPECTION TYPE	DESCRIPTION
8. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
9. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
10. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
11. Bolts are pretensioned in accordance with RCSC *Specification*, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.6.3 and Table C-N5.6-3		
TASK	INSPECTION TYPE	DESCRIPTION
12. Acceptance or rejection of all bolted connections	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

C. STRUCTURAL STEEL - NONDESTRUCTIVE TESTING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Section N5.5		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify use of qualified nondestructive testing personnel	**PERFORM**	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 Clause 7.2
2. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue. Table A-3.1 in AISC 360-22 provides Fatigue Design Parameters for welded joints that must be checked.

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

D. STRUCTURAL STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS)

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 341-22: Section J7.2		
TASK	INSPECTION TYPE[1]	DESCRIPTION
3. CJP groove welds	OBSERVE	Ultrasonic testing (UT) shall be performed on 100% of complete-joint-penetration (CJP) groove welds in materials 5/16 in. (8 mm) thick or greater. UT in materials less than 5/16 in. (8 mm) thick is not required. Welds shall be inspected by UT in compliance with AWS D1.8/D1.8M. Magnetic particle testing (MT) shall be performed on 25% of all beam-to-column CJP groove welds. Welds shall be inspected by MT in compliance with AWS D1.8/ D1.8M. For ordinary moment frames in structures in risk categories I or II, UT and MT of CJP groove welds shall be required only for demand critical welds.
4. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.
5. *k*-area NDT (AISC 341 Table J7.1 and AWS D1.8 Clause 7.4)	**PERFORM AND DOCUMENT**	Where welding of doubler plates, continuity plates or stiffeners has been performed in the *k*-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the *k*-area base metal within 3 in. of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
6. Placement of reinforcing or contouring fillet welds (Table J7.1)	**PERFORM AND DOCUMENT**	
7. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT.

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports

E. STRUCTURAL STEEL - COMPOSITE CONSTRUCTION[1]

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

COMPOSITE CONSTRUCTION PRIOR TO PLACING CONCRETE – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-2, AISC 341-22: Table J10.1		
TASK	INSPECTION TYPE	DESCRIPTION
1. Placement and installation of steel headed stud anchors	**PERFORM**	
2. Material identification of reinforcing steel (Type/Grade)	OBSERVE	
3. Determination of carbon equivalent for reinforcing steel other than ASTM A706	OBSERVE	
4. Proper reinforcing steel size, spacing, clearances, support, and orientation	OBSERVE	
5. Reinforcing steel has not been rebent in the field	OBSERVE	
6. Required reinforcing steel clearances have been provided	OBSERVE	
7. Reinforcing steel has been tied and supported as required	OBSERVE	
8. Composite member has required size	OBSERVE	

END SECTION

F. STRUCTURAL STEEL - OTHER INSPECTIONS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22 Section N5.8, AISC 341-22: Tables J9.1 & J11.1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Verify anchor rods and other embedments supporting structural steel	**PERFORM**	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Check reduced beam sections (RBS) where/if they occur	**PERFORM AND DOCUMENT**	✓ Contour and finish ✓ Dimensional tolerances
4. Check protected zones	**PERFORM AND DOCUMENT**	No holes or unapproved attachments made by fabricator or erector
5. Check H-piles where/if they occur	**PERFORM AND DOCUMENT**	No holes or unapproved attachments made by the responsible contractor

END SECTION

G. STRUCTURAL COLD-FORMED METAL DECK PLACEMENT

---

[1] See Concrete Construction Section for all concrete related inspection of composite steel construction.

[2] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION PRIOR TO DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	**PERFORM**	
2. Acceptance or rejection of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION AFTER DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.2		
TASK	INSPECTION TYPE	DESCRIPTION
3. Verify compliance of deck and all deck accessory installation with construction documents	**PERFORM**	
4. Verify deck materials are represented by the mill certifications that comply with the construction documents	**PERFORM**	
5. Acceptance or rejection of installation of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.3		
TASK	INSPECTION TYPE	DESCRIPTION
6. Verify welding procedure specification (WPS) is available	**PERFORM**	
7. Verify manufacturer's certifications for welding consumables are available	**PERFORM**	
8. Material identification (type/grade)	OBSERVE	
9. Check welding equipment	**PERFORM**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

H. STRUCTURAL COLD-FORMED METAL DECK – WELDING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.4		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified welders	OBSERVE	
2. Control and handling of welding consumables	OBSERVE	
3. Environmental conditions (wind speed, moisture, temperature)	OBSERVE	
4. WPS followed	OBSERVE	
METAL DECK INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.5		
TASK	INSPECTION TYPE	DESCRIPTION
5. Verify size and location of welds, including support, sidelap, and perimeter welds.	**PERFORM**	
6. Verify welds meet visual acceptance criteria	**PERFORM**	
7. Verify repair activities	**PERFORM**	
8. Acceptance or rejection of welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

I. STRUCTURAL COLD-FORMED METAL DECK – FASTENING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION BEFORE MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.6		
TASK	INSPECTION TYPE	DESCRIPTION
1. Manufacturer installation instructions available for mechanical fasteners	OBSERVE	
2. Proper tools available for fastener installation	OBSERVE	
3. Proper storage for mechanical fasteners	OBSERVE	✓ Fasteners are located away from moisture and in a protected location, such as off the ground and away from excessive handling. ✓ Uncoated fasteners are stored in airtight containers to reduce corrosion and rust.
METAL DECK INSPECTION DURING MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.7		
TASK	INSPECTION TYPE	DESCRIPTION
4. Fasteners are positioned as required	OBSERVE	
5. Fasteners are installed in accordance with manufacturer's instructions	OBSERVE	
METAL DECK INSPECTION AFTER MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.8		
TASK	INSPECTION TYPE[1]	DESCRIPTION
6. Check spacing, type, and installation of support fasteners	**PERFORM**	
7. Check spacing, type, and installation of side-lap fasteners	**PERFORM**	
8. Check spacing, type, and installation of perimeter fasteners	**PERFORM**	
9. Verify repair activities	**PERFORM**	
10. Acceptance or rejection of mechanical fasteners	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

J. STRUCTURAL COLD-FORMED STEEL FRAMING AND/OR COLD-FORMED TRUSSES

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

COLD-FORMED STEEL CONSTRUCTION AND CONNECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.5, 1705.12.2, 1705.12.3, 1705.13.3, 1705.13.9, UFC 4 023 03		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify compliance of trusses spanning 60-feet or greater where/if applicable	**PERFORM**	Verify that temporary and permanent truss restraint/bracing is installed in accordance with approved truss submittal package.
2. Welded connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all welds that are part of the main wind or seismic force resisting system, including shear walls, braces, collectors (drag struts), and hold-downs.
3. Connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all screw attachment, bolting, anchoring and other fastening of components within the main wind or seismic force resisting system, including roof deck, roof framing, exterior wall covering, wall to roof/floor connections, braces, collectors (drag struts) and hold-downs.
4. Cold-formed steel (progressive collapse resisting system where/if applicable)	OBSERVE	Verify proper welding operations, screw attachment, bolting, anchoring and other fastening of components within the progressive collapse resisting system, including horizontal tie force elements, vertical tie force elements and bridging elements (UFC 4 023 03).

END SECTION

K. STRUCTURAL OPEN-WEB STEEL JOISTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

OPEN-WEB STEEL JOISTS AND JOIST GIRDERS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.2.4, 2024 IBC 2207.1, SJI 100 OR 200		
	INSPECTION TYPE [1]	DESCRIPTION
1. Installation of open-web steel joists and joist girders	OBSERVE	✓ End connections – welded or bolted for compliance with SJI 100 or 200 ✓ Bridging – horizontal and diagonal for compliance with SJI 100 or 200

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

L. STRUCTURAL CONCRETE CONSTRUCTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.3 (ACI 318-19 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	PERIODIC	Verify prior to placing concrete that reinforcement is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that specified cover has been provided; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that specified lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report.
2. Inspect reinforcing bar welding	PERIODIC	✓ Verify weldability of reinforcing bars other than ASTM A 706 ✓ Inspect single-pass fillet welds, maximum 5/16" in accordance with AWS D1.4
	CONTINUOUS	✓ Inspect welding of reinforcement for special moment frame, boundary elements of special shear walls, and coupling beams. ✓ Inspect welded reinforcement splices. ✓ Inspect welding of primary tension reinforcement in corbels.
	PERIODIC	✓ Inspect all other welds in accordance with AWS D1.4
3. Inspect cast-in-place anchors, post-installed drilled anchors, and adhesive anchors other than those in item 4 below	PERIODIC	✓ Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance. ✓ Inspection requirements for adhesive anchors are different from those for other post-installed anchors and require assessment and qualification under the provisions of ACI 355.4 which may require proof loading.
4. Inspect post-installed adhesive anchors in horizontal or upward inclined orientations and	CONTINUOUS AND DOCUMENT	✓ Inspect as required per approved ICC-ES report

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.3 (ACI 318-19 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
subject to sustained tension loading.		✓ Verify that installer is certified for installation of horizontal and overhead installation applications ✓ Verify proof loading as required by the contract documents
5. Verify use of required mix design	PERIODIC	Verify that all mixes used comply with the approved construction documents
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	CONTINUOUS	At the time fresh concrete is sampled to fabricate specimens for strength test, verify these tests are performed by qualified technicians.
7. Inspect concrete and/or shotcrete placement for proper application techniques	CONTINUOUS	Verify proper application techniques are used during concrete conveyance and that depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
8. Verify maintenance of specified curing temperature and technique	PERIODIC	Inspect curing and cold weather, or hot weather protection procedures.
9. Inspect prestressed concrete	CONTINUOUS	Verify application of prestressing forces and grouting of bonded prestressing tendons.
10. Inspect erection of precast concrete members	PERIODIC	✓ Verify dimensional tolerances for precast members and interfacing members. ✓ Verify details of lifting devices, embedments, and related reinforcement required to resist temporary loads from handling, storage, transportation, and erection, if designed by the licensed design professional.
11. Inspect precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability element (MDE or HDE) in structures assigned to Seismic Design Category C, D, E, or F	**CONTINUOUS**	Inspect such connections and reinforcement in the field for: ✓ Installation of the embedded parts ✓ Completion of the continuity of reinforcement across joints. ✓ Completion of connections in the field
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5	PERIODIC	

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.3 (ACI 318-19 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	PERIODIC	See ACI 318 26.11.2
14. Inspect formwork for shape, location and dimensions of the concrete member being formed.	PERIODIC	Formwork fabrication and installation shall result in final structure that conforms to shapes, lines, and dimensions of the members as required by the construction documents.

END SECTION

M. STRUCTURAL - MASONRY CONSTRUCTION (ALL RISK CATEGORIES)

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH AT START OF CONSTRUCTION 2024 IBC 1705.4 (TMS 402/602-22 TABLE 3 & 4)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify compliance with approved submittals prior to start	PERIODIC	
2. Verify proportions of site-mixed mortar.	PERIODIC	
3. Verify grade, type and size of reinforcement, connectors, and anchor bolts	PERIODIC	
4. Verify sample panel construction	PERIODIC	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH PRIOR TO GROUTING IBC 1705.4 (TMS 402/602-22 TABLE 4)		
TASK	INSPECTION TYPE	DESCRIPTION
5. Verify grout space	PERIODIC	
6. Verify placement of reinforcement, connectors, and anchor bolts	PERIODIC	
7. Verify proportions of site-prepared grout	PERIODIC	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH DURING CONSTRUCTION IBC 1705.4 (ACI 530-16 TABLE 4)		
TASK	INSPECTION TYPE	DESCRIPTION
8. Verify compliance of materials and procedures with the approved submittals	PERIODIC	
9. Verify placement of masonry units and mortar joint construction	PERIODIC	
10. Verify size and location of structural elements	PERIODIC	
11. Verify type, size and placement of reinforcement, connectors, anchor bolts, and anchorages, including details of anchorage of masonry to structural members, frames, or other construction	PERIODIC	
12. Verify type, size and location of veneer ties and movement joints	PERIODIC	Periodic inspection of veneers is required when the height of the veneer exceeds 60 ft (18.3 m) above grade plane. See Commentary in Appendix A.
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH DURING CONSTRUCTION IBC 1705.4 (ACI 530-16 TABLE 4)		
TASK	INSPECTION TYPE	DESCRIPTION
13. Verify installation of adhered veneer	PERIODIC	Periodic inspection of veneers is required when the height of the veneer exceeds 60 ft (18.3 m) above grade plane
14. Verify welding of reinforcement	**CONTINUOUS**	
15. Verify preparation, construction, and protection of masonry during cold weather (temperature	PERIODIC	

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

below 40°F (4.4°c) or hot weather (temp above 90°F (32.2°C))		
16. Verify placement of grout	**CONTINUOUS**	
17. Observe preparation of grout specimens, mortar specimens, and/or prisms	PERIODIC	

END SECTION

N. STRUCTURAL – WOOD CONSTRUCTION – SPECIALTY ITEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.5		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. High-load diaphragms where applicable	PERIODIC	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 60 feet or greater	PERIODIC	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package
Mass timber elements in Type IV-A, IV-B, and IV-C construction. Refer to 2024 IBC 602.4 for details about Type IV construction		
3. Inspect anchorage and connections of mass timber construction to timber deep foundation systems	PERIODIC	
4. Inspect erection of mass timber construction	PERIODIC	
5. Inspect connections where installation methods are required to meet design loads		
a) Threaded fasteners	PERIODIC	✓ Verify use of proper installation equipment ✓ Verify use of pre-drilled holes where required ✓ Inspect screws, including diameter, length, head type, spacing, installation angle and depth
b) Adhesive anchors connections installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	CONTINUOUS	
c) Adhesive anchors not defined in preceding cell	PERIODIC	
d) Bolted connections	PERIODIC	
e) Concealed connections	PERIODIC	

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

O. STRUCTURAL WOOD CONSTRUCTION - SEISMIC & WIND

THIS SECTION IS APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.12 & 1705.13.2		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	PERIODIC	Includes connectors for: shear wall sheathing, roof/floor sheathing, drag struts/collectors (double top plates), braces, hold downs, roof connections to exterior walls.
2. Field gluing operations of elements of the main wind/seismic force-resisting system	**CONTINUOUS**	

END SECTION

P. STRUCTURAL ISOLATION AND ENERGY DISSIPATION SYSTEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.13.8, 1705.14.4		
TASK	INSPECTION TYPE[2]	DESCRIPTION
1. Verify fabrication and installation of isolator units and energy dissipation devices	PERFORM	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer's recommendations and approved construction documents
2. Test of seismic isolation systems in seismically isolated structures	PERFORM	Seismic isolation systems in seismically isolated structures shall be tested in accordance with ASCE 7, Section 17.8

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

[2] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.

Q. GEOTECHNICAL - SOILS INSPECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.6 and TABLE 1705.6		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	PERIODIC	
2. Verify excavations are extended to proper depth and have reached proper material	PERIODIC	
3. Perform classification and testing of compacted fill materials	PERIODIC	
4. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly	PERIODIC	
5. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill	**CONTINUOUS**	

END SECTION

R. GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

DRIVEN DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.7 and TABLE 1705.7		
TASK	INSPECTION TYPE	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	**CONTINUOUS**	
2. Inspect driving operations and maintain complete and accurate records for each element	**CONTINUOUS**	
3. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	**CONTINUOUS**	
4. Determine capacities of test elements and conduct additional load tests if required.	**CONTINUOUS**	
5. For steel, concrete, concrete-filled, perform additional special inspections in accordance with the steel and concrete sections in this schedule		
6. For specialty elements, perform additional inspections as determined by the licensed design professional in responsible charge		In accordance with Statement of Special Inspections

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

S. GEOTECHNICAL - HELICAL PILE FOUNDATIONS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.9		
TASK	INSPECTION TYPE	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required. The approved geotechnical report and the contract documents prepared by the licensed design professional in responsible charge shall be used to determine compliance	**CONTINUOUS**	
2. Determine capacities of test elements and conduct additional load tests if required.	**CONTINUOUS**	

END SECTION

T. GEOTECHNICAL – CAST-IN-PLACE CONCRETE DEEP FOUNDATION ELEMENTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

CAST-IN-PLACE CONCRETE DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element	**CONTINUOUS**	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	**CONTINUOUS**	
3. For concrete elements, perform tests and additional special inspections in accordance with Concrete section of this schedule	**CONTINUOUS**	
4. Determine capacities of test elements and conduct additional load tests if required.	**CONTINUOUS**	

END SECTION

[1] **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

U. FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

SPRAYED FIRE RESISTANT MATERIALS (SFRM) – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.15		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Check substrate condition	PERIODIC	Prior to application, confirm that surfaces have been prepared according to the approved fire-resistant design and manufacturer's instructions. See 2024 IBC 1705.15.2 and 1705.15.3 for more details.
2. Verify material thickness	PERIODIC	Verify SFRM thickness according to 2024 IBC 1705.15.4
3. Verify material density	PERIODIC	Verify SFRM density according to 2024 IBC 1705.15.5
4. Verify bond strength	PERIODIC	Verify bond strength of cured SFRM according to 2024 IBC 1705.15.6
5. Inspect the condition of finished application	PERIODIC	

END SECTION

V. FIRE PROTECTION - INTUMESCENT FIRE-RESISTIVE MATERIALS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

INTUMESCENT FIRE-RESISTIVE MATERIALS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.16		
TASK	INSPECTION TYPE	DESCRIPTION
1. Inspect according to AWCI 12-B and the contract documents	PERIODIC	Inspections shall be performed in accordance with AWCI 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials. Inspections shall be performed during construction. Additional visual inspection shall be performed after rough installation and where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

END SECTION

W. FIRE PROTECTION – FIRE-RESISTANT PENETRATIONS AND JOINTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

FIRE-RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.18		
TASK	INSPECTION TYPE	DESCRIPTION
1. Inspect of penetration firestop systems conducted in accordance with ASTM E2174.	PERIODIC	
2. Inspecti of fire-resistant joint systems conducted in accordance with ASTM E2393	PERIODIC	

END SECTION

X. FIRE PROTECTION – SMOKE CONTROL

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.19		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify device locations and perform leakage testing	PERIODIC	Perform during erection of ductwork and prior to concealment
2. Perform pressure difference testing, flow measurements and detection and control verification	PERIODIC	Perform prior to occupancy and after sufficient completion

END SECTION

Y. SEALANT – SEALING OF MASS TIMBER

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

SEALING OF MASS TIMBER – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.20		
TASK	INSPECTION TYPE	DESCRIPTION
1. Inspect sealants or adhesives	PERIODIC	Inspect sealants or adhesives where sealant and adhesive are required by 2024 IBC 703.7

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

Z. ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.17		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Water-resistive barrier coating applied over a sheathing substrate.	PERIODIC	Verify that water-resistive barrier coating complies with ASTM E2570.

END SECTION

AA.ARCHITECTURAL – ARCHITECTURAL COMPONENTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.13.5, 1705.13.7 and TABLE 1705.13.7		
TASK	INSPECTION TYPE	DESCRIPTION
1. Erection and fastening of exterior cladding and interior and exterior veneer.	PERIODIC	Verify appropriate materials, fasteners and attachment at commencement of work and at completion.
2. Interior and exterior non-load-bearing walls	PERIODIC	Verify appropriate materials, fasteners and attachment at commencement of work and at completion
3. Access floors	PERIODIC	Verify that anchorage complies with approved construction documents.
4. Storage racks	PERIODIC	Steel storage racks and steel cantilevered storage racks that are 8 feet in height or greater shall be inspected for: ✓ Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents ✓ Fabricated storage rack elements ✓ Storage rack anchorage installation ✓ Completion of storage rack system Inspection of post-installed anchors shall comply with approved ICC-ES report.

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

BB. PLUMBING/MECHANICAL/ELECTRICAL - DESIGNATED SEISMIC SYSTEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

PLUMBING, MECHANICAL AND ELECTRICAL – DESIGNATED SEISMIC SYSTEMS 2024 IBC 1705.13.6		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Check anchorage of electrical equipment for emergency and standby power systems	PERIODIC	✓ Check for general conformance
2. Check anchorage of all other electrical equipment in Seismic Design Categories E and F only (See first page of this schedule for Seismic Design Category)	PERIODIC	✓ Check for general conformance
3. Check installation and anchorage of piping designed to carry hazardous materials and their associated mechanical units.	PERIODIC	✓ Check for general conformance
4. Check installation and anchorage of vibration isolation systems where the construction documents require a nominal clearance of ¼" or less between support framing and restraint.	PERIODIC	✓ Check for general conformance
5. Verify clearance between fire sprinkler piping and surrounding mechanical and electrical equipment, including ductwork, piping and their structural supports.	PERIODIC	✓ Check for minimum clearances noted in ASCE 7 13.2.3 or a nominal clearance of not less than 3 in.

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

APPPENDIX A

Commentary on M12

Table 4 of TMS 602-22 does not have any Level 3 inspection requirements (for Risk Category IV structures). The leadership of the standard committee was contacted. They indicated that there are no requirements because veneers are covered under Part 4: Prescriptive Design Methods, and for prescriptive design there is never any Level 3 inspection requirement according to Table 3.1 of TMS 402-22. Although veneer is covered in Part 4, Chapter 13 of TMS 402-22, in Section 13.2.3, there is Engineered Design of Anchored Masonry Veneer and in Section 13.3.3, there is Engineered Design of Adhered Masonry Veneer. Engineered Design is covered in Part 3 of the standard, and for Part 3, Engineered Design, there are Level 3 inspection requirements in Table 3.1 of TMS 402-22. Upon further discussion, the leadership of the standard committee suggested to keep inspection Periodic for all Risk Category structures.

THIS PAGE INTENTIONALLY LEFT BLANK

Project:	Guam P-012 Equipment Yard Screenwall
Location:	Andersen AFB
Project #:	1665555
Date:	11/5/2025

STATEMENT OF SPECIAL INSPECTIONS

Seismic Design Category:	D
Risk Category:	II
Number of Stories above Grade:	210
Height of Highest Occupied Roof or Floor	12

Hazardous Occupancy or attached to such? No Group H Occupancies

Special Inspector of Record (SIOR)

A Special Inspector of Record (SIOR) **IS NOT** required (per UFGS 01 45 35, Section 1.3.7)

Lateral Force Resisting System (LFRS)

2024 IBC 1704.3.2 and 1704.3.3

Following is a listing of critical elements of the main wind/seismic force-resisting system for this structure. Carefully inspect these elements as part of the roles and responsiblities of the Special Inspector (reference the Schedule of Special Inspections for inspection checklists).

Vertical LFRS Elements	Notes
Special Reinforced Concrete Moment Frames	Mechanical screenwall

Horizontal LFRS Elements	Notes
Special Reinforced Concrete Moment Frames	Screenwall top beams

Project: Guam P-012 Equipment Yard Screenwall
Location: Andersen AFB
Project #: 1665555
Date: 11/5/2025

Designated Seismic Systems (DSS)

(2024 IBC 1705.13.4) (ASCE 7-22, 13.2.3, C13.2.2) (UFC 3-301-1, 2-5.3)

ELECTRICAL Components that are part of the Designated Seismic System (DSS) , which require a Certificate of Compliance	
1.	DSS Emergency or Standby Power System

MECHANICAL/PLUMBING Components that are part of the Designated Seismic System (DSS), which require a Certificate of Compliance	
1.	DSS Gas lines and associated fittings, anchorage, & flexible Connections
2.	
3.	
4.	
5.	
6.	

If additional space is required, append an additional sheet listing the remaining DSS

OTHER Designated Seismic Systems (DSS) requiring a Certificate of Compliance	
1.	
2.	
3.	
4.	
5.	
6.	

Final Walk-Down Inspection and Report

(UFC 3 301 01 SECTION 2-5.4)

Designated Seismic Systems shall receive a final walk-down inspection by the Registered Design Professional in Responsible Charge

Final Walk-Down Report, Prepared by the Registered Design Professional in Responsible Charge, must Include:

1. Record observations of Final Walk-Down Inspection
2. Document that Inspections were performed in accordance with the Schedule of Special Inspections
3. Document that all Designated Seismic Systems are installed according to construction/manufacturer document requirements, and that Compliance Certificates have been collected (UFC 03 301 01, 3-5.2, 13.2.3.2).

SCHEDULE OF SPECIAL INSPECTIONS – VAULTS AND PITS

Reference UFGS 01 45 35 for all requirements not noted as part of this schedule.

INSPECTION DEFINITIONS:

PERFORM: Perform these tasks for each weld, fastener or bolted connection, and required verification.

OBSERVE: Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.

DOCUMENT: Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

PERIODIC: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

The Seismic Design Category for this project is: ☐ A, ☐ B, ☐ C, ☒ D, ☐ E, ☐ F (check appropriate box)

A. STRUCTURAL STEEL – WELDING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-1 and Table C-N5.4-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	**PERFORM**	
2. Verify manufacturer certifications for welding consumables are available	**PERFORM**	
3. Verify material identification	**PERFORM**	Type and grade.
4. Verify use of qualified welders	**PERFORM**	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.
5. Welder Identification System	OBSERVE	✓ Fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. ✓ Die stamping of members subjected to fatigue shall be prohibited unless approved by the engineer of record.
6. Fit-up of groove welds (including joint geometry)	OBSERVE	✓ Joint preparation ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location) ✓ Backing type and fit (if applicable)
7. Fit-up of CJP groove welds of HSS T-, Y-, and K-connections without backing (including joint geometry	**PERFORM**	✓ Joint preparations ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
8. Configuration and finish of access holes	OBSERVE	
9. Fit-up of fillet welds	OBSERVE	✓ Dimensions (alignment, gaps at root) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
STEEL INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-2 and Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
10. Control and handling of welding consumables	OBSERVE	✓ Packaging ✓ Electrode atmospheric exposure control
11. No welding over cracked tack welds	OBSERVE	
12. Environmental conditions	OBSERVE	✓ Wind speed within limits ✓ Precipitation and temperature

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

STEEL INSPECTION <u>DURING</u> WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-2 and Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
13. Welding Procedures Specification followed	OBSERVE	✓ Settings on welding equipment ✓ Travel speed ✓ Selected welding materials ✓ Shielding gas type/flow rate ✓ Preheat applied ✓ Interpass temperature maintained (min./max.) ✓ Proper position (F, V, H, OH) ✓ Intermix of filler metals avoided
14. Welding techniques	OBSERVE	✓ Interpass and final cleaning ✓ Each pass within profile limitations ✓ Each pass meets quality requirements
STEEL INSPECTION <u>AFTER</u> WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-3 and Table C-N5.4-3		
TASK	INSPECTION TYPE[1]	DESCRIPTION
15. Welds cleaned	OBSERVE	✓
16. Verify size, length, and location of all welds	**PERFORM**	✓ Size, length, and location of all welds conform to the requirements of the construction drawings.
17. Verify welds meet visual acceptance criteria	**PERFORM AND DOCUMENT**	✓ Crack prohibition ✓ Weld/base-metal fusion ✓ Crater cross section ✓ Weld profiles ✓ Weld size ✓ Undercut ✓ Porosity
18. Check for arc strikes	**PERFORM**	
19. Visually inspect *k*-area	**PERFORM**	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 in. (75 mm) of the weld
20. Verify backing removed, weld tabs removed and finished, and fillet welds added where required	**PERFORM**	
21. Repair activities	**PERFORM AND DOCUMENT**	
22. Acceptance or rejection of welded joint or member	**PERFORM AND DOCUMENT**	
23. No prohibited welds have been added without the approval of the engineer of record	OBSERVE	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

B. STRUCTURAL STEEL – BOLTING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.6-1 and Table C-N5.6-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify manufacture's certifications available for fastener materials	**PERFORM**	
2. Fasteners marked in accordance with ASTM requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Pre-installation verification testing for each fastener assembly performed by installation personnel, carefully observing and documenting the installation methods.	OBSERVE	Check if the fastener assemblies and the installation methods are capable of achieving 105%, or more, of the minimum required bolt pretension.
7. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.6-2 and Table C-N5.6-2		
TASK	INSPECTION TYPE	DESCRIPTION
8. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
9. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
10. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
11. Bolts are pretensioned in accordance with RCSC *Specification*, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.6.3 and Table C-N5.6-3		
TASK	INSPECTION TYPE	DESCRIPTION
12. Acceptance or rejection of all bolted connections	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

C. STRUCTURAL STEEL - NONDESTRUCTIVE TESTING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Section N5.5		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify use of qualified nondestructive testing personnel	**PERFORM**	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 Clause 7.2
2. CJP groove welds	OBSERVE	**[NOTE: DOR must delete this row if Section D (SEISMIC PROVISIONS SECTION) is checked]** Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 20% of CJP groove welds for materials greater than 5/16" (8 mm) thick. Testing rate must be increased to 100% if greater than 5% of welds tested have unacceptable defects.
3. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue. Table A-3.1 in AISC 360-22 provides Fatigue Design Parameters for welded joints that must be checked.

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

D. STRUCTURAL STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS)

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 341-22: Section J7.2		
TASK	INSPECTION TYPE[1]	DESCRIPTION
[NOTE: DOR may uncheck this section for projects NOT designed in accordance with AISC 341 (Seismic Provisions) or for projects designed according to AISC 341, but using an R value equal to 3]		
4. CJP groove welds	OBSERVE	Ultrasonic testing (UT) shall be performed on 100% of complete-joint-penetration (CJP) groove welds in materials 5/16 in. (8 mm) thick or greater. UT in materials less than 5/16 in. (8 mm) thick is not required. Welds shall be inspected by UT in compliance with AWS D1.8/D1.8M. Magnetic particle testing (MT) shall be performed on 25% of all beam-to-column CJP groove welds. Welds shall be inspected by MT in compliance with AWS D1.8/ D1.8M. For ordinary moment frames in structures in risk categories I or II, UT and MT of CJP groove welds shall be required only for demand critical welds.
5. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.
6. *k*-area NDT (AISC 341 Table J7.1 and AWS D1.8 Clause 7.4)	**PERFORM AND DOCUMENT**	Where welding of doubler plates, continuity plates or stiffeners has been performed in the *k*-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the *k*-area base metal within 3 in. of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
7. Placement of reinforcing or contouring fillet welds (Table J7.1)	**PERFORM AND DOCUMENT**	
8. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT.

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports

E. STRUCTURAL STEEL - COMPOSITE CONSTRUCTION[1]

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

COMPOSITE CONSTRUCTION PRIOR TO PLACING CONCRETE – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22: Table N5.4-2, AISC 341-22: Table J10.1		
TASK	INSPECTION TYPE	DESCRIPTION
1. Placement and installation of steel headed stud anchors	**PERFORM**	
2. Material identification of reinforcing steel (Type/Grade)	OBSERVE	
3. Determination of carbon equivalent for reinforcing steel other than ASTM A706	OBSERVE	
4. Proper reinforcing steel size, spacing, clearances, support, and orientation	OBSERVE	
5. Reinforcing steel has not been rebent in the field	OBSERVE	
6. Required reinforcing steel clearances have been provided	OBSERVE	
7. Reinforcing steel has been tied and supported as required	OBSERVE	
8. Composite member has required size	OBSERVE	

END SECTION

F. STRUCTURAL STEEL - OTHER INSPECTIONS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.1, AISC 360-22 Section N5.8, AISC 341-22: Tables J9.1 & J11.1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Verify anchor rods and other embedments supporting structural steel	**PERFORM**	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Check reduced beam sections (RBS) where/if they occur	**PERFORM AND DOCUMENT**	✓ Contour and finish ✓ Dimensional tolerances
4. Check protected zones	**PERFORM AND DOCUMENT**	No holes or unapproved attachments made by fabricator or erector
5. Check H-piles where/if they occur	**PERFORM AND DOCUMENT**	No holes or unapproved attachments made by the responsible contractor

END SECTION

G. STRUCTURAL COLD-FORMED METAL DECK PLACEMENT

---

[1] See Concrete Construction Section for all concrete related inspection of composite steel construction.

[2] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION PRIOR TO DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	**PERFORM**	
2. Acceptance or rejection of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION AFTER DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.2		
TASK	INSPECTION TYPE	DESCRIPTION
3. Verify compliance of deck and all deck accessory installation with construction documents	**PERFORM**	
4. Verify deck materials are represented by the mill certifications that comply with the construction documents	**PERFORM**	
5. Acceptance or rejection of installation of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.3		
TASK	INSPECTION TYPE	DESCRIPTION
6. Verify welding procedure specification (WPS) is available	**PERFORM**	
7. Verify manufacturer's certifications for welding consumables are available	**PERFORM**	
8. Material identification (type/grade)	OBSERVE	
9. Check welding equipment	**PERFORM**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

H. STRUCTURAL COLD-FORMED METAL DECK – WELDING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.4		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified welders	OBSERVE	
2. Control and handling of welding consumables	OBSERVE	
3. Environmental conditions (wind speed, moisture, temperature)	OBSERVE	
4. WPS followed	OBSERVE	
METAL DECK INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.5		
TASK	INSPECTION TYPE	DESCRIPTION
5. Verify size and location of welds, including support, sidelap, and perimeter welds.	**PERFORM**	
6. Verify welds meet visual acceptance criteria	**PERFORM**	
7. Verify repair activities	**PERFORM**	
8. Acceptance or rejection of welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

I. STRUCTURAL COLD-FORMED METAL DECK – FASTENING

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION BEFORE MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.6		
TASK	INSPECTION TYPE	DESCRIPTION
1. Manufacturer installation instructions available for mechanical fasteners	OBSERVE	
2. Proper tools available for fastener installation	OBSERVE	
3. Proper storage for mechanical fasteners	OBSERVE	✓ Fasteners are located away from moisture and in a protected location, such as off the ground and away from excessive handling. ✓ Uncoated fasteners are stored in airtight containers to reduce corrosion and rust.
METAL DECK INSPECTION DURING MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.7		
TASK	INSPECTION TYPE	DESCRIPTION
4. Fasteners are positioned as required	OBSERVE	
5. Fasteners are installed in accordance with manufacturer's instructions	OBSERVE	
METAL DECK INSPECTION AFTER MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.3, SDI QA/QC-2022, Appendix 1, Table 1.8		
TASK	INSPECTION TYPE[1]	DESCRIPTION
6. Check spacing, type, and installation of support fasteners	**PERFORM**	
7. Check spacing, type, and installation of side-lap fasteners	**PERFORM**	
8. Check spacing, type, and installation of perimeter fasteners	**PERFORM**	
9. Verify repair activities	**PERFORM**	
10. Acceptance or rejection of mechanical fasteners	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

J. STRUCTURAL COLD-FORMED STEEL FRAMING AND/OR COLD-FORMED TRUSSES

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

COLD-FORMED STEEL CONSTRUCTION AND CONNECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.2.5, 1705.12.2, 1705.12.3, 1705.13.3, 1705.13.9, UFC 4 023 03		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify compliance of trusses spanning 60-feet or greater where/if applicable	**PERFORM**	Verify that temporary and permanent truss restraint/bracing is installed in accordance with approved truss submittal package.
2. Welded connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all welds that are part of the main wind or seismic force resisting system, including shear walls, braces, collectors (drag struts), and hold-downs. **[NOTE: DOR must identify critical wind and/or seismic force resisting welds in the contract drawings so that the special inspector can confirm compliance.]**
3. Connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all screw attachment, bolting, anchoring and other fastening of components within the main wind or seismic force resisting system, including roof deck, roof framing, exterior wall covering, wall to roof/floor connections, braces, collectors (drag struts) and hold-downs. **[NOTE: DOR must identify critical wind and/or seismic force resisting connection/fastener components in the contract drawings so that the special inspector can confirm compliance.]**
4. Cold-formed steel (progressive collapse resisting system where/if applicable)	OBSERVE	Verify proper welding operations, screw attachment, bolting, anchoring and other fastening of components within the progressive collapse resisting system, including horizontal tie force elements, vertical tie force elements and bridging elements (UFC 4 023 03). **[NOTE: DOR must identify critical progressive collapse resisting connection/fastener components in the contract drawings so that the special inspector can confirm compliance.]**

END SECTION

K. STRUCTURAL OPEN-WEB STEEL JOISTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

OPEN-WEB STEEL JOISTS AND JOIST GIRDERS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.2.4, 2024 IBC 2207.1, SJI 100 OR 200		
	INSPECTION TYPE [1]	DESCRIPTION
1. Installation of open-web steel joists and joist girders	OBSERVE	✓ End connections – welded or bolted for compliance with SJI 100 or 200 ✓ Bridging – horizontal and diagonal for compliance with SJI 100 or 200

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

L. STRUCTURAL CONCRETE CONSTRUCTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.3 (ACI 318-19 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	PERIODIC	Verify prior to placing concrete that reinforcement is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that specified cover has been provided; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that specified lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report.
2. Inspect reinforcing bar welding	PERIODIC	✓ Verify weldability of reinforcing bars other than ASTM A 706 ✓ Inspect single-pass fillet welds, maximum 5/16" in accordance with AWS D1.4
	CONTINUOUS	✓ Inspect welding of reinforcement for special moment frame, boundary elements of special shear walls, and coupling beams. ✓ Inspect welded reinforcement splices. ✓ Inspect welding of primary tension reinforcement in corbels.
	PERIODIC	✓ Inspect all other welds in accordance with AWS D1.4
3. Inspect cast-in-place anchors, post-installed drilled anchors, and adhesive anchors other than those in item 4 below	PERIODIC	✓ Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance. ✓ Inspection requirements for adhesive anchors are different from those for other post-installed anchors and require assessment and qualification under the provisions of ACI 355.4 which may require proof loading.
4. Inspect post-installed adhesive anchors in horizontal or upward inclined orientations and	CONTINUOUS AND DOCUMENT	✓ Inspect as required per approved ICC-ES report

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.3 (ACI 318-19 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
subject to sustained tension loading.		✓ Verify that installer is certified for installation of horizontal and overhead installation applications ✓ Verify proof loading as required by the contract documents
5. Verify use of required mix design	PERIODIC	Verify that all mixes used comply with the approved construction documents
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	CONTINUOUS	At the time fresh concrete is sampled to fabricate specimens for strength test, verify these tests are performed by qualified technicians.
7. Inspect concrete and/or shotcrete placement for proper application techniques	CONTINUOUS	Verify proper application techniques are used during concrete conveyance and that depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
8. Verify maintenance of specified curing temperature and technique	PERIODIC	Inspect curing and cold weather, or hot weather protection procedures.
9. Inspect prestressed concrete	CONTINUOUS	Verify application of prestressing forces and grouting of bonded prestressing tendons.
10. Inspect erection of precast concrete members	PERIODIC	✓ Verify dimensional tolerances for precast members and interfacing members. ✓ Verify details of lifting devices, embedments, and related reinforcement required to resist temporary loads from handling, storage, transportation, and erection, if designed by the licensed design professional.
11. Inspect precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability element (MDE or HDE) in structures assigned to Seismic Design Category C, D, E, or F	**CONTINUOUS**	Inspect such connections and reinforcement in the field for: ✓ Installation of the embedded parts ✓ Completion of the continuity of reinforcement across joints. ✓ Completion of connections in the field
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5	PERIODIC	

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC TABLE 1705.3 (ACI 318-19 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	PERIODIC	See ACI 318 26.11.2
14. Inspect formwork for shape, location and dimensions of the concrete member being formed.	PERIODIC	Formwork fabrication and installation shall result in final structure that conforms to shapes, lines, and dimensions of the members as required by the construction documents.

END SECTION

M. STRUCTURAL - MASONRY CONSTRUCTION (ALL RISK CATEGORIES)

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH AT START OF CONSTRUCTION 2024 IBC 1705.4 (TMS 402/602-22 TABLE 3 & 4)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify compliance with approved submittals prior to start	PERIODIC	
2. Verify proportions of site-mixed mortar.	PERIODIC	
3. Verify grade, type and size of reinforcement, connectors, and anchor bolts	PERIODIC	
4. Verify sample panel construction	PERIODIC **CONTINUOUS**	**[NOTE: DOR must either delete 'PERIODIC' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/ III]**
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH PRIOR TO GROUTING IBC 1705.4 (TMS 402/602-22 TABLE 4)		
TASK	INSPECTION TYPE	DESCRIPTION
5. Verify grout space	PERIODIC **CONTINUOUS**	**[NOTE: DOR must either delete 'PERIODIC' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/ III]**
6. Verify placement of reinforcement, connectors, and anchor bolts	PERIODIC **CONTINUOUS**	**[NOTE: DOR must either delete 'PERIODIC' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/ III]**
7. Verify proportions of site-prepared grout	PERIODIC	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH DURING CONSTRUCTION IBC 1705.4 (ACI 530-16 TABLE 4)		
TASK	INSPECTION TYPE	DESCRIPTION
8. Verify compliance of materials and procedures with the approved submittals	PERIODIC	
9. Verify placement of masonry units and mortar joint construction	PERIODIC	
10. Verify size and location of structural elements	PERIODIC	
11. Verify type, size and placement of reinforcement, connectors, anchor bolts, and anchorages, including details of anchorage of masonry to structural members, frames, or other construction	PERIODIC **CONTINUOUS**	**[NOTE: DOR must either delete 'PERIODIC' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/III]**
12. Verify type, size and location of veneer ties and movement joints	PERIODIC	Periodic inspection of veneers is required when the height of the veneer exceeds 60 ft (18.3 m) above grade plane. See Commentary in Appendix A.

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH DURING CONSTRUCTION IBC 1705.4 (ACI 530-16 TABLE 4)		
TASK	INSPECTION TYPE	DESCRIPTION
13. Verify installation of adhered veneer	PERIODIC	Periodic inspection of veneers is required when the height of the veneer exceeds 60 ft (18.3 m) above grade plane
14. Verify welding of reinforcement	**CONTINUOUS**	
15. Verify preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°c) or hot weather (temp above 90°F (32.2°C))	PERIODIC	
16. Verify placement of grout	**CONTINUOUS**	
17. Observe preparation of grout specimens, mortar specimens, and/or prisms	PERIODIC **CONTINUOUS**	**[NOTE: DOR must either delete 'PERIODIC' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/III]**

END SECTION

N. STRUCTURAL – WOOD CONSTRUCTION – SPECIALTY ITEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.5		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. High-load diaphragms where applicable	PERIODIC	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 60 feet or greater	PERIODIC	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package
Mass timber elements in Type IV-A, IV-B, and IV-C construction. Refer to 2024 IBC 602.4 for details about Type IV construction		
3. Inspect anchorage and connections of mass timber construction to timber deep foundation systems	PERIODIC	
4. Inspect erection of mass timber construction	PERIODIC	
5. Inspect connections where installation methods are required to meet design loads		
a) Threaded fasteners	PERIODIC	✓ Verify use of proper installation equipment ✓ Verify use of pre-drilled holes where required ✓ Inspect screws, including diameter, length, head type, spacing, installation angle and depth
b) Adhesive anchors connections installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	CONTINUOUS	
c) Adhesive anchors not defined in preceding cell	PERIODIC	
d) Bolted connections	PERIODIC	
e) Concealed connections	PERIODIC	

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

O. STRUCTURAL WOOD CONSTRUCTION - SEISMIC & WIND

THIS SECTION IS APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.12 & 1705.13.2		
TASK	INSPECTION TYPE[1]	DESCRIPTION
[NOTE: DOR may uncheck this section where the lateral resistance is provided by structural sheathing, the sheathing nailing/fasteners (shear walls, shear panels and diaphragms) are consistently greater than 4" on center, or if the design wind speed (ASD) is less than 140 mph (62.6 meters/sec) AND the seismic design category is A or B]		
1. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	PERIODIC	Includes connectors for: shear wall sheathing, roof/floor sheathing, drag struts/collectors (double top plates), braces, hold downs, roof connections to exterior walls.
2. Field gluing operations of elements of the main wind/seismic force-resisting system	**CONTINUOUS**	

END SECTION

P. STRUCTURAL ISOLATION AND ENERGY DISSIPATION SYSTEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.13.8, 1705.14.4		
[NOTE: This section is <u>not</u> applicable to Seismic Design Category A. Uncheck this section if this category applies]		
TASK	INSPECTION TYPE[2]	DESCRIPTION
1. Verify fabrication and installation of isolator units and energy dissipation devices	PERFORM	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer's recommendations and approved construction documents
2. Test of seismic isolation systems in seismically isolated structures	PERFORM	Seismic isolation systems in seismically isolated structures shall be tested in accordance with ASCE 7, Section 17.8

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

[2] **PERFORM**: Perform these tasks for each weld, fastener, or bolted connection, and required verification.

Q. GEOTECHNICAL - SOILS INSPECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.6 and TABLE 1705.6		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	PERIODIC	
2. Verify excavations are extended to proper depth and have reached proper material	PERIODIC	
3. Perform classification and testing of compacted fill materials	PERIODIC	
4. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly	PERIODIC	
5. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill	**CONTINUOUS**	

END SECTION

R. GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

DRIVEN DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.7 and TABLE 1705.7		
TASK	INSPECTION TYPE	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	**CONTINUOUS**	
2. Inspect driving operations and maintain complete and accurate records for each element	**CONTINUOUS**	
3. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	**CONTINUOUS**	
4. Determine capacities of test elements and conduct additional load tests if required.	**CONTINUOUS**	
5. For steel, concrete, concrete-filled, perform additional special inspections in accordance with the steel and concrete sections in this schedule		
6. For specialty elements, perform additional inspections as determined by the licensed design professional in responsible charge		In accordance with Statement of Special Inspections

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

S. GEOTECHNICAL - HELICAL PILE FOUNDATIONS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.9		
TASK	INSPECTION TYPE	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required. The approved geotechnical report and the contract documents prepared by the licensed design professional in responsible charge shall be used to determine compliance	**CONTINUOUS**	
2. Determine capacities of test elements and conduct additional load tests if required.	**CONTINUOUS**	

END SECTION

T. GEOTECHNICAL – CAST-IN-PLACE CONCRETE DEEP FOUNDATION ELEMENTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

CAST-IN-PLACE CONCRETE DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element	**CONTINUOUS**	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	**CONTINUOUS**	
3. For concrete elements, perform tests and additional special inspections in accordance with Concrete section of this schedule	**CONTINUOUS**	
4. Determine capacities of test elements and conduct additional load tests if required.	**CONTINUOUS**	

END SECTION

[1] **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

U. FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

SPRAYED FIRE RESISTANT MATERIALS (SFRM) – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.15		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Check substrate condition	PERIODIC	Prior to application, confirm that surfaces have been prepared according to the approved fire-resistant design and manufacturer's instructions. See 2024 IBC 1705.15.2 and 1705.15.3 for more details.
2. Verify material thickness	PERIODIC	Verify SFRM thickness according to 2024 IBC 1705.15.4
3. Verify material density	PERIODIC	Verify SFRM density according to 2024 IBC 1705.15.5
4. Verify bond strength	PERIODIC	Verify bond strength of cured SFRM according to 2024 IBC 1705.15.6
5. Inspect the condition of finished application	PERIODIC	

END SECTION

V. FIRE PROTECTION - INTUMESCENT FIRE-RESISTIVE MATERIALS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

INTUMESCENT FIRE-RESISTIVE MATERIALS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.16		
TASK	INSPECTION TYPE	DESCRIPTION
1. Inspect according to AWCI 12-B and the contract documents	PERIODIC	Inspections shall be performed in accordance with AWCI 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials. Inspections shall be performed during construction. Additional visual inspection shall be performed after rough installation and where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

END SECTION

W. FIRE PROTECTION – FIRE-RESISTANT PENETRATIONS AND JOINTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

FIRE-RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.18		
TASK	INSPECTION TYPE	DESCRIPTION
1. Inspect of penetration firestop systems conducted in accordance with ASTM E2174.	PERIODIC	**[NOTE: This section applies to Risk Category III, IV, & V structures, or in fire areas containing Group R occupancies with an occupant load greater than 250. DOR may choose to uncheck this section where project is assigned to Risk Category I or II. Confirm Risk Category with licensed design professional in responsible charge]**
2. Inspecti of fire-resistant joint systems conducted in accordance with ASTM E2393	PERIODIC	

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

X. FIRE PROTECTION – SMOKE CONTROL

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.19		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify device locations and perform leakage testing	PERIODIC	Perform during erection of ductwork and prior to concealment
2. Perform pressure difference testing, flow measurements and detection and control verification	PERIODIC	Perform prior to occupancy and after sufficient completion

END SECTION

Y. SEALANT – SEALING OF MASS TIMBER

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

SEALING OF MASS TIMBER – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.20		
TASK	INSPECTION TYPE	DESCRIPTION
1. Inspect sealants or adhesives	PERIODIC	Inspect sealants or adhesives where sealant and adhesive are required by 2024 IBC 703.7

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

Z. ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.17		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Water-resistive barrier coating applied over a sheathing substrate.	PERIODIC	Verify that water-resistive barrier coating complies with ASTM E2570. **[NOTE: Not required for EIFS applications installed over:** **a) a water-resistive barrier with a means of draining moisture to the exterior.** **b) masonry or concrete walls** **Uncheck this section in those cases]**

END SECTION

AA. ARCHITECTURAL – ARCHITECTURAL COMPONENTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE WITH 2024 IBC 1705.13.5, 1705.13.7 and TABLE 1705.13.7		
TASK	INSPECTION TYPE	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A, B, & C. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with the licensed design professional in responsible charge.]		
1. Erection and fastening of exterior cladding and interior and exterior veneer.	PERIODIC	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **[NOTE: Inspection not required if height is less than 30 feet or weight is less than 5psf]**
2. Interior and exterior non-load-bearing walls	PERIODIC	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **[NOTE: Inspection not required if interior non-load-bearing walls weigh less than 15psf]**
3. Access floors	PERIODIC	Verify that anchorage complies with approved construction documents.
4. Storage racks	PERIODIC	Steel storage racks and steel cantilevered storage racks that are 8 feet in height or greater shall be inspected for: ✓ Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents ✓ Fabricated storage rack elements ✓ Storage rack anchorage installation ✓ Completion of storage rack system Inspection of post-installed anchors shall comply with approved ICC-ES report. **[NOTE: Not required for racks less than 8 feet in height]**

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

BB. PLUMBING/MECHANICAL/ELECTRICAL - DESIGNATED SEISMIC SYSTEMS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

PLUMBING, MECHANICAL AND ELECTRICAL – DESIGNATED SEISMIC SYSTEMS 2024 IBC 1705.13.6		
TASK	INSPECTION TYPE[1]	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A or B. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with licensed design professional in responsible charge.]		
1. Check anchorage of electrical equipment for emergency and standby power systems	PERIODIC	✓ Check for general conformance
2. Check anchorage of all other electrical equipment in Seismic Design Categories E and F only (See first page of this schedule for Seismic Design Category)	PERIODIC	✓ Check for general conformance
3. Check installation and anchorage of piping designed to carry hazardous materials and their associated mechanical units.	PERIODIC	✓ Check for general conformance
4. Check installation and anchorage of vibration isolation systems where the construction documents require a nominal clearance of ¼" or less between support framing and restraint.	PERIODIC	✓ Check for general conformance
5. Verify clearance between fire sprinkler piping and surrounding mechanical and electrical equipment, including ductwork, piping and their structural supports.	PERIODIC	✓ Check for minimum clearances noted in ASCE 7 13.2.3 or a nominal clearance of not less than 3 in.

END SECTION

[1] **PERIODIC**: Special inspection by a special inspector who is intermittently present where the work to be inspected has been or is being performed.

APPPENDIX A

Commentary on M12

Table 4 of TMS 602-22 does not have any Level 3 inspection requirements (for Risk Category IV structures). The leadership of the standard committee was contacted. They indicated that there are no requirements because veneers are covered under Part 4: Prescriptive Design Methods, and for prescriptive design there is never any Level 3 inspection requirement according to Table 3.1 of TMS 402-22. Although veneer is covered in Part 4, Chapter 13 of TMS 402-22, in Section 13.2.3, there is Engineered Design of Anchored Masonry Veneer and in Section 13.3.3, there is Engineered Design of Adhered Masonry Veneer. Engineered Design is covered in Part 3 of the standard, and for Part 3, Engineered Design, there are Level 3 inspection requirements in Table 3.1 of TMS 402-22. Upon further discussion, the leadership of the standard committee suggested to keep inspection Periodic for all Risk Category structures.

THIS PAGE INTENTIONALLY LEFT BLANK

Project:	Guam P-012 Vaults and Pits
Location:	Andersen AFB
Project #:	1665555
Date:	11/5/2025

STATEMENT OF SPECIAL INSPECTIONS

Seismic Design Category:	D
Risk Category:	II
Number of Stories above Grade:	1
Height of Highest Occupied Roof or Floor	2

Hazardous Occupancy or attached to such? No Group H Occupancies

Special Inspector of Record (SIOR)

A Special Inspector of Record (SIOR) **IS NOT** required (per UFGS 01 45 35, Section 1.3.7)

Lateral Force Resisting System (LFRS)

2024 IBC 1704.3.2 and 1704.3.3

Following is a listing of critical elements of the main wind/seismic force-resisting system for this structure. Carefully inspect these elements as part of the roles and responsiblities of the Special Inspector (reference the Schedule of Special Inspections for inspection checklists).

Vertical LFRS Elements	Notes
Ordinary Reinforced Concrete Shear Walls	Perimeter vault walls

Horizontal LFRS Elements	Notes
Load-bearing Reinforced Concrete Walls	Vault top slab

Project: Guam P-012 Pits and Vaults
Location: Andersen AFB
Project #: 1665555
Date: 11/5/2025

Designated Seismic Systems (DSS)

(2024 IBC 1705.13.4) (ASCE 7-22, 13.2.3, C13.2.2) (UFC 3-301-1, 2-5.3)

ELECTRICAL Components that are part of the Designated Seismic System (DSS) , which require a Certificate of Compliance	
1.	
2.	
3.	
4.	
5.	

If additional space is required, append an additional sheet listing the remaining DSS

MECHANICAL/PLUMBING Components that are part of the Designated Seismic System (DSS), which require a Certificate of Compliance	
1.	DSS fuel piping and associated fittings, anchorage, & flexible connections
2.	
3.	
4.	
5.	
6.	

If additional space is required, append an additional sheet listing the remaining DSS

OTHER Designated Seismic Systems (DSS) requiring a Certificate of Compliance	
1.	
2.	
3.	
4.	
5.	
6.	

Final Walk-Down Inspection and Report

(UFC 3 301 01 SECTION 2-5.4)

Designated Seismic Systems shall receive a final walk-down inspection by the Registered Design Professional in Responsible Charge

Final Walk-Down Report, Prepared by the Registered Design Professional in Responsible Charge, must Include:

1. Record observations of Final Walk-Down Inspection
2. Document that Inspections were performed in accordance with the Schedule of Special Inspections
3. Document that all Designated Seismic Systems are installed according to construction/manufacturer document requirements, and that Compliance Certificates have been collected (UFC 03 301 01, 3-5.2, 13.2.3.2).

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
11/20, CHG 3: 08/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2017; R 2021) Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code
NFPA 241	(2022; ERTA 22-1) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2023) Manual on Uniform Traffic Control Devices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G

Traffic Control Plan; G

Haul Road Plan; G

Contractor Computer Cybersecurity Compliance Statements; G

Contractor Temporary Network Cybersecurity Compliance Statements; G

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit for Government approval a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.4 BACKFLOW PREVENTERS CERTIFICATE

1.4.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with a company participating in other phases of this Contract.

1.4.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.5 CONDITION OF READINESS (COR) LEVELS FOR WEATHER

The Condition of Readiness (COR) is based on the weather forecast and the potential for sustained winds 50 knots (58 mph) or greater. Contact the Contracting Officer for the current COR.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted Accident Prevention Plan, EM 385-1-1 Emergency Plan requirements and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

a. Condition FOUR (Sustained winds of 58 mph or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 3.3 feet high. Remove all debris, trash, or objects that could become missile hazards. Review requirements pertaining to "Condition THREE" and continue action as necessary to attain "Condition FOUR" readiness. Contact Contracting Officer for weather

and COR updates and completion of required actions.

b. Condition THREE (Sustained winds of 58 mph or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and COR updates and completion of required actions. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.

c. Condition TWO (Sustained winds of 58 mph or greater expected within 24 hours): Secure the jobsite, and leave Government premises.

d. Condition ONE. (Sustained winds of 58 mph or greater expected within 12 hours): Contractor access to the jobsite and Government premises is prohibited.

1.6 CYBERSECURITY DURING CONSTRUCTION

{For Reference Only: This subpart (and its subparts) relates to AC-18, SA-3, CCI-00258.} Meet the following requirements throughout the construction process.

1.6.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

1.6.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

1.6.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

1.6.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.6.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at https://www.wbdg.org/dod/ufgs/ufgs-01-50-00. Each Statement must be signed by a cybersecurity representative for the relevant company.

1.6.2 Temporary IP Networks

Temporary Contractor-installed IP networks may be used during construction. Provide Government access to Contractor furnished temporary IP networks during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

1.6.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

1.6.3 Government Access to Network

Government personnel, as defined, prescribed, and identified by the Contracting Officer, must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification. If there is a Government agency responsible for network access, identify that agency.

1.6.4 Temporary Wireless IP Networks

1.6.4.1 Contractor Provided Wi-Fi Network

Provide standalone Wi-Fi network for authorized Government personnel. Network access must be available throughout the jobsite and for the entire Contract period. The Government will use the Wi-Fi service for coordination in the field and related activities. Do not attach or connect the temporary Wi-Fi network to Government networks or systems unrelated to construction activities.

Password information must adhere to requirements outlined in Paragraph PASSWORDS AND PASSPHRASES. Provide password and Wi-Fi network name (SSID) to the Contracting Officer for Government personnel access. Wi-Fi performance must be capable of handling bandwidth to support Government and Contractor activities, including drawing and model access onsite. Provide a point of contact for reporting Wi-Fi outages.

1.6.4.2 Temporary Wireless IP Networks Security

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

1.6.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access

must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.6.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at https://www.wbdg.org/dod/ufgs/ufgs-01-50-00. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, and in location as approved by the Contracting Officer.

2.1.2 Project Identification Signs

The requirements for the signs, their content, and location are as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.1.3 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily. Post signs at all points of entry designating the construction site as a hard hat area.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this Contract in accordance with EM 385-1-1. Construct with suitable grades and widths; avoid sharp curves, blind corners, and dangerous cross traffic. Submit haul road plan for approval. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional,

must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and haul roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1. Remove the fence upon completion and acceptance of the work.

2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

2.5 BACKFLOW PREVENTERS

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval is not acceptable.

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound flanged , bronze, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. Employee parking must not interfere with existing and established parking requirements of the Government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Payment for Utility Services

a. The Government will make all reasonably required utilities available from existing outlets and supplies, as specified in the Contract. Unless otherwise provided in the Contract, the amount of each utility service consumed will be charged to or paid at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. Carefully conserve utilities furnished without charge.

b. Reasonable amounts of the following utilities will be made available at the prevailing rates:

c.

Utility Services		
	Cost ($) per	Unit
Electricity	384.30	MWh
Sewer	18.00	kGal

d. The point at which the Government will deliver such utilities or services and the quantity available is as indicated. Pay all costs incurred in connecting, converting, and transferring the utilities to the work. Make connections, including providing backflow-preventing devices on connections to domestic water lines; providing meters; and providing transformers; and make disconnections.

e. The Contractor must provide their own utilities.

3.2.3 Meters and Temporary Connections

Provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. Notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. Do not make the final electrical connection.

3.2.4 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed prior to the end of the current fiscal year.

3.2.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. Then remove all the temporary distribution lines, meter bases, and associated appurtenances. Pay all outstanding utility bills before final acceptance of the work by

the Government.

3.2.6 Utilities at Special Locations

3.2.6.1 Utilities at Guam by Contractor for Special Projects

Contact the Government of Guam for water and electricity.

3.2.7 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities in accordance with EM 385-1-1. Locate the facilities behind the construction fence or out of the public view. Clean units and empty wastes at least once a week or more frequently into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into a municipal, district, or commercial sanitary sewer system. Penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

3.2.8 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.2.9 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.3 STATION OPERATION AFFECT ON CONTRACTOR OPERATIONS

3.3.1 Restricted Access Area

The Government will monitor work in areas indicated. Notify Contracting Officer at least 14 calendar days prior to starting work in these areas.

3.4 TRAFFIC PROVISIONS

3.4.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close a thoroughfare or interfere with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan for Government approval detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain all permits required for modification to traffic movements outside Station's jurisdiction. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain

approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, Life Safety Signage, overhead protection, and other items that may be required by the authority having jurisdiction.

d. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

3.4.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Provide self-illuminated (lighted) barricades during hours of darkness. All personnel working in roadways will wear brightly-colored vests or other high visibility apparel in accordance with EM 385-1-1. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of damage to roads caused by construction operations.

3.4.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations without notification to and approval by the Contracting Officer.

3.4.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.5 REDUCED PRESSURE BACKFLOW PREVENTERS

Provide an approved reduced pressure backflow prevention assembly at each location where the Contractor taps into the Government potable water supply.

Perform backflow preventer tests using test equipment, procedures, and certification forms conforming to those outlined in the latest edition of the Manual of Cross-Connection Control published by the FCCCHR Manual. Test and tag each reduced pressure backflow preventer upon initial installation (prior to continued water use) and monthly thereafter. Tag must contain the following information: make, model, serial number, dates of tests, results, maintenance performed, and signature of tester. Record test results on certification forms conforming to requirements cited earlier in this paragraph.

3.6 CONTRACTOR'S TEMPORARY FACILITIES

Contractor is responsible for security of their property. Provide adequate outside security lighting at the temporary facilities. Trailers must be anchored to resist high winds and meet applicable state or local standards for anchoring mobile trailers. Coordinate anchoring with EM 385-1-1. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

3.6.1 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

In the event a new building is constructed for the temporary project field office, it must be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery-operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Provide approved sanitary facilities. Screen the windows and doors and provide the doors with deadbolt type locking devices or a padlock and heavy-duty hasp bolted to the door. Door hinge pins must be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, provide air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F. Unless otherwise directed by the Contracting Officer, remove the building from the site upon completion and acceptance of the work.

3.6.2 Quality Control Manager Records and Field Office

Provide on the jobsite an office with approximately 100 square feet of useful floor area for the exclusive use of the QC Manager. Provide a weathertight structure with adequate cooling, toilet facilities, lighting, ventilation, a 4 by 8 foot plan table, a standard size office desk and chair, computer station, and working communications facilities. Provide either a 1,500 watt a window-mounted air conditioner rated at 9,000 Btus minimum or a window-mounted heat pump of the same minimum heating and cooling ratings. Provide a door with a cylinder lock and windows with locking hardware. Make utility connections. Locate where indicated. File quality control records in the office and make available at all times to the Government. After completion of the work, remove the entire structure from the site.

3.6.3 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored green or brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless

such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on the current day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

Keep fencing in a state of good repair and proper alignment. If the Contractor elects to traverse grassed or unpaved areas which are not established roadways with construction equipment or other vehicles, cover the grassed or unpaved areas with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation must be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, structures, under trailers, and in areas not accessible to mowers must be edged or trimmed neatly.

3.6.4 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

3.6.5 Appearance of Trailers

a. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.

b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

3.6.6 Safety Systems

Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish Contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.6.7 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building

from damage.

3.6.7.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.7 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the Contract and, upon completion and acceptance of the work, remove from the work site.

3.8 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store all salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.9 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS
08/22, CHG 2: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846	(Third Edition; Update VII) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1053	Respirable Crystalline Silica
29 CFR 1910.1200	Hazard Communication
29 CFR 1926.1153	Respirable Crystalline Silica
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
40 CFR 64	Compliance Assurance Monitoring
40 CFR 82	Protection of Stratospheric Ozone
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste

40 CFR 261.7	Residues of Hazardous Waste in Empty Containers
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 262.11	Hazardous Waste Determination and Recordkeeping
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards for Universal Waste Management
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 372	Toxic Chemical Release Reporting
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 172.101	Hazardous Material Regulation-Purpose and Use of Hazardous Material Table
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

GUAM CODE ANNOTATED (GCA)

10 GCA CH47	Water Pollution Control
10 GCA CH49	Air Pollution Control Act
10 GCA CH50	Guam Pesticides Act
10 GCA CH51	Solid Waste Management and Litter Control
10 GCA CH76	Storage of Hazardous Materials
22 GCA CH32	Professional Engineers, Architects, and Land Surveyors Law

GUAM ADMINISTRATIVE RULES AND REGULATIONS (GAR)

22 GAR DIV1 CH1	Guam Air Pollution Control Act
22 GAR DIV2 CH5	Guam Water Quality Standards
22 GAR DIV2 CH10	Guam Soil Erosion and Sediment Control Regulations
22 GAR DIV3 CH15	Pesticides
22 GAR DIV4 CH20	Solid Waste Disposal Regulations
22 GAR DIV2 CH30	Hazardous Waste Management
22 GAR DIV9 CH45	Soil Erosion and Sedimentation Control
22 GAR DIV10 CH50	Underground Storage Tanks

Department of the Air Force

Final EIS	(2025) Final Environmental Impact Statement for F-15 Beddown and Infrastructure Upgrade at Andersen Air Force Base, Guam
ICRMP	(2015) Andersen Air Force Base Integrated Cultural Resources Management Plan
Data Recovery Plan	(2025) Data Recovery Plan for Sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog), Andersen Air Force Base, Guam

U.S. Fish and Wildlife Service

2025 BO	Biological Opinion for Expansions of Aircraft Operations Area at Northwest Field, and Munitions Storage Area (MSA-1), Andersen Air Force Base, Guam, 25 February 2025
HACCP Manual	(2019) HACCP Hazard Analysis and Critical Control Point Planning to Prevent the Spread of Invasive Species

1.2 DEFINITIONS

1.2.1 State

"State" when used in reference to states of the United States, also includes the Territory of Guam.

1.2.2 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink. https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink. https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e., methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.5 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.6 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes

management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.7 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with 40 CFR 261. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

1.2.8 Hazardous Materials

Hazardous material is any material that: Is defined in 49 CFR 171, listed in 49 CFR 172, regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.1200; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

1.2.9 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibits a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D, or meets a state, local, or host nation definition of a hazardous waste.

1.2.10 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

1.2.11 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by municipalities or installations to obtain NPDES permit coverage for their stormwater discharges.

1.2.12 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

1.2.13 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum,

Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.14 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

1.2.15 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.16 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

1.2.16.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

1.2.16.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

1.2.16.3 Material Not Regulated As Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.16.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 261.

1.2.16.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of "lead contaminated" or "lead based paint contaminated" may be included as recyclable only if the metal is handled and transported in accordance with regulations, and the facility receiving the material is permitted and authorized to accept and process lead contaminated materials. Paint cans that meet the definition of empty containers in accordance with 40 CFR 261.7 may be included as recyclable if sold to a scrap metal company.

1.2.16.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

1.2.16.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

1.2.16.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

1.2.17 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm

sewers, or creeks meeting the definition of "waters of the United States". Surface discharges from construction sites are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

1.2.18 Wastewater

Wastewater is the aqueous liquid waste generated by a project, to include both domestic wastewater (sewage) and industrial wastewater.

1.2.18.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

1.2.19 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

1.2.20 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1.2.21 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273. The Guam Environmental Protection Agency (Guam EPA or GEPA) has not adopted the Universal Regulation Rule. Comply with the GEPA regulations and requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Hazardous Material Inventory Log; G

Storage Material Inventory

Preconstruction Survey

Regulatory Notifications

Environmental Manager Qualifications

Employee Training Records

Environmental Protection Plan; G

Dirt and Dust Control Plan

Solid Waste Management Permit

Stormwater Pollution Prevention Plan (SWPPP); G

Stormwater Notice of Intent (for NPDES coverage under the general permit for construction activities)

Spill Prevention Control and Countermeasure (SPCC) Plan; G

Hazard Analysis and Critical Control Point (HACCP) Plan; G

GEPA Clearing, Grubbing, Grading, and Stockpiling Permit / General Permit Application; G

Final Work Plan for Tarague Forest Enhancement Area; G

Draft Work Plan for Tarague Forest Enhancement Area; G

Draft Natural Resource Work Plan; G

Final Natural Resource Work Plan; G

Natural Resource Field Assessment Report for P-012 Construction Footprint; G

Natural Resource Field Assessment Report for Tarague Forest Enhancement Area; G

Archaeological Monitoring and Discovery Plan; G

SD-02 Shop Drawings

Alignment of Ungulate Fence; G

SD-06 Test Reports

Monthly Solid Waste Disposal Report; G

SWPPP Inspection Reports

Laboratory Analysis

SD-07 Certificates

ECATTS Certificate of Completion; G

Employee Training Records; G

Erosion and Sediment Control Inspector Qualifications

Qualification of Qualified Biologist(S); G

Qualification of Archaeologist(s); G

SD-10 Operation and Maintenance Data

Weekly Natural Resources Conservation Status Report; G

Monthly Natural Resources Conservation Progress Report; G

Annual Natural Resources Conservation Progress Report; G

Reports and Submittals required by Data Recovery Plan; G

End of Field (EOF) Letter for Archaeological Monitoring - Tarague FEA; G

SD-11 Closeout Submittals

Contractor Hazardous Material Inventory Log; G

Regulatory Notifications; G

Assembled Employee Training Records; G

Solid Waste Management Permit; G

Stormwater Pollution Prevention Plan Compliance Notebook; G

Stormwater Notice of Termination (for NPDES coverage under the general permit for construction activities); G

As-Built Topographic Survey

Waste Determination Documentation; G

Project Solid Waste Disposal Documentation Report; G

Sales Documentation; G

Contractor Certification

Hazardous Waste/Debris Management; G

Disposal Documentation for Hazardous and Regulated Waste; G

Draft Natural Resources Conservation Report; G

Final Natural Resources Conservation Report; G

Weekly archaeological monitoring report-Tarague FEA; G

Draft Archaeological Monitoring Report-Tarague FEA; G

Final Archaeological Monitoring Report-Tarague FEA; G

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental

protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

1.4.1 Training in Environmental Compliance Assessment Training and Tracking System (ECATTS)

1.4.1.1 Personnel Requirements

The Environmental Manager is responsible for environmental compliance on projects. The Environmental Manager and other environmental staff, must complete applicable ECATTS training modules (installation specific or general) prior to starting respective portions of on-site work under this Contract. If personnel changes occur for any of these positions after starting work, replacement personnel must complete applicable ECATTS training within 14 days of assignment to the project.

1.4.1.2 Certification

Submit an ECATTS certificate of completion for personnel who have completed the required ECATTS training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

Register for NAVFAC Environmental Compliance Assessment, Training, and Tracking System, by logging on to https://environmentaltraining.ecatts.com/. Obtain the password for registration from the Contracting Officer.

1.4.1.3 Refresher Training

This training has been structured to allow contractor personnel to receive credit under this contract and to carry forward credit to future contracts. Ensure the Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific state regulatory requirements; therefore, Contractors working in multiple states will be required to retake modules tailored to the state where the contract work is being performed.

1.4.2 Conformance with the Environmental Management System

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering

questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

1.5 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements listed here and attached at the end of this section.

Attachment B. Data Recovery Plan for Sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog), Andersen Air Force Base, Guam. Conduct data recovery for the archaeological sites that will be impacted/disturbed by the project.

Attachment C. P-012 Permits Record of Decision (PROD): Obtain all required environmental or construction permits and approvals listed in the PROD. Obtain any additional permits or approvals needed but not listed in the PROD at no cost to the Government.

Attachment D. Environmental Mitigations presented in the 2025 Final Environmental Impact Statement (Final EIS) for F-15 Beddown and Infrastructure Upgrade at Andersen Air Force Base, Guam. Comply with the environmental mitigation requirements.

Attachment E. Natural Resources Requirements specified in the Biological Opinion (2025 BO) for Expansions of Aircraft Operations Area at Northwest Field, and Munitions Storage Area (MSA-1), Andersen Air Force Base, Guam, 25 February 2025.

Attachment F. Natural Resources Performance Work Statement (PWS)

1.5.1 Abandoned Waste Debris

Refer to the Project Demolition Plan (CD-series). Remove and dispose of stockpiles and waste debris. Refer to the Visual Stockpile Observation Report included in Section 02 61 13 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL. The site includes abandoned waste debris. Waste debris contains asbestos transite pipes and lead paints. Refer to the Hazardous Material Survey Report for the asbestos transite pipes and lead paints. The report is provided at the end of Section 02 82 00 ASBESTOS REMEDIATION.

1.5.2 PFAS Contamination and G-RAM/LLRW

Refer to Section 02 61 13 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL; Attachment A, Soil Management Plan; and Attachment B, G-RAM/LLRW Performance Work Statement.

The project site include PFAS-impacted areas and potential General Radioactive Material (G-RAM)/Low-Level Radioactive Waste (LLRW) Area. Implement Section 02 61 13 and Section Attachments A and B.

1.5.3 Sinkhole Protection

Sinkholes are present in the vicinity of project sites. Provide the sinkhole mitigation plan and submittals for Government and GEPA review and approval. Obtain Class V Underground Injection Control (UIC) Permits for three exising sinkholes.

1.5.4 Pacific

Comply with the following state, regional and local requirements.

1.5.4.1 Control and Disposal of Ionization Smoke Detectors or Tritium Exit Signs

1.5.4.1.1 Material Bagging

Remove existing ionization smoke detectors and tritium exit signs, and place like types, together (that is same manufacturer and model number) in a plastic bag. Label the bag with the following data:

Manufacturer:	Activity:
MODEL No.:	Contract No.:
Isotope and Quantity (if known):	

1.5.4.1.2 Material Storage

Store plastic bags in 55 gallon covered drum(s). Do not seal the drum(s). Provide a label with a description of the contents and note on the label "TO BE DISPOSED OF BY RASO". Apply the label to the exterior surface of the cover and site of the drum(s). Provide a record copy of the label for each drum storage material inventory to the Contracting Officer, and the RASO.

1.5.4.2 Guam

Comply with all applicable Guam regulations, requirements, and guidance including but are not limited to: HACCP Manual; 10 GCA CH47; 10 GCA CH49; 10 GCA CH50; 10 GCA CH51; 10 GCA CH76; 22 GCA CH32; 22 GCA CH32; 22 GAR DIV1 CH1; 22 GAR DIV1 CH1; 22 GAR DIV2 CH5; 22 GAR DIV2 CH10; 22 GAR DIV3 CH15; 22 GAR DIV4 CH20; 22 GAR DIV2 CH30; 22 GAR DIV9 CH45; 22 GAR DIV10 CH50; and the CNMI and Guam Stormwater Management Manual, prepared by Horsley Witten Group Inc, dated (October 2006, as amended).

1.5.4.2.1 Demarcate Project Limits

Under General Provision section of 22 GCA CH32, use a Professional Land Surveyor in order to layout/demarcate the project limits. Demarcate the limits of construction and use a licensed professional land surveyor to delineate project limits. The limits of construction are to be clearly

marked in the field and must be maintained throughout the duration of construction. Use durable, high-visibility tape/rope (unless a physical feature exists at the limit e.g. fence). The marked limits must be on or within the project boundary presented in the project plan.

1.6 QUALITY ASSURANCE

1.6.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

1.6.2 Regulatory Notifications

Provide regulatory notification requirements in accordance with federal, state and local regulations. In cases where the Government will also provide public notification (such as stormwater permitting), coordinate with the Contracting Officer. Submit copies of regulatory notifications to the Contracting Officer at least 30 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.6.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP) or equipment local requirement. Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

1.6.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for coordinating contractor

compliance with federal, state, local, and installation requirements. The Environmental Manager must ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers, PFAS-contaminated soil, G-RAM/LLRW). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Submit Environmental Manager Qualifications to the Contracting Officer.

1.6.5 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with federal, state and local regulatory requirements for RCRA Large Quantity Generator. Provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet EPA and state requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the Erosion and Sediment Control Inspector Qualifications as defined by EPA Certification as required by state.

1.6.6 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part

of the work until satisfactory corrective action has been taken. FAR 52.242-14 Suspension of Work provides that a suspension, delay, or interruption of work due to the fault or negligence of the Contractor allows for no adjustments to the contract for time extensions or equitable adjustments. In addition to a suspension of work, the Contracting Officer may use additional authorities under the contract or law.

1.7 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after notice to proceed and not less than 10 days before the preconstruction meeting. Submit the EPP not less than 60 calendar days before scheduled final site or building design approval. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

1.7.1 General Overview and Purpose

1.7.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as but is not limited to:

a. stormwater pollution prevention plan,

b. spill control plan,

c. solid waste management plan,

d. wastewater and hydrostatic/hydrotesting water management plan,

e. air pollution control plan,

f. contaminant prevention plan,

g. historical, archaeological, cultural resources including data recovery and archaeological monitoring,

h. biological, natural resources, and compliance with 2025 BO

i. sinkhole mitigation plan,

j. traffic control plan,

k. Hazardous, Toxic and Radioactive Waste (HTRW) Plan (PFAS-contaminated soil, G-RAM/LLRW),

l. Non-Hazardous Solid Waste Disposal Plan including abandoned waste debris and green waste management,

m. borrowing material plan,

n. surplus soil management plan.

1.7.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

1.7.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

1.7.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

1.7.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

1.7.2 General Site Information

1.7.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

1.7.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

Show where any hazardous materials or waste (e.g., asbestos, G-RAM/LLRW, contaminated soil), fuels, hazardous substances, solvents, or lubricants will be stored. Provide a spill plan to address any releases of those

materials.

1.7.2.3 Documentation

A letter signed by an officer of the firm appointing the Environmental Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

1.7.3 Management of Natural Resources

a. Land resources

b. Natural resources and tree protection including Endangered Species Act (ESA)-listed Endangered and Threatened (T&E) species

c. Replacement of damaged landscape features

d. Temporary construction

e. Sinkhole protection

f. Fish and wildlife resources (e.g., Mariana fruit bats)

1.7.4 Protection of Historical and Archaeological Resources

a. Objectives

b. Methods

1.7.5 Stormwater Management and Control

a. Ground cover

b. Erodible soils

c. Temporary measures

(1) Structural Practices

(2) Temporary and permanent stabilization

d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

e. Stormwater Pollution Prevention Plan (SWPPP).

1.7.6 Protection of the Environment from Waste Derived from Contractor Operations

This item consists of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan when within an installation. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan as applicable.

As a minimum, include the following:

a. List of the types of hazardous wastes expected to be generated

b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated

c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications

d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)

e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)

f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)

g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar

h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures

i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

j. Plans for off-site reuse or disposal of surplus soil.

1.7.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

1.7.8 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 240 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

1.7.9 Clean Air Act Compliance

1.7.9.1 Haul Route

Submit truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

1.7.9.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require

federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager). Ensure required permits are obtained prior to installing and operating applicable equipment/processes.

1.7.9.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between maintenance/testing, emergency, and non-emergency operation.

1.7.9.4 Refrigerants

Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants complies with 40 CFR 82 requirements. Technicians must be certified, maintain copies of certification on site, use certified equipment and log work that requires the addition or removal of refrigerant. Any refrigerant reclaimed is the property of the Government, coordinate with the Installation Environmental Office to determine the appropriate turn in location.

1.7.9.5 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, concrete batch plants, generators, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

1.7.9.6 Compliant Materials

Provide the Government a list of SDSs for all hazardous materials proposed for use on site. Materials must be compliant with all Clean Air Act regulations for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

1.8 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7 Permits and Responsibilities. Notify the Government of all equipment that may require permits or special approvals that the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7 Permits and Responsibilities.

1.9 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

1.10 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

1.10.1 Monthly Solid Waste Disposal Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

1.11 FACILITY HAZARDOUS WASTE GENERATOR STATUS

AAFB is designated as a Large Quantity Generator. Meet the regulatory requirements of this generator designation for any work conducted within the boundaries of this Installation. Comply with provisions of federal, state, and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of construction derived wastes.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office as applicable, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility. The following species are known and could be affected within the construction area:

a. Cycas micronesica
b. Tabernaemontana rotensis (T. rotensis)
c. Bulbophyllum guamense, Dendrobium guamense, and Tuberolabium guamense
d. Mariana fruit bats

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements

of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 2025 BO and NR PWS

Comply with and implement the natural resources requirements, including conservation measures and Best Management Practices (BMP), specified in Attachment E, Biological Opinion (2025 BO) and Attachment F, Natural Resources Performance Work Statement (PWS) for the project. Comply with and implement all requirements for the P-012 project site, Tarague Forest Enhancement Area (Tarague FEA), and Habitat Management Unit (HMU). The locations of Tarague FEA and HMU are presented in Attachment F1, Figures for Natural Resources Conservation. The Contractor must review, understand, and execute the 2025 BO. Prepare a Hazard Analysis and Critical Control Point (HACCP) Plan for Government review and approval.

Submit the plans and reports specified in the PWS.

a. Qualification of qualified biologist(s)

b. Draft Natural Resource Work Plan

c. Final Natural Resource Work Plan

d. Natural Resource Field Assessment Report for P-012 Construction footprint

e. Natural Resource Field Assessment Report for Tarague Forest Enhancement Area

f. Alignment of Ungulate Fence

g. Draft Work Plan for Tarague Forest Enhancement Area

h. Final Work Plan for Tarague Forest Enhancement Area

i. Weekly Natural Resources Conservation Status Report

j. Monthly Natural Resources Conservation Progress Report

k. Annual Natural Resources Conservation Progress Report

l. Draft Natural Resources Conservation Report

m. Final Natural Resources Conservation Report

3.1.2 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

3.1.3 Vegetation

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use

of attached ropes, cables, or guys is authorized, the Contractor is responsible for any resultant damage.

Protect existing trees and critical root zones (CRZ) that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations.

3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

3.2.1 Construction General Permit

Provide a Construction General Permit as required by 40 CFR 122.26 or EPA General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPPP inspection reports. Maintain construction operations and management in compliance with the terms and conditions of the general permit for stormwater discharges from construction activities.

3.2.1.1 Stormwater Pollution Prevention Plan

Submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to the Contracting Officer for approval, within 30 days of notice to proceed and prior to the commencement of work. The SWPPP must meet the requirements of 40 CFR 122.26 and the EPA General Permit for stormwater discharges from construction sites.

Include the following:

a. Comply with terms of the EPA general permit for stormwater discharges from construction activities. Prepare SWPPP in accordance with EPA requirements. Use EPA guide Developing your Stormwater Pollution Prevention Plan located at https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp to prepare the SWPPP.

b. Select applicable BMPs from EPA Fact Sheets located at https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#constr or in accordance with applicable state or local requirements.

c. Include a completed copy of the Notice of Intent, BMP Inspection Report Template, and Stormwater Notice of Termination, except for the effective date.

d. Comply with local additional requirements including the Commonwealth of the Northern Marianas Islands (CNMI) and the Territory of Guam, Stormwater Management Manuals (2006 or as amended). Apply and obtain a GEPA Clearing, Grubbing, Grading, and Stockpiling Permit / General Permit Application for Earthmoving Work & Full Construction prior to

relevant construction activities. The permit requires an Environmental Protection Plan.

3.2.1.2 Stormwater Notice of Intent for Construction Activities

Prepare and submit the Notice of Intent for NPDES coverage under the general permit for construction activities to the Contracting Officer for review and approval.

Submit the approved NOI and appropriate permit fees onto the appropriate federal or state agency for approval. No land disturbing activities may commence without permit coverage. Maintain an approved copy of the SWPPP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

Comply with additional state and local requirements.

3.2.1.3 SWPPP Inspection Reports

Submit "SWPPP Inspection Reports" to the Contracting Officer in accordance with EPA Construction General Permit.

3.2.1.4 Stormwater Pollution Prevention Plan Compliance Notebook

Create and maintain a three ring binder of documents that demonstrate compliance with the Construction General Permit. Include a copy of the permit Notice of Intent, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports and related corrective action records, copies of correspondence with the EPA and GEPA Permitting Agency, and a copy of the permit Notice of Termination in the binder. At project completion, the notebook becomes property of the Government. Provide the compliance notebook to the Contracting Officer.

3.2.1.5 Stormwater Notice of Termination for Construction Activities

Submit a Notice of Termination to the Contracting Officer for approval once construction is complete and final stabilization has been achieved on all portions of the site for which the permittee is responsible. Once approved, submit the Notice of Termination to the appropriate state or federal agency. Prepare as-built topographic survey information required by the permitting agency for certification of the stormwater management system, and provide to the Contracting Officer.

3.2.2 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

3.2.2.1 Erosion Control

Prevent erosion by mulching, Compost Blankets, Geotextiles, temporary slope drains. Stabilize slopes by chemical stabilization, sodding, seeding, or such combination of these methods necessary for effective erosion control. Use of hay bales is prohibited. Use of sandbags as stormwater BMPs is not allowed.

3.2.2.2 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Include the following devices: silt fence, temporary diversion dikes, storm drain inlet protection. Location and details of installation and construction are indicated on the drawings.

3.2.3 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, all markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

3.2.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements. Comply with local requirements.

3.3 SURFACE AND GROUNDWATER

3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the Guam water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office or Contracting Officer. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any

circumstances.

3.3.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States.

3.4 PROTECTION OF CULTURAL RESOURCES

3.4.1 Archaeological Resources

Existing archaeological resources within the work area are shown on Attachment B, Data Recovery Plan.

Protect these resources and be responsible for their preservation during the life of the Contract. If, during excavation or other construction activities, any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, activities that may damage or alter such resources will be suspended. Resources covered by this paragraph include, but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds must be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources. The Government retains ownership and control over archaeological resources.

3.4.2 Qualified Archaeologists

Provide qualified archaeologists. Archaeologists must have a graduate degree in archaeology, anthropology, or closely related field and meet the Secretary of the Interior's Professional Qualifications for Archaeology. The qualified archaeologist(s) can be one person or more than one person who meets the qualifications listed above. Submit the Qualification of Archaeologist(s).

3.4.3 P-012 Project Site

3.4.3.1 Archaeological Monitoring: Not Required

Archaeological monitoring is not required. However, in the event that unidentified archaeological resources or human remains are discovered, the archaeologist retained by the Contractor, Contracting Officer, and AAFB Cultural Resources Manager (CRM) must be immediately notified.

The on-site manager must halt all action in the vicinity of the discovery and secure the area per the guidance of the archaeological monitors.

The AAFB CRM and archaeologist will assess the discovery and make the appropriate notifications and follow-up actions. Any archaeological resources discovered during the project and construction must be reported and documented in accordance with the ICRMP SOP 8 and 9. The area will be released back for construction activities by the Contracting Officer once AAFB CRM has made the notification that the inadvertent discovery has been

mitigated.

3.4.3.2 Data Recovery

The qualified archaeologist retained by the Contractor must execute and implement Attachment B, Data Recovery Plan for Sites 66-07-2113, 66-07-2117, and 66-07-2118 for the archaeological sites. Conduct data recovery for the archaeological sites that will be impacted/disturbed by the P-012 project. Provide the Reports and Submittals required by Data Recovery Plan.

3.4.4 Tarague Forest Enhancement Area (FEA)

Tarague FEA is likely to contain significant subsurface deposits. Provide archaeological monitoring for all ground disturbing activities, including vegetation clearance, installation of ungulate fencing, T&E transplanting, and invasive species clearance. The qualified archaeologists must provide monitoring. Submit an Archaeological Monitoring and Discovery Plan (AMDP)for the Government review and approval. Anticipate review by the Guam State Historic Preservation Office (Guam SHPO).

If subsurface deposits are encountered during archaeological monitoring, note the observation. Additional testing is not required. Install the ungulate fence and transplant plants nearby areas without subsurface deposits.

Provide an End of Field (EOF) Letter for Archaeological Monitoring - Tarague FEA within 5 working days after completion of ungulate fencing. Submit a Draft Archaeological Monitoring Report-Tarague FEA within 30 calendar days after completion of ungulate fencing. Submit the Final Archaeological Monitoring Report-Tarague FEA within 30 calendar days after receipt of Government comments.

Provide a weekly archaeological monitoring report-Tarague FEA.

3.5 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with 40 CFR 64 and state air emission and performance laws and standards. Use ultra-low sulfur diesel fuel.

3.5.1 Preconstruction Air Permits

Notify the Air Program Manager, through the Contracting Officer, at least 6 months prior to bringing equipment, assembled or unassembled, onto the Installation, so that air permits can be secured. Necessary permitting time must be considered in regard to construction activities. Clean Air Act (CAA) permits must be obtained prior to bringing equipment, assembled or unassembled, onto the Installation.

Confirm that these permits have been obtained.

3.5.2 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat,

process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Provide in accordance with paragraph PRECONSTRUCTION AIR PERMITS.

3.5.3 Burning

Burning is prohibited on the Government premises.

3.5.4 Class I and II ODS Prohibition

Class I and II ODS are Government property and must be returned to the Government for appropriate management. Coordinate with the Installation Environmental Office to determine the appropriate location for turn in of all reclaimed refrigerant.

3.5.5 Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported immediately to the Contracting Officer. Intentional venting of refrigerants (including most Non-ODS substitute refrigerants) is prohibited per 40 CFR 82.

3.5.6 EPA Certification Requirements

Heating and air conditioning technicians must be certified through an EPA-approved program. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by environmental law.

3.5.7 Dust Control

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Since these products contain Crystalline Silica, comply with the applicable OSHA standard, 29 CFR 1910.1053 or 29 CFR 1926.1153 for controlling exposure to Crystalline Silica Dust.

3.5.7.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed 40 CFR 50, state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a

particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

3.5.7.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.5.8 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not constitute a health hazard.

3.6 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

3.6.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

3.6.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to Installation Environmental Office through the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. Include the following in the report:

Construction and Demolition (C&D) Debris Disposed	cubic yards or tons, as appropriate
C&D Debris Recycled	cubic yards or tons, as appropriate

Construction and Demolition (C&D) Debris Disposed	cubic yards or tons, as appropriate
C&D Debris Composted	cubic yards or tons, as appropriate
Total C&D Debris Generated	cubic yards or tons, as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount must not be included in the recycled amount)	cubic yards or tons, as appropriate

3.7 WASTE MANAGEMENT AND DISPOSAL

3.7.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g., scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 262.11 or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not exhaustive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

3.7.1.1 Sampling and Analysis of Waste

3.7.1.1.1 Waste Sampling

Sample waste in accordance with EPA SW-846. Clearly mark each sampled drum or container with the Contractor's identification number, and cross reference to the chemical analysis performed.

3.7.1.1.2 Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. Provide analytical results and reports performed to the Contracting Officer. Coordinate all activities with Installation Hazardous Waste Manager.

3.7.1.1.3 Analysis Type

Identify hazardous waste by analyzing for the following characteristics: ignitability, corrosivity, reactivity, toxicity based on TCLP results. Laboratory must be certified by the National Environmental Laboratory Accreditation Program (NELAP) or DoD Environmental Laboratory Accreditation Program (ELAP).

3.7.2 Solid Waste Management

3.7.2.1 Project Solid Waste Disposal Documentation Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation Contractor certification must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.7.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with 40 CFR 260, state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Segregate and separate treated wood components disposed at a lined landfill approved to accept this waste in accordance with local and state regulations. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

3.7.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer and Installation Hazardous Waste Manager.

3.7.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with federal, state, and local regulations, including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved

containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, hazardous waste manifests must be signed by personnel from the Installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D.

3.7.3.2 Waste Storage/Satellite Accumulation/90 Day Storage Areas

Accumulate hazardous waste at satellite accumulation points and in compliance with 40 CFR 262 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or one quart for acutely hazardous wastes). If the Contractor expects to generate hazardous waste at a rate and quantity that makes satellite accumulation impractical, the Contractor may request a temporary 90-day or 180-day, as appropriate, accumulation point be established. Submit a request in writing to the Contracting Officer and provide the following information (Attach Site Plan to the Request):

Contract Number	_____
Contractor	_____
Haz/Waste or Regulated Waste POC	_____
Phone Number	_____
Type of Waste	_____
Source of Waste	_____
Emergency POC	_____
Phone Number	_____
Location of the Site	_____

Attach a Waste Determination form for the expected waste streams. Allow 10 working days for processing this request. Additional compliance requirements (e.g., training and contingency planning) that may be required are the responsibility of the Contractor. Barricade the designated area where waste is being stored and post a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.7.3.3 Hazardous Waste Disposal

3.7.3.3.1 Responsibilities for Contractor's Disposal

Provide hazardous waste manifest to the Installations Environmental Office for review, approval, and signature prior to shipping waste off Government property.

3.7.3.3.1.1 Services

Provide service necessary for the final treatment or disposal of the

hazardous material or waste in accordance with 40 CFR 260 - 40 CFR 279, local, and state, laws and regulations, and the terms and conditions of the Contract within 60 days after the materials have been generated. These services include necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal or transportation, include manifesting or complete waste profile sheets, equipment, and compile documentation).

3.7.3.3.1.2 Samples

Obtain a representative sample of the material generated for each job done to provide waste stream determination.

3.7.3.3.1.3 Analysis

Analyze each sample taken and provide analytical results to the Contracting Officer. See paragraph WASTE DETERMINATION DOCUMENTATION.

3.7.3.3.1.4 Labeling

During waste accumulation label all containers in accordance with 40 CFR 262. Prior to offering a waste for off-site transport, determine the Department of Transportation's (DOT's) proper shipping names for waste in accordance with 49 CFR 172 (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the words "Hazardous Waste" or other words to describe the contents of the container in accordance with 40 CFR 262 and applicable state or local regulations.

3.7.3.3.2 Contractor Disposal Turn-In Requirements

Hazardous waste generated must be disposed of in accordance with the following conditions to meet installation requirements:

a. Drums must be compatible with waste contents and drums must meet DOT requirements for 49 CFR 173 for transportation of materials.

b. Band drums to wooden pallets.

c. No more than three 55 gallon drums or two 85 gallon over packs are to be banded to a pallet.

d. Band using 1-1/4 inch minimum band on upper third of drum.

e. Provide label in accordance with 49 CFR 172.101.

f. Leave 3 to 5 inches of empty space above volume of material.

3.7.3.4 Universal Waste Management

GEPA has not adopted the Universal Regulation Rule. Comply with the Guam EPA regulations and installation specific requirements.

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to

prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed.

3.7.3.5 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with 40 CFR 260-262, state, and local requirements, and installation instructions.

3.7.3.6 Disposal Documentation for Hazardous and Regulated Waste

Contact the Contracting Officer or designated representative for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or state permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office. Refer to location special requirements for the Installation Point of Contact information.

3.7.4 Releases/Spills of Oil and Hazardous Substances

3.7.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer and the state or local authority.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and documentation that a verbal notification was made within 20 days. Spill response must be in accordance with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

3.7.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

3.7.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

3.7.6 Wastewater

3.7.6.1 Disposal of Wastewater

Disposal of wastewater must be as specified below.

3.7.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways or to be discharged. Dispose of the construction- related waste water off-Government property in accordance with 40 CFR 403, state, regional, and local laws and Prior to disposal, submit a WIS to the Installation Environmental Officeand have the results reviewed and approved by the Contracting Officer prior to being discharged or disposed of off-Government property.

3.7.6.1.2 Surface Discharge

For discharge of ground water, obtain a state or federal permit specific for pumping and discharging ground water prior to surface discharging. Surface discharge in accordance with federal, state, and local laws and regulations. Surface discharge in accordance with the requirements of the NPDES or state STORMWATER DISCHARGES FROM CONSTRUCTION SITES permit.

3.7.6.1.3 Land Application

Water generated from the flushing of lines after disinfection or hydrostatic testing must be land- applied in accordance with federal, state, and local laws and regulations for land application upon receiving approval from the Installation Environmental Office.

3.8 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Accident Prevention Plan (APP), in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet

the definition of hazardous waste, in accordance with 40 CFR 261 and state and installation requirements.

3.8.1 Contractor Hazardous Material Inventory Log

Submit the "Contractor Hazardous Material Inventory Log"(found at: https://www.wbdg.org/dod/ufgs/forms-graphics-tables), which provides information required by (EPCRA Sections 312 and 313) along with corresponding SDS, to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Keep copies of the SDSs for hazardous materials onsite. At the end of the project, provide the Contracting Officer with copies of the SDSs, and the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used.

The Contracting Officer may request documentation for any spills or releases, environmental reports, or off-site transfers.

3.9 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

3.10 CONTROL AND MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM)

Manage and dispose of asbestos- containing waste in accordance with all applicable federal, state, and local (or Host Nation) requirements. Refer to Section 02 82 00 ASBESTOS REMEDIATION. Manifest asbestos-containing waste and provide the manifest to the Contracting Officer. Notifications to the regulatory authorities and Installation Air Program Manager are required before starting any asbestos work.

3.11 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP)

Manage and dispose of lead-contaminated waste in accordance with 40 CFR 745 and Section 02 83 00 LEAD REMEDIATION. Manifest any lead-contaminated waste and provide the manifest to the Contracting Officer.

3.12 CONTROL AND MANAGEMENT OF POLYCHLORINATED BIPHENYLS (PCBs)

Manage and dispose of PCB-contaminated waste in accordance with 40 CFR 761 and Section 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs).

3.13 CONTROL AND MANAGEMENT OF LIGHTING BALLAST AND LAMPS CONTAINING PCBs

Manage and dispose of contaminated waste in accordance with 40 CFR 761. Refer to Section 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY.

3.14 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered

or uncovered, immediately stop work in that area and immediately inform the Contracting Officer.

Provide Munitions and Explosives of Concern (MEC) screening and escort for any ground-disturbing activities, including vegetation clearance at Tarague FEA.

3.15 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of fuel on the project site must be in accordance with EPA, state, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.

3.15.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

3.15.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overfill protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 5 inches freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 1320 gallons will be used onsite (only containers with a capacity of 55 gallons or greater are counted), provide and implement a Spill Prevention Control and Countermeasure (SPCC) plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

3.16 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

3.17 CHLORDANE

Evaluate excess soils and concrete foundation debris generated during the demolition of housing units or other wooden structures for the presence of chlordane or other pesticides prior to reuse or final disposal.

3.18 SOUND INTRUSION

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives are not permitted without written permission from the Contracting Officer, and then only during the designated times. Confine pile-driving operations to the period between 8 a.m. and 4 p.m., Monday through Friday, exclusive of holidays, unless otherwise specified.

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the Guam rules.

3.19 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

3.20 ATTACHMENTS

Attachment A. Contractor Hazardous Material Inventory Log

Attachment B. Data Recovery Plan for Sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog), Andersen Air Force Base, Guam

Attachment C. P-012 Permits Record of Decision

Attachment D. 2025 Final Environmental Impact Statement (Final EIS) for F-15 Beddown and Infrastructure Upgrade at Andersen Air Force Base, Guam.

Attachment E. Biological Opinion (2025 BO) for Expansions of Aircraft Operations Area at Northwest Field, and Munitions Storage Area (MSA-1), Andersen Air Force Base, Guam, 25 February 2025.

Attachment F. Natural Resources Performance Work Statement (NR PWS)

Attachment G. Low Impact Development (LID) Data Cards

-- End of Section --

CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG
(EPRCA)

PRIME COMPANY NAME: _____ CONTRACT NO: _____

PROJECT TITLE / LOCATION: _____

Material Name	Manufacturer	MSDS Number	State (i.e. Liquid, Solid, Gas)	Storage Quantity		Quality (lbs/gals) used in Calendar Year [ ]
				Average Daily	Max Daily	

Contractor(s) certifies that the hazardous material(s) removed from installation will be used/reused for its intended purpose.

_____ _____

Company Using Material Listed Above Company Representative's Signature

Submitted By: _____ Phone: _____ Fax: _____ Date: _____
Printed Name

Contracting Officer _____ Phone: _____ Fax: _____
or ROICC Representative

CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG
(EPRCA)
Continuation Sheet

PRIME COMPANY NAME: _____ CONTRACT NO: _____

PROJECT TITLE / LOCATION: _____

Material Name	Manufacturer	MSDS Number	State (i.e. Liquid, Solid, Gas)	Storage Quantity		Quality (lbs/gals) used in Calendar Year [ ]
				Average Daily	Max Daily	

Page ____ of ____

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS
Attachment B

DRAFT

Data Recovery Plan for Sites 66-07-2113, 66-07-2117, 66-07-2118 and 66-08-2981 (Fafalog), Andersen Air Force Base, Guam

Environmental Impact Statement for F-15 Beddown and Infrastructure Upgrades at Andersen AFB, Guam

July 2025

This page intentionally left blank.

DRAFT Data Recovery Plan for Sites 66-07-2113, 66-07-2117, 66-07-2118 and 66-08-2981 Andersen Air Force Base, Guam

HDR
369 Inverness Parkway
Suite 325
Englewood, CO 80112
(303) 754-4200

TYPE OF WORK
Data Recovery

PRINCIPAL INVESTIGATOR
Kevin P. Gilmore, PhD, RPA

AUTHOR(S)
Kevin P. Gilmore, PhD, RPA
Paul H. Buckner, MA, RPA
Andrew Mueller, PhD, RPA

DATE: July 2025

This page intentionally left blank.

Abstract

The Department of the Air Force (DAF) has prepared an Environmental Impact Statement, in compliance with the National Environmental Policy Act. This statement addresses the proposal for infrastructure upgrades needed to support the mission requirements of aircraft at Andersen Air Force Base (AFB) in Guam. The use of this infrastructure would be consistent with the types of operations currently occurring on the installation.

In support of the proposed construction of new infrastructure upgrades adjacent to the northwest corner of the airfield (North Ramp) and within Munitions Storage Area 1 (MSA-1), HDR conducted archaeological investigations in 2021 on 204 acres (ac; 82.6 hectares [ha]) scheduled for construction (Gilmore et al. 2023). Historic properties identified in the North Ramp project area are sites 66-07-2113, 66-07-2117, and 66-07-2118 (Gilmore et al. 2023), and a single historic property was identified in the MSA-1 project area, site 66-08-2981 (Fafalog) (Gilmore et al. 2023, 2025).

The presence of possible agricultural features containing burned coconut shell at two of the sites (66-07-2117 and 66-07-2118) indicated that they have potential to provide additional information important to the archaeology of the northern plateau and the sites are recommended eligible for inclusion in the National Register of Historic Places (NRHP) under Criterion D. The discovery of artifacts outside the previous site boundaries during the subsurface testing of three sites (66-07-2110, 66-07-2111, and 66-07-2113) resulted in these three sites being combined into a single site (66-07-2113). The presence at 66-07-2113 of a possible agricultural feature containing burned coconut shell and a surface stain consisting of diffuse charcoal and burned limestone

that was interpreted as possible earth oven clean-out debris indicates this site has the potential to provide information important to the archaeology of the northern plateau. Therefore, the site was recommended eligible for inclusion in the NRHP under Criterion D.

Pedestrian survey within the MSA-1 project area in 2021 identified one Latte period site and four isolated finds. Site 66-08-2981 (Fafalog) was interpreted as a possible Late Latte period ceramic scatter in the western portion of the MSA-1 survey area. Although subsurface testing at Site 66-08-2981 in 2021 did not result in the detection of any features, the density of the ceramic scatter indicates the site represents a relatively intact activity area and has the potential to provide one or more reconstructable ceramic vessels, and possible residue analysis. Examination of historical aerial imagery indicates the site is adjacent to what appear to be multiple agricultural fields of different ages. Examination of lidar data indicated a rectangular anomaly resembling Post-contact period agricultural features is located less than 40 meters (m; 131 feet [ft]) east of the site. In addition, a single human deciduous maxillary molar and an unidentified bone fragment were found in the top 15 centimeters (cm; 5.9 inches [in]) of shovel test pit (STP) 8 at 66-08-2981. Because work was immediately stopped in the vicinity of the human remains, there was insufficient data collected to determine if they represent an intact burial or scattered disarticulated human remains.

A cultural resource pedestrian survey of an expanded MSA-1 project area in 2024 identified additional cultural materials, including three artifact concentrations and two features that were added to an expanded 66-08-2981 footprint. Feature (F) 1 is a possible anthroposol, interpreted as a midden or cleanout debris from a combustion

feature, and F2 is a surface concentration of weathered limestone 8 m (26 ft) long from east to west and 5 m (16 ft) wide from north to south. Artifacts identified at Site 66-08-2981 (Fafalog) in 2024 consist of ceramics, ground stone and abrading tools, lithic debitage and debris, and historical ammunition. Because of the potential to provide additional information vital to the archaeology of the northern plateau, Site 66-08-2981 (Fafalog) was recommended eligible for inclusion in the NRHP under Criterion D (Gilmore et al. 2023, 2025).

As designed, the infrastructure upgrades will result in complete disturbance of the designated project area. As a result, none of the NRHP eligible Sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog) can be avoided during the execution of the proposed undertaking. The Department of Defense (DoD) has determined that the project would have an “adverse effect on historic properties” as defined under 36 Code of Federal Regulations (CFR) Part 800.5, and the Guam State Historic Preservation Office (SHPO) concurred with this determination. Therefore, mitigation of adverse effects in the form of archaeological data recovery will be required prior to the initiation of any ground-disturbing activities in the vicinity of the above sites. This data recovery plan outlines the approach at these sites.

Contents

1 Introduction 1
Project location 3
Project Statement of Work 4
Archaeological Data Recovery Plan Preparation 6
Archaeological Data Recovery Plan Organization 6
2 Background 9
Physiography and Geology 9
Soils and Stratigraphy 10
Disturbance Processes and Archaeological Implications 15
Flora and Fauna 15
Climate 16
Paleoenvironment 17
Mid-Holocene High Stand (circa [ca]. 6000 – 2000 calibrated [cal.] BP, 4000 – 100 Before the Common Era [BCE]) 17
Medieval Climate Anomaly (ca. 1000 – 700 cal. BP, 950 – 1250 CE) 19
AD 1300 Event (ca. 700 – 550 cal. BP, 1250 – 1400 CE) 21
Little Ice Age (ca. 550 – 60 cal. BP, 1400 – 1890 CE) 23
Cultural History of Northern Guam 24
Pre-contact Period 26
Early Pre-Latte Period Occupation of the Tarague Embayment 28
Post-contact Period 41
3 Research Methods 44
General Research Questions 44
4 Site-Specific Data Recovery Objectives 51
Site 66-07-2113 51
Site Summary and Previous Investigations 51
Mitigation Requirements and Data Recovery Plan 56
Laboratory and Data Analysis 57
Research Objectives 59
Site 66-07-2117 59
Site Summary and Previous Investigations 59
Mitigation Requirements and Data Recovery Plan 64
Laboratory and Data Analysis 65
Research Objectives 68
Site 66-07-2118 68
Site Summary and Previous Investigations 70
Mitigation Requirements and Data Recovery Plan 71
Laboratory and Data Analysis 74
Research Objectives 74

Site 66-08-2981 (Fafalog) 75
Site Summary and Previous Investigations 79
Mitigation Requirements and Data Recovery Plan 84
Laboratory and Data Analysis 87
Research Objectives 87
5 Deliverables and Schedule 88
Project Reports 88
Artifact Curation 91
Digital Geospatial Data 91
Geospatial Data Projection 93
Geospatial Data Collection 94
Media for Geospatial Data Deliverables 94
Geographic Data Documentation 94
Ownership 96
Project Schedule 96
6 References 97

Figures

Figure 1. Project location. 2
Figure 2. Location of project areas. 8
Figure 3. Soils within and near the North Ramp project area. 12
Figure 4. Soils within and near the MSA-1 project area. 13
Figure 5. Latte from Epau, Guam (left), and Lieutenant H.G. Hornbostel next to a latte stone on Guam (right) (Gill 1924:162–164). 34
Figure 6. Latte set at Hinapsau, Guam (Gill 1924:155). 34
Figure 7. Proxy Pre-contact population for the Northern Plateau. 39
Figure 8. 1944 Aerial photograph of the North Ramp Area. 47
Figure 9. 1953 Aerial photograph of the North Ramp Area. 48
Figure 10. 1944 Aerial photograph of MSA-1 49
Figure 11. 1953 Aerial photograph of MSA-1 50
Figure 12. 66-07-2113 site map 53
Figure 13. 66-07-2113 ceramic density map. 58
Figure 14. 66-07-2117 site map 62
Figure 15. Site 66-07-2117, Feature 66-07-2117.0001, STP 370E; 620N west profile. 65
Figure 16. 66-07-2117 ceramic density map. 67
Figure 17. 66-07-2118 site map 69
Figure 18. 66-07-2118 ceramic density map. 73
Figure 19. Site 66-08-2981 site map (north half). 77
Figure 20. Site 66-08-2981 site map (south half). 78
Figure 21. Kernel density analysis of Site 66-08-2981. 86

Tables

Table 1. Guam SHPO historic context periods. 24
Table 2. Site 66-08-2981 artifacts encountered in 2021 and 2024. 75
Table 3. Radiocarbon dates and calibrated ages obtained from Site 66-08-2981. 82
Table 4. Project Schedule 96

Appendices

Appendix A. Munitions and Explosives of Concern Support Work Plan

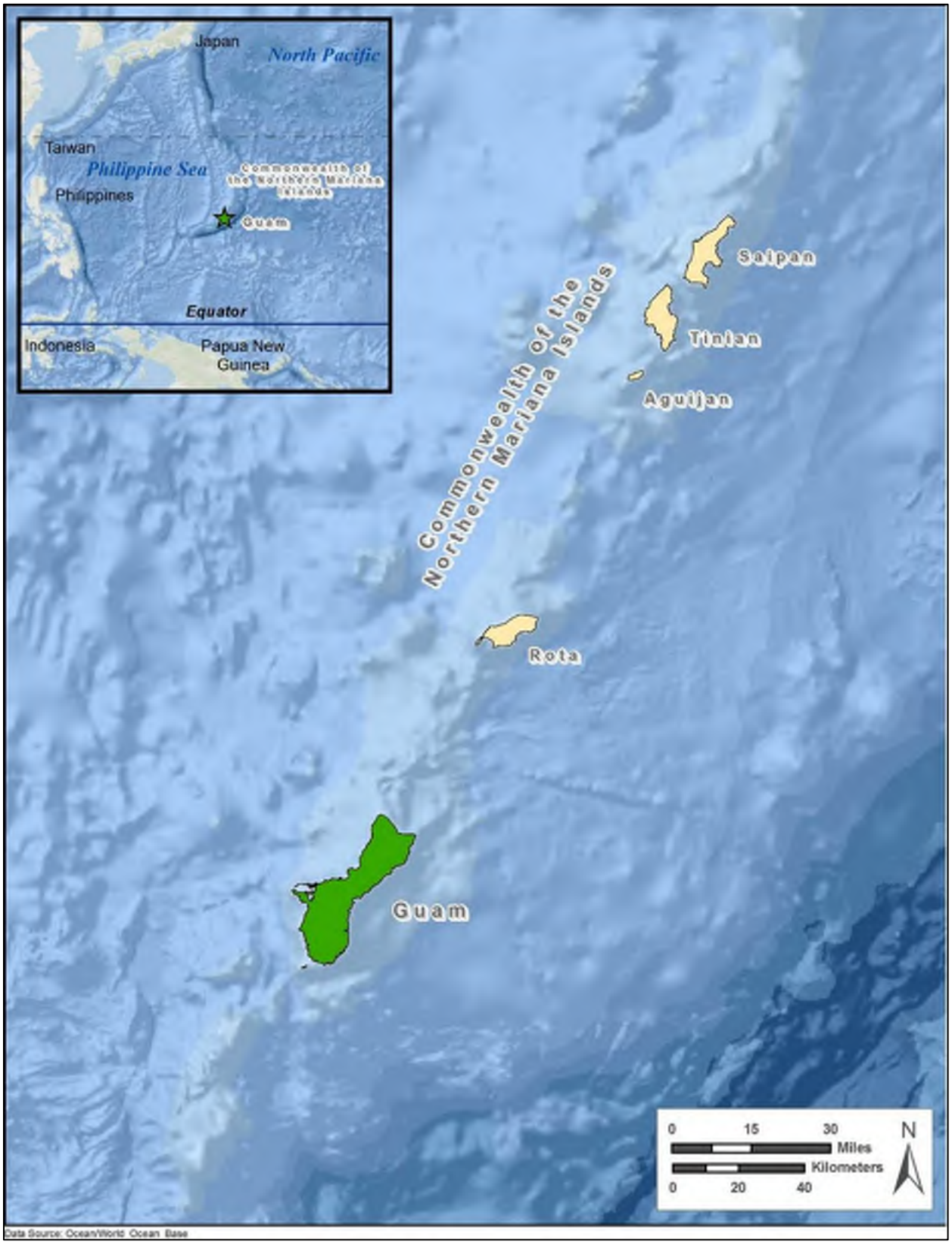
Acronyms

ac	acre(s)
AD	Anno Domini
AFB	Air Force Base
AMS	Accelerator Mass Spectrometry
APE	Area of Potential Effects
BCE	Before the Common Era
bgs	below ground surface
BP	Before Present
ca	circa
cal.	calibrated
CD	compact disc
CD-ROM	compact disc, read-only memory
CE	Common Era
CFR	Code of Federal Regulations
cm	centimeter(s)
CRM	Cultural Resource Manager
DAF	Department of the Air Force
DoD	Department of Defense
DVD	Digital Versatile Disc
F	Feature
FGDC	Federal Geographic Data Committee
ft	feet (foot)
g/m2	grams per square meter
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare(s)
in	inch(es)
km	kilometer(s)
KO	Contracting Officer
LIA	Little Ice Age
m	meter(s)
m2	square meter(s)
MCA	Medieval Climate Anomaly
µg/cm2	micrograms per square centimeter
MHHS	Mid-Holocene High Stand
mi	mile(s)
MSA	Munitions Storage Area
NAVFAC	Naval Facilities Engineering Command
NRHP	National Register of Historic Places
PA	Programmatic Agreement
PWS	performance work statement
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment
SHPO	State Historic Preservation Office
SPD	summed probability distribution
SST	sea surface temperatures
STP	shovel test pit
WWII	World War II

1 Introduction

At the request of the Department of the Air Force (DAF), HDR has prepared a project-specific archaeological data recovery plan for multiple archaeological sites within the proposed infrastructure upgrades at Andersen Air Force Base (AFB), Territory of Guam (Figure 1). The purpose of the Proposed Action is to enhance Andersen AFB's capability to support permanent and rotational forces within the Indo-Pacific region and strengthen the United States' ability to respond regionally and worldwide, in alignment with evolving DAF and Department of Defense (DoD) strategies and initiatives for the region. The Proposed Action is needed to meet national security objectives and improve Andersen AFB's ability to support the mission requirements for permanent and rotational aircraft in the face of evolving global security challenges. The Proposed Action includes construction of new infrastructure upgrades adjacent to the northwest corner of the airfield (North Ramp) and within Munitions Storage Area 1 (MSA-1) at Andersen AFB. This data recovery plan would mitigate adverse effects to known historic properties that would be directly impacted by the proposed infrastructure upgrades. Construction of the infrastructure would involve mechanical excavation, sediment removal and recontouring for stormwater outfall basins, and construction of pavements and buildings that will adversely affect three cultural resources in North Ramp and one cultural resource at MSA-1 that the DAF has determined are eligible for inclusion in the National Register of Historic Places (NRHP). Given the project needs, it is unlikely that any of the historic properties can be avoided by modifying the current design plans. However, data recovery will not occur at any site that can be avoided during construction.

Figure 1. Project location.



Project location

The four historic properties that will be adversely affected by the Proposed Action are within the North Ramp and MSA-1 project areas on Andersen AFB (Figure 2). Andersen AFB is a United States military installation on the island of Guam that is administered by the DAF. Guam is in the Western Pacific Ocean and lies approximately 3,700 miles (mi; 5,954 kilometers [km]) west of Hawaii. The island is the most southerly and largest in the Mariana Islands chain. Guam is 30 mi (48 km) long, with a width of 4 to 8 mi (6.4 to 12.8 km) and a total land area of approximately 209 square mi (541 square km). Andersen AFB covers 16,021 acres (ac; 6,483 hectares [ha]) or approximately 25 square mi (64.7 square km) on Guam's northern plateau and is situated on an escarpment above the Tarague Embayment that is characterized by low relief sloping terrain underlain by limestone bedrock.

Within Andersen AFB, the North Ramp project area encompasses 192 ac (77.7 ha) of forested land adjacent to the apron and taxiways of the North Field runways. This area is the north edge of the original World War II (WWII)-era airfield, which is now Andersen AFB's current active airfield. The North Ramp project area is largely undeveloped, apart from two lightly used roads on utility corridors through the area. Some vegetation clearing has occurred in the southeast portion of the North Ramp project area, where various pieces of debris and abandoned equipment are located. The area is seldom used, although conversations with an Air Force security patrol indicated the area is periodically used for K9 training (Gilmore et al. 2023). Historic properties identified in the North Ramp project area are Sites 66-07-2113, 66-07-2117, and 66-07-2118 (Gilmore et al. 2023).

The MSA-1 project area is within Andersen AFB's munitions storage area (Figure 3). The eastern part of the munitions storage area consists of a series of munitions storage igloos, or earth-covered magazines, which are accessible by a grid of paved access roads. The western part of the facility is less developed, although some clearing and grading have taken place. The MSA-1 project area includes portions of C Avenue and areas cleared for munitions storage igloos, interspersed with undeveloped areas of relatively mature tropical forest. The 2021 MSA-1 project area was 12 ac (4.8 ha), consisting of developed and grassy areas between roads within the larger ammunition igloos complex. The MSA-1 supplemental survey area surveyed in 2024 was 5.5 ac (2.2 ha) adjacent to the previous survey area and was located in the margins of existing roads, pads cleared to bedrock for munitions bunker placement, and small areas of relatively mature tropical forest (Gilmore et al. 2025). The historic property identified in the MSA-1 project area is Site 66-08-2981 (Fafalog) (Gilmore et al. 2023, 2025).

Project Statement of Work

The Statement of Work for the proposed action requires HDR to develop a mitigation strategy for historic properties that may be adversely affected by the undertaking in consultation with the DAF and the Guam State Historic Preservation Office (SHPO). The Proposed Action is anticipated to result in the destruction of all or part of NRHP eligible Sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog). The Proposed Action will result in adverse effects as defined in section 800.5(a)(1) of the Advisory Council on Historic Preservation's implementing regulations for the National Historic Preservation Act at 36 Code of Federal Regulations (CFR) Part 800. Construction activities associated with this federal action are expected to result in the

loss of integrity for these properties, and removal of subsurface archaeological deposits will adversely affect their ability to convey their significance under Criterion D. In recognition of these adverse effects, DAF has invited the Advisory Council on Historic Preservation to comment on this data recovery plan, which is being prepared to conform to the 2008 Programmatic Agreement (PA) for the Andersen AFB Infrastructure Upgrades undertaking. The purpose of the PA was to establish mitigation activities for anticipated adverse effects to any NRHP-eligible archaeological sites impacted by the proposed action. This includes the North Ramp (Sites 66-07-2113, 66-07-2117, and 66-07-2118) and MSA-1 (Site 66-08-2981) areas. Accordingly, HDR has prepared this archaeological data recovery plan as a preferred mitigation for the resolution of these adverse effects.

In preparation for archaeological data recovery at the above sites, HDR reviewed and reevaluated the NRHP eligibility status of 18 previously recorded archaeological sites in the North Ramp project area and conducted initial and supplemental Class III cultural resources surveys of the MSA-1 project area to identify potential historic properties and delineate subsurface components (Gilmore et al. 2023, 2025). In 2021, HDR archaeologists conducted archaeological investigations on 204 ac (82.6 ha) scheduled for construction across the North Ramp and MSA-1 project areas (Gilmore et al. 2023). Within the MSA-1 area of potential effects (APE), cultural work consisted of a pedestrian survey to locate previously unidentified cultural resources. These investigations included subsurface testing of one newly documented site to determine the site boundary and support NRHP eligibility recommendations. A total of 60 shovel test pits (STPs) were excavated to define the boundaries of Site 66-08-2981 (Fafalog) within the

original 12 ac (4.8 ha) MSA-1 APE in 2021 (Gilmore et al. 2023), and an additional 58 STPs were excavated on a 10 meter (m; 32.8 foot [ft]) grid and to further define the boundary of Site 66-08-2981 (Fafalog) in the 5.5 ac (2.2-ha) MSA-1 supplemental survey area (Gilmore et al. 2025). Within the North Ramp APE, HDR revisited 18 previously documented sites recommended as not eligible for the NRHP in Grant et al. (2007). These sites included two historical sites and 16 Pre-contact sites. Seven hundred and sixty-three STPs were excavated in the North Ramp sites to delineate site boundaries and confirm previous NRHP eligibility evaluations.

Archaeological Data Recovery Plan Preparation

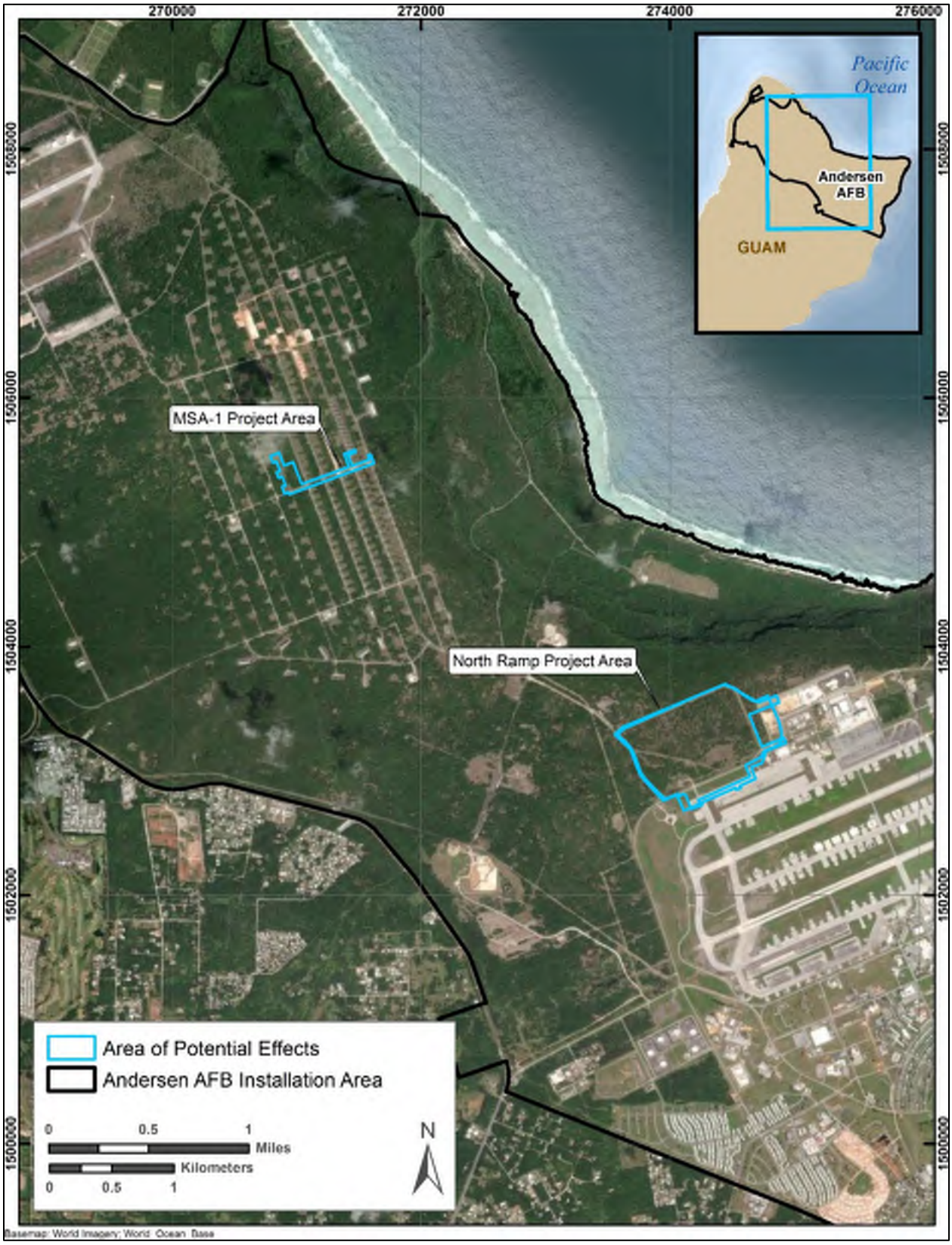
This data recovery plan was developed based on the results of Gilmore et al. (2023); specifics for Site 66-08-2981 (Fafalog) also rely on the results of Gilmore et al. (2025), and supporting contextual research on the archaeology of the Tarague Embayment. In addition, the results and recommendations of previous archaeological contract reports for the area, including those by Grant et al. (2007), Yoklavich and Tuggle (2004), DeFant and Guerrero (2006), Welch (2010), Mason Architects, Inc. (2004), Dixon et al. (2018) and Hlatky and Maxwell (2018), were also consulted. Together, the data recovery plan synthesizes these data to define research objectives and data requirements necessary to address research questions associated with planned data recovery at sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog).

Archaeological Data Recovery Plan Organization

This archaeological data recovery plan is organized in a manner that best contextualizes planned data recovery activities at sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog) within the framework of the known archaeological

record on the Tarague Embayment. Section 1 provides an introduction that summarizes the proposed infrastructure upgrades at Andersen AFB, the need for archaeological data recovery, and the work that has been completed to date. Section 2 presents background research on the environmental, paleoenvironmental, and cultural context of northern Guam with the objective of laying a foundation for data recovery at 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog). Section 3 presents the research questions, general objectives for the planned data recovery, and anticipated findings. Section 4 summarizes previous work at sites 66-07-2113, 66-07-2117, 66-07-2118, and 66-08-2981 (Fafalog) and site-specific data recovery objectives and methodologies. Section 5 describes the general schedule and deliverables that the proposed archaeological data recovery will generate. A Munitions and Explosives of Concern Support Work Plan is appended to the archaeological data recovery plan.

Figure 2. Location of project areas.



2 Background

This section provides the physical and cultural context necessary for assessing the significance of four sites in North Ramp and MSA-1. It establishes the physical and cultural framework to formulate hypotheses and research questions necessary to guide data recovery. Additionally, it provides the theoretical context for evaluating the outcomes of the data recovery.

Physiography and Geology

Guam is divided into two distinct physiographic provinces by the Adelup Fault (Tracey et al. 1964). To the south of this fault, the region is primarily composed of volcanic rocks dating to the late Eocene through Miocene epochs. In contrast, north of the fault features a low-angle limestone plateau, dominated by the Miocene-Pliocene-age Barrigada limestone. This limestone is exposed on the surface in the interior of the limestone plateau but transitions laterally and upward into the various facies of the Pliocene-Pleistocene-age Mariana limestone (Taborosi et al. 2005:20). The North Ramp and MSA-1 project areas are underlain by the reef facies of the Mariana limestone (Taborosi et al. 2005:19).

Coralline limestone tends to develop small solution depressions in the epikarstic zone of low-angle limestone bedrock, where sediment often accumulates. Outside of these specific landscape contexts, the fine-textured material accumulating on the surface of the dissolving limestone bedrock is relatively thin and contains weathered pieces of the underlying limestone.

Soils and Stratigraphy

The soils mapped within the project area are uniform, reflecting the homogeneity of the underlying geology. They are differentiated based on ground slope, bedrock depth, and disturbance level. Soils in the project area are dominated by the Guam soil series, taxonomically classified as isohyperthermic Lithic Ustorthents. These soils have developed in a relatively warm temperature regime, where moisture is present but limited during certain parts of the year and lack horizon development (USDA NRCS 2021). In the North Ramp project area, soils are primarily classified as Guam cobbly clay loam (3 to 7% slopes) (Figure 3), which is a shallow (5 to 25 centimeters [cm; 2.0 to 9.8 inches (in)] to bedrock) soil developed in residuum derived from coralline limestone (Young 1988).

The soils in the MSA-1 project area are mapped as Guam-Urban land complex (0 to 3% slopes) (Figure 4). The complex consists of at least 55% Guam soils and 45% urban area (Young 1988). Due to their shallow and well-drained nature, Guam soils are considered poorly suited for agriculture. However, they can be productive when irrigated (Young 1988:11). Areas mapped as Guam soils contain small areas of Yigo soils. Compared to Guam soils Yigo soils are deep (100 cm [39.4 in]) to very deep (greater than 150 cm [59.1 in] to bedrock), and have developed in slope alluvium within karstic depressions on the surface of the underlying limestone bedrock (Young 1988).

Because the limestone is permeable and the soils are well-drained, the weathering products in Yigo soils have been rapidly removed. This has resulted in characteristics typical of ancient soils, such as low cation exchange capacity and gibbsitic mineralogy. (Young 1988:106). This suggests that both Yigo soils and the contemporary Guam soils

predate the human colonization of the Mariana Islands (circa 3,500 Before Present [BP]) and by extension predate the significant increase in settlement in the North Ramp project area, which, based on diagnostic artifacts, began after circa 1000 Common Era (CE) in the Latte period (Grant et al. 2007). Therefore, any artifacts buried within these soils have been translocated into the subsurface due to post-depositional disturbance processes instead of through the natural accumulation of sediments.

Ritidian soils, which are mapped adjacent to the North Ramp and MSA-1 project areas but not within the project area itself, are shallow, well drained, thin, rocky, and poorly suited for agriculture (Young 1988:50). To the east of the project area, the Tarague Embayment contains some areas where sediments can be relatively thick. However, the deposits have been disturbed in many locations, likely due to storm events, and therefore do not retain intact stratigraphy. In other areas of the embayment, further from the shoreline, pockets of deep sediments appear to be intact, based on the presence of temporally diagnostic ceramics found in proper stratigraphic order. Some of the oldest pre-contact dates in Guam have been obtained from archaeological sites within these intact sediments in the Tarague Embayment (Kurashina and Clayshulte 1983a, 1983b).

Figure 3. Soils within and near the North Ramp project area.

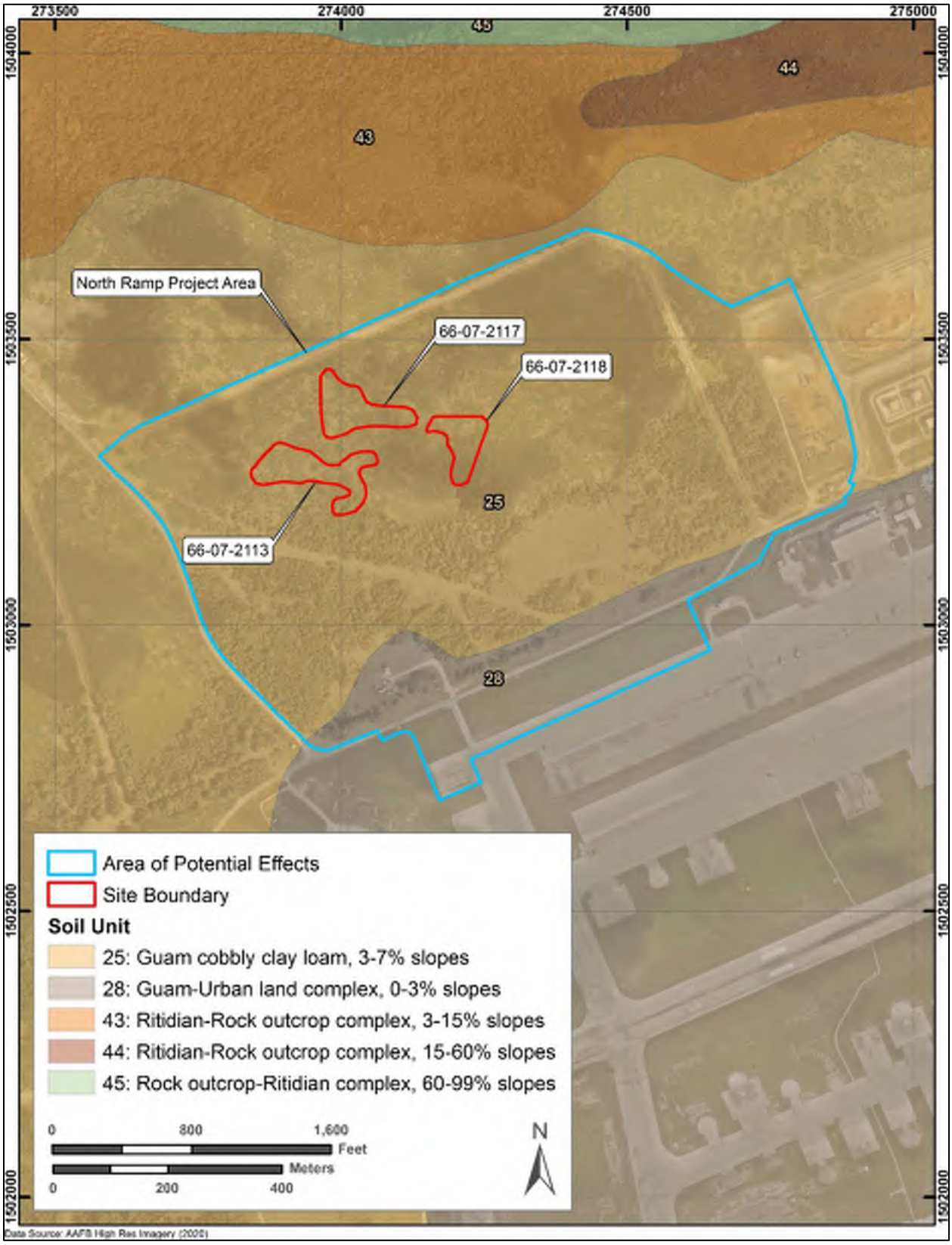
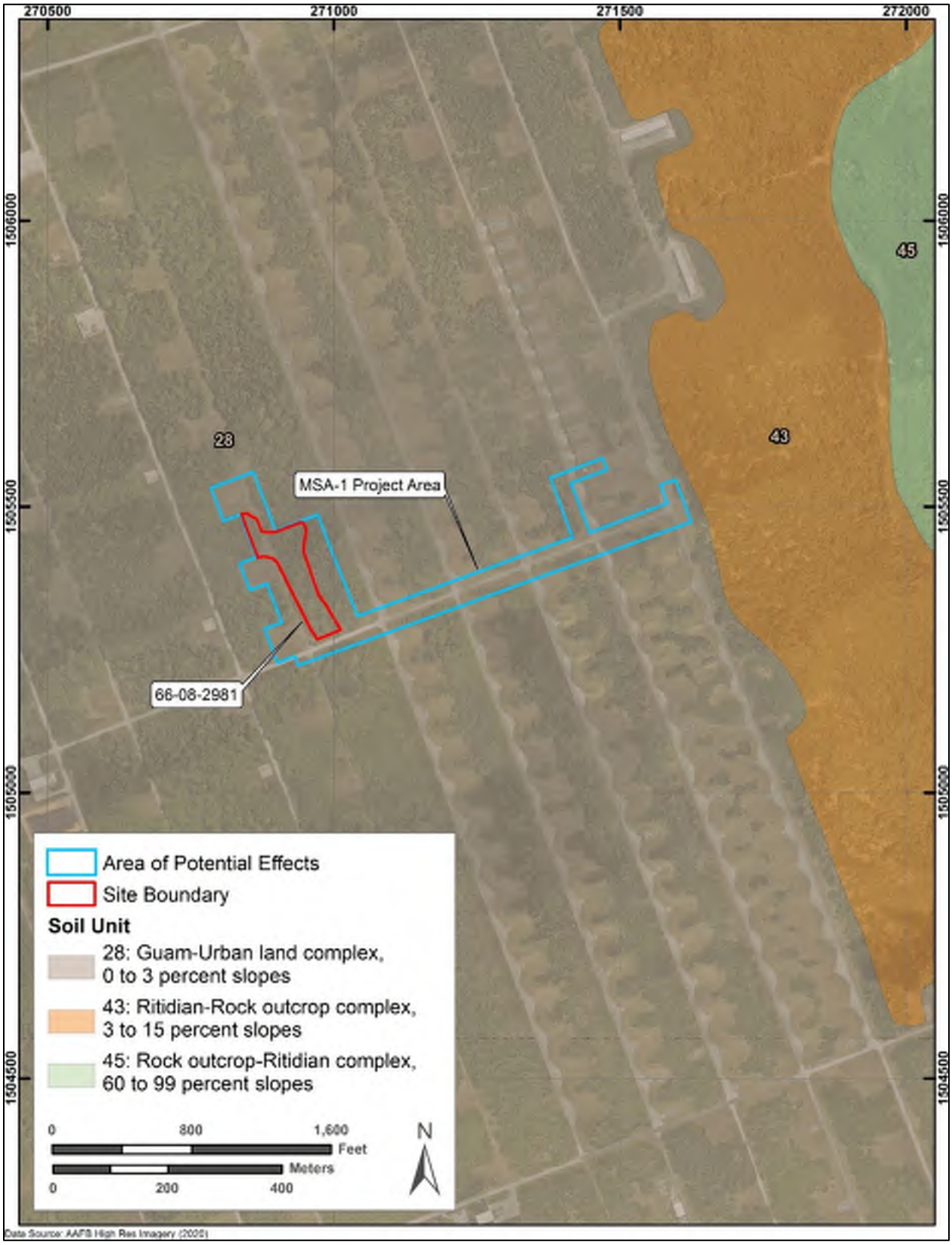


Figure 4. Soils within and near the MSA-1 project area.



Several factors contribute to the stability of Guam soils, which have an erodibility factor (K) of 0.05 on a scale that extends from 0.02 (least erodible) to 0.69 (highly erodible) (Young 1988:Table 12). The soils are located on low-angle landforms on the northern plateau, resulting in a low potential for colluvial transport. The soils have a moderately rapid permeability, which leads to very low water retention (Young 1988:Table 12). Due to the high permeability, runoff is almost non-existent, and as a result, there are no permanent drainages on the northern plateau; therefore, there is no fluvial transport of sediments.

Additionally, the low-angle slopes on the northern plateau present little opportunity for sediment transport through sheet wash or rill erosion. Due to the humid climate and ubiquitous vegetation cover, there is also a lack of exposed sediment available for eolian transport on the limestone plateau. Although dust carried aloft from deserts in east Asia (and to a lesser extent from volcanoes in the western Pacific) is transported and deposited in the western Pacific, it is in amounts that are effectively insignificant, and far too small to contribute to the burial of archaeological materials (Uematsu et al. 1983; Seo et al. 2014).

Measurements show that modern dust flux between 5 and 15 North latitude from Asian sources ranges from 6 to 15 micrograms per square centimeter (µg/cm^2 per year; Uematsu et al. 1983:5350), representing a maximum rate of deposition of 150 grams per square meter (g/m^2) per 1,000 years. This means the equivalent of less than two hundredths of a centimeter of accumulation. The radiocarbon dates on foraminifera in a core from the Philippine Sea, located midway between the Philippines and Guam, support this low deposition rate. These samples, taken from the upper 4 to 5 cm (1.6-

2.0 in) of sediment, returned dates of more than 11,000 years BP and indicated that the dust flux was dominated by material that was chemically traced to east Asian deserts (Seo et al. 2014:11,495).

Disturbance Processes and Archaeological Implications

Natural biomechanical processes can significantly influence archaeological sites within seemingly stable upland landforms, disrupting the original archaeological patterns (Schiffer 1987). Artifacts may be categorized by size, temporally intermixed, and dislocated laterally and vertically. It is a common perspective among archaeologists that the surface can be considered stable in the absence of erosion or deposition, and consequently, so can the soil. In context, a stable soil would remain there unless new sediment were to cover it. However, a stable geomorphic surface does not necessarily mean the soil is stable or static (Atkinson 1957). Balek (2002) observed, "Burial of most, if not all, artifacts in stable upland soils developed in pre-Holocene sediments in nonfeature contexts, is due to vertical movement of the artifact in response to normal biologic activity, namely, burrowing and mounding by earthworms, ants, and other fauna, and by tree-uprooting" (2002:49). For a more comprehensive analysis of the various disturbance processes potentially affecting the integrity of archaeological sites on the limestone plateau, refer to Gilmore et al. (2023).

Flora and Fauna

Vegetation in northern Guam is primarily classified as limestone degraded forest, with lesser areas of limestone native forest and scrubland. The limestone degraded forest is dominated by species such as vitex (*Vitex parviflora*), tangantangan (*Leucaena leucocephala*), mapunyao (*Aglaia mariannensis*), pandanus (*Pandanus tectorius*), and

Premna serratifolia. Limestone native forest species include nunu (*Ficus prolixa*), fagot (*Ochrosia oppositifolia*), pandanus (*Pandanus* spp.), macaranga (*Macaranga thompsonii*), and pago (*Hibiscus tiliaceus*) (DON 2022).

The developed portions of Andersen AFB are vegetated with various ornamental native and non-native species and extensive areas of low turf grasses.

The fauna on Andersen AFB consists mainly of non-native species that have outcompeted native species. These include domestic dogs (*Canis lupus familiaris*), domestic cats (*Felis catus*), feral pigs (*Sus scrofa*), cattle (*Bos taurus*), and several species of rats (*Rattus norvegicus, Rattus exulans,* and *Rattus tanezumi*). Limited native faunal species observed at Andersen AFB include the Mariana fruit bat (*Pteropus mariannus mariannus*), Mariana crow (*Corvus kubaryi*), Micronesian starling (*Aplonis opaca*), white-throated ground dove (*Gallicolumba xanthonura*), one native skink species (*Emoia caeruleocauda*), one native gecko species (*Nactus pelagicus*), and the Mariana eight-spot butterfly (*Hypolimnas octocula*) (DON 2022).

Climate

Guam is in a humid maritime tropical climate zone, with an average temperature of 81 degrees Fahrenheit (27 degrees Celsius) and minimal seasonal variation. The island receives an average annual rainfall of 226 cm (89 in). The rainy season spans from July to December, accounting for approximately two-thirds of the annual rainfall (Gingerich et al. 2015).

Paleoenvironment

Studying paleoenvironment is valuable for several reasons, two of which are critical. First is the context it provides for examining the adaptations of ancient people to their environment. Second is the insight it provides into site formation processes vital to the proper interpretation of the archaeological record.

However, climate can manifest in different ways. Depending on the mechanisms involved in how climate is translated into local environmental conditions, the same climate can be expressed differently between regions and even within a single region. Therefore, when used with caution, paleoenvironmental reconstructions can provide useful insight into what influence, if any, the environment had on human cultural adaptation and how this is reflected in the archaeological record.

Three paleoenvironmental episodes and one "event" have been identified as important to understanding the initial colonization of Guam and the subsequent development of Pre-contact Chamorro society: the Mid-Holocene High Stand (MHHS), the Medieval Climate Anomaly (MCA), the Anno Domini (AD) 1300 Event, and the Little Ice Age (LIA).

Mid-Holocene High Stand (circa [ca]. 6000 – 2000 calibrated [cal.] BP, 4000 – 100 Before the Common Era [BCE])

The MHHS was an episode of increased sea level above preindustrial mean sea level, resulting from eustatic sea level rise due to melting continental glaciers and ice caps during the early Holocene. This rise was subsequently reinforced by hydro-isostatic increase in sea level driven by readjustment of the Earth's shape to deglaciation, resulting in loss of mass in the higher latitudes (Mitrovica and Peltier 1991, in Dickinson

2003). In response to this readjustment, water was siphoned from continental shelves into the deep sea. The magnitude and timing of the MHHS was complex, with high stands in some regions coinciding with low stands in others. Sea level discrepancies of several meters have been documented between regions or even in different reaches of a single coast (Woodroffe and Horton 2005).

At its greatest extent in the middle Holocene, relative sea level in the Northern Mariana Islands, based on paleoshoreline indicators, ranged between 1.2 and 3.0 m (3.9 to 9.8 ft) above mean modern sea level. Of this total, 0.6 to 1.2 m (2.0 to 3.9 ft) resulted from non-hydro-isostatic influences (Dickinson 2001). During the same period, relative sea level for northern Guam was reported to be 2.5 to 2.7 m (8.2 to 8.9 ft) above mean modern sea level, with approximately 0.8 m (2.6 ft) attributable to non-hydro-isostatic influences (Dickinson 2001).

When the Mariana Islands were first colonized (ca. 3500–3300 cal. BP), sea level was approximately 1.46 m (4.8 ft) above current mean sea level, and by 2000 cal. BP sea level had declined to 0.7 m (2.3 ft) above modern mean sea level (Nunn and Carson 2015). This was the case for island groups throughout the western Pacific, with sea level falling an average of 0.7 m (2.3 ft) from 3500 BP to 200 BP (Nunn and Carson 2015). Because the first inhabitants of northern Guam occupied embayments on the shoreline and subsisted primarily on the marine resources provided by productive near shore reefs formed during the MHHS, sea level rise had a significant impact on the habitat and, in turn, the productivity of near shore environments critical to the humans that relied on them.

As temperatures and sea levels began to decrease after the end of the Holocene Thermal Maximum, ca. 3000 cal. BP, the reefs formed during the MHHS in the western Pacific were elevated above the tide line. These exposed reefs could no longer provide the habitat necessary for the shellfish that humans had relied on for the previous five hundred years. This significant decrease in near-shore environments necessitated a shift to much greater reliance on the products of agriculture and other terrestrial resources. Subsistence strategies that formerly relied almost exclusively on foraging for marine resources, augmented by minor amounts of terrestrial resources, shifted to mixed economies that still relied on marine resources but focused much more on terrestrial food production. The timing of this transition was relatively consistent throughout the western Pacific (Nunn and Carson 2015). Although the basis of human economy had shifted, the locations of settlements had not, and most habitation sites and agriculture were still concentrated near shorelines. These economic changes were accompanied by social changes, and the synchronous occurrence of this transition across a broad geographic region suggests it was due to environmental factors, "plausibly as a result of climate-driven environmental changes" (Nunn and Carson 2015:25).

Medieval Climate Anomaly (ca. 1000 – 700 cal. BP, 950 – 1250 CE)

The MCA, also called the Medieval Warm Period, refers to a period of warmer temperatures recognized in many areas of the Northern Hemisphere, beginning ca. 950 CE and lasting until ca. 1250 CE (Bradley 2000; Broecker 2001; Mann and Jones 2003). However, evidence suggests that the MCA was perhaps not as spatially coherent as previously thought. Different regions around the globe experienced

asynchronous climate conditions, and there are indications that it was not characterized by uniformly warm temperatures but was instead more accurately characterized as a period of increased variability in climate (Bradley 2000; Broecker 2001). Hence, the term “Climate Anomaly” instead of “Warm Period” is preferred.

Although temperatures in North America and Europe were relatively warm, oxygen isotope analysis of fossil corals from Palmyra Island (5,880 km [3,654 mi] east of Guam) provides a paleoclimate record suggesting cool sea surface temperatures resulted in cool and/or dry conditions in the central tropical Pacific concurrent with warm and wet conditions in Europe that started in the tenth century CE, and gradually warmed into the twelfth century CE (Cobb et al. 2003). Cool sea surface temperatures in the Western Pacific were concurrent with La Niña-like conditions in the Eastern Pacific that contributed to widespread severe drought documented in North America during the MCA (Cobb et al. 2003).

Multiproxy records for eastern Indonesia indicate drier conditions during the MCA; however, drier conditions in Indonesia were accompanied by wetter conditions in the central and eastern equatorial Pacific (Griffiths et al. 2016:4). After a survey of existing paleoclimatic data, Allen (2006) characterized the MCA in the central Pacific as a generally warm, dry episode. Nunn et al. (2007) also characterized the MCA as a warm, dry episode that was a “time of plenty” accompanied by increased sociopolitical complexity in many societies in the Pacific Basin. This increase in complexity was reflected archaeologically by the construction of monumental architecture and the development of long-distance trade networks, indicating increased social stratification. Nunn et al. (2007) also noted that others had attributed some of the social changes that

occurred during the MCA to "unverifiable notions" such as increasing population, but climate changes offered a much more reasonable explanation for widespread coeval changes (2007:386).

AD 1300 Event (ca. 700 – 550 cal. BP, 1250 – 1400 CE)

The AD 1300 Event is described as a period of rapid cooling, possible increased precipitation, and a drop in sea level, marking the transition between the MCA and the LIA that occurred 1250–1350 CE (Nunn 2000; Nunn et al. 2007). Based on additional paleoenvironmental evidence, in addition to cooling the AD 1300 Event can also be characterized as a period of climatic instability reflected in increase in the amplitude and frequency of climate factors such as temperature and precipitation (Gilmore et al. 2023; Mann et al. 2009), and based on several factors discussed below, the end date for the AD 1300 Event is extended here to 1400 CE.

If the previous MCA was a "time of plenty," and the subsequent LIA is characterized as a "time of less" (Nunn et al. 2007:387), the AD 1300 Event represents an unstable transition between these two relatively steady states. Nunn et al. (2007) define the AD 1300 Event based on archaeological evidence and present multiple case studies (although none from the Mariana Islands) that support their model. They argue that the adverse impact of falling sea levels on the productivity of coastal environments was the key driver of social and economic reorganization. However, Fitzpatrick (2010, 2011) disputes this contention, citing the specific example of Palau, one of the case studies used by Nunn et al. to support their model, arguing that the archaeological evidence for Palau does not indicate that 1250–1350 CE was a period of universal societal change and cultural upheaval (Fitzpatrick 2010, 2011). Fitzpatrick also highlights that climate

conditions can be highly variable over larger geographic regions, which is undoubtedly true. In addition to spatial variability in climate, the AD 1300 Event was more importantly characterized by greater temporal variability.

Recent research published after Nunn et al. (2007) further supports the contention that the transitional AD 1300 Event between the MCA and the LIA was characterized in many places, including the western Pacific, as a period of unstable climate. Records of stable oxygen isotopes derived from speleothems from a cave in eastern Indonesia, as well as regional and world models of hydroclimate, indicate that conditions in the western Pacific became drier and cooler within a relatively short period after ca. 1250 CE (Griffiths et al. 2016). Although the AD 1300 Event is not explicitly discussed by Mann et al. (2009), reconstructed sea surface temperatures (SST) for several regions in the northern hemisphere indicate both a significant drop in SST coupled with substantial increase in the variability in SST during the period 1300–1400 CE (Mann et al. 2009:Figure 1). A significant increase in climate variability results in increased unpredictability in the availability of critical food resources, increasing food insecurity and social instability.

Several significant volcanic eruptions could explain rapid climate changes during the 1250–1350 CE period. Miller et al. (2012) documented an abrupt onset of summer cooling and glacial increases in Arctic Canada between 1275 and 1300 CE, with significant intensification of cold between 1430 and 1455 CE (Miller et al. 2012). Closer to the western Pacific, Lavigne et al. (2013) documented an eruption of the Samalas volcano in Indonesia in 1257 CE that was determined to be the most significant volcanic release of sulfur in the past 7,000 years and ranks as one of the most significant

explosive volcanic eruptions of the Holocene; the eruption is identified in ice cores from both Greenland and Antarctica. Cool temperatures in the second half of the thirteenth century are likely attributable to this eruption (Lavigne et al. 2013:16746). These changes led to a reorganization of subsistence and settlement patterns, and in many island groups in the western Pacific (but not *all*), there was a significant movement inland from coastal settlements (Nunn et al. 2007:387).

Little Ice Age (ca. 550 – 60 cal. BP, 1400 – 1890 CE)

The LIA in the western Pacific was a period of greater moisture, whereas the central and eastern Pacific experienced drier conditions (Griffiths et al. 2016:4). In contrast to the characterization of the MCA, Nunn et al. (2007) characterize the LIA as "a time of less," during which societies were reorganized, many coastal settlements were abandoned, fewer marine resources were used, and less productive small islands and the inland areas that had been sparsely occupied during the MCA were occupied much more extensively (Nunn et al. 2007:387). This characterization was based on archaeological evidence representing widespread social upheaval and conflict, based on significant changes in settlement patterns and diet. These changes are attributed to cooling temperatures and falling sea levels, further impacting the productivity of near-shore environments, thus requiring even greater reliance on terrestrial food production. Resource stress led to significant development of inland areas for agricultural production, not just as sources for foraged plant resources (Nunn et al. 2007). After the disruption of the AD 1300 Event, most paleoenvironmental proxies point toward sustained cool and dry conditions in the western Pacific during the LIA (Allen 2006; Mann et al. 2009).

Cultural History of Northern Guam

Cultural context review for NRHP historical significance of archaeological sites will follow the Guam SHPO's established periods (Table 1). The Guam SHPO has created a context for Guam that divides the Pre-contact and Post-contact occupation of the island into 14 temporal periods. Seven of these divisions predate the arrival of European explorers (ca. 1500 BCE–1521 CE), and seven periods cover the Post-contact era (1521 CE–present). A brief overview of the cultural history of northern Guam, focused on the Tarague Embayment, is outlined below.

Table 1. Guam SHPO historic context periods.

Date Range	Period Name	Description
1500–1000 BCE	Early Pre-Latte Period	Artifact assemblages consists of common shell tools/ ornaments, chert tools, and ceramic artifacts. Ceramic technology consists largely of thin-walled vessels dominated by rounded jars and bowls with thin rims and calcareous temper. Major pottery types include Marianas Red, Achugao, and Sant Roque incised. Settlements are concentrated on the coast, and subsistence activities are focused on the procurement of marine resources.
1000–500 BCE	Middle Pre-Latte Period	Ceramic artifacts display slightly thicker walls than the Early Pre-Latte period. Marianas Red pottery remains common. Pottery displays more prominent impressed designs filled with lime. Subsistence strategies retain a marine focus, but more evidence exists for the inclusion of inland resources.
500 BCE–500 CE	Late Pre-Latte Period	Ceramic artifacts from this period are dominated by large, thick-walled pans and bowls with Type A (unthickened) rims. Ceramic temper is mostly mixed sand. Some vessels have mat impressions or Ipao Stamped decorations. Settlement remains focused on the coastline, but expansion inland along river valleys occurs during this period.
500–800 CE	Transitional Period	Ceramic artifacts move from Type A (unthickened) to Type B (thickened) rim types. Vessel forms transition from flat bottomed pans to more rounded forms. Pottery uses both calcareous and volcanic temper and generally lacks decoration. The first identified agricultural fields date to this period.
800–1100 CE	Early Latte Period	This period is marked by the appearance of latte structures. Ceramic vessel sizes increase and exhibit thickened side walls and rims. Shell (*Tridacna*) adzes increase in frequency, and both slingstones and lusong are introduced during this period.

Table 1. Guam SHPO historic context periods.

Date Range	Period Name	Description
1100–1350 CE	Middle Latte Period	This period is similar to the Early Latte period. Although there is a continued emphasis on marine resources, sites from this period are found within many areas of the island's interior.
1350–1521 CE	Late Latte Period	The material culture of this period is similar to the Middle Latte period. Ceramics show a tendency toward very thick Type B rims. Latte villages increase in size on both the coasts and in favorable inland areas.
1521–1668 CE	Pre-Colonial European Trade Period	This period begins with Magellan's arrival on the island in 1521. Material culture and subsistence strategies are largely the same as those of the Late Latte period, with the addition of some European trade goods and the introduction of new animal species.
1668–1700 CE	Spanish Missionization Period/ Chamorro Spanish Wars	During this period, the Spanish introduced missionaries with protective military contingents to the island. Attempts to Christianize the Chamorro and alter their culture led to a series of uprisings that ended with the conquest of the island. This, combined with introduced diseases, decimated the Chamorro population. The Spanish practice of reduction concentrated the remaining Chamorro population into a small number of settlements.
1700–1898 CE	Spanish Colonial Period	The Spanish maintained a rigid social system, with the population concentrated in a few large settlements. The traditional subsistence economy of the Chamorro was changed to provide products for the Manila galleons that passed through the area seasonally. The Catholic Church became the most important focus of local life.
1898–1941	First American Territorial Period	The U.S. took possession of Guam following the Spanish-American War. The island was useful as a coaling station and hub for transoceanic communication cables. Later, it was an important link for the Pan-American trans-Pacific clippers. The U.S. military maintained a minimal presence on the island, and no significant bases or defenses were constructed during this period.
1941–1944	World War II – Japanese Military Occupation	The Japanese seized the island on December 10, 1941, when the badly outnumbered U.S. garrison surrendered without a fight. The Japanese began a program of indoctrination to introduce Japanese culture to the Chamorro population.
1944–1950	Post-World War II/Second American Territorial Period	Following the recapture of Guam, the U.S. created a large military base on the island for the Army Air Corps and the Navy. Following WWII, the island was administered by the U.S. Navy, with an interim civilian government created in 1949 to facilitate the 1950 transition to a U.S. territory.
1950–present	Organic Act/Home Rule/ Economic Development Period	Once Guam became a U.S. territory, a civilian government was formed, and all island inhabitants were given U.S. citizenship. Guam became a tourist destination and continued serving as a significant U.S. military base.

Pre-contact Period

The Pre-contact era in Guam has traditionally been divided into two main divisions, the Pre-Latte and Latte periods. Each of these periods are, in turn, divided into early, middle, and late subdivisions. The Pre-Latte period starts with the first evidence of settlement in Guam and ends with introducing the stone pillar and capstone architecture typical of the Latte period. The Pre-Latte period covers most of the island's human occupation, from 1500 BCE to 800–1000 CE.

Early Pre-Latte Period

Initial human occupation of Guam marks the beginning of the Early Pre-Latte period. At this time, sea levels were approximately 2 m (6.6 ft) higher than present, and coastline beaches were fewer and limited to relatively narrow strands. Many areas that are currently lowland areas were brackish marshes and wetlands during this period. Settlement was apparently limited to the beach areas, predominantly on the more sheltered, lee side of the island. Only limited and temporary use of inland areas appears to have occurred during this period. Because sea levels were higher during occupation, these sites were far from the current beach line. The Mariana Islands were the first of the island groups in Remote Oceania to be settled by Austronesian populations despite lying at a distance of more than 1,200 mi (1,931 km) from their likely origin point in the Philippines (Tomonari-Tuggle et al. 2018:10; Clark and Winter 2019:39; Carson and Kurashina 2012). Based on genetic analysis of ancient burials from throughout Oceania, the earliest population appears to have originated in the Philippines a few hundred years earlier than the Lapita culture colonized other parts of Micronesia (Pugach et al. 2021).

During this period, settlement consisted of small populations along the coast on or near lagoons, estuaries, and other resource-rich marine environments. Cultivated plants were limited to easily grown and processed species. Evidence of architectural features is limited, and structures appear to have been stilt-raised structures similar to those known from Fiji and the Bismarck Archipelago from approximately the same period (Tomonari-Tuggle et al. 2018).

Artifact assemblages during the Early Pre-Latte period are dominated by Marianas Red pottery, a thin-walled pottery with a red slip and calcareous sand temper. Marianas Redware typically has rims that are either the same thickness or thinner than the body walls. Less common pottery types from this period include Achugao Incised and San Roque Incised. San Roque Incised decoration consists of a curvilinear series of linked arches and stamped circles. Achugao Incised has more complex, rectilinear patterns with major elements separated by areas of fine punctations, although curvilinear elements are sometimes present. Over time, both types became simplified, with bolder lines and lime-filled, incised decorations. Decorated pottery of these two types is rare, generally constituting less than 2% of the sherds at most sites. Vessel sizes are generally small, with openings 10 to 35 cm (3.9 to 13.8 in) in diameter, with a mean of 20 cm (7.9 in) (Clark and Winter 2019:39, 45). Vessel forms from this period are typically small bowls and rounded jars. Vessel sizes are generally small (approximately 20 cm [7.9 in] or fewer in diameter). These vessels closely resemble contemporary styles in the Philippines, supporting the supposition that the early settlers of Guam originated from this area. Other artifacts commonly found in sites of this period include ground-stone items, flaked lithic tools, and various shell and bone utilitarian and

ornamental artifacts. Midden areas often contain substantial amounts of shellfish (*Anadara*) remains (Tomonari-Tuggle et al. 2018:10–11).

The earliest known archaeological sites in Guam are at Ritidian (66-08-0012) and Mangilao (66-04-0025, Mochom Complex). The site at Ritidian, situated at the northern end of the island, northeast of Tarague, shows evidence of a possible habitation structure constructed on stilts within the intertidal area of a shallow, sandy lagoon as well as limited contemporary use of two associated caves; the likely dates of this occupation fall within the range of 1500 to 1100 BCE (Carson 2017). The Mochom complex at Mangilao is what is interpreted as a small village in the relatively small Mangilao Embayment on the east-central coast of Guam, with an associated Bayesian modeled date range of 1681 to 1198 BCE. During this early period, settlement was limited to coastal areas, and the inhabitants' diet focused on marine resources. At both sites, ceramic artifacts are the most common components of the artifact assemblages. Other artifacts are limited in number and include basalt and chert lithic artifacts, bone and shell tools, and decorative items made from shells.

Early Pre-Latte Period Occupation of the Tarague Embayment

The earliest archaeological site within the Tarague Embayment was previously thought to be the Tarague Beach site, which was thought to have been initially occupied by 1500 BCE (Kurashina and Clayshulte 1983a; 1983b). However, Athens (1986:11) states that when these radiocarbon dates on marine shells are corrected for the carbon reservoir effect, the earliest date is actually 915 BCE. Until further field investigations can be undertaken and additional radiocarbon dates can be obtained, the initial occupation of the Tarague Beach site cannot be irrefutably determined.

Radiocarbon dates and relative dating using prehistoric ceramics from the archaeological investigation for the DoD Legacy Resource Management Program indicate occupation of the Tarague Embayment as early as the middle Pre-Latte period (1000 to 500 BCE), and analysis of sherds from a block rock shelter (Site 66-07-1605) and an extensive site complex (Site 66-08-1588) suggest that by 500 BCE people were living intermittently in localities quite far from the beach (Liston 1996). This investigation also identified two extensive Pre-contact village sites (Sites 66-07-1595 and 66-07-1614) along the eastern shoreline of Tarague. Site 66-07-1595 has, unfortunately, been substantially disturbed by sand mining. However, Site 66-07-1614 remains in pristine condition, at least since the late 1990s, as represented by an extensive artifact scatter. A significant feature of Site 66-07-1614 is a rock-lined well that was used as a freshwater source during the Pre-Latte period. Additionally, two other localities identified during the investigation, Sites 66-08-1588 and 66-07-1673, are thought to be large agricultural areas based on the extensive distribution and character of the component features, the majority of which are rock mounds and alignments. It was also found that within the Tarague embayment, a network of rock-lined trails connected the entire DoD Legacy Resource Management Program study area. These features were some of the first of their kind to be recorded in the Mariana Islands (Liston 1996).

Middle Pre-Latte Period

The transition from Early to Middle Pre-Latte is marked by environmental ceramic technology changes. During this period, sea levels began to drop, leading to an expansion of available backshore areas on the coast and the disappearance of many coastal wetland areas. Most sites dating to this period are found in backshore contexts

in bay areas such as Tumon and Hagåtña on Guam's western coast and Ritidian Bay at the northern end of the island (Tomonari-Tuggle et al. 2018:13). This period also shows an increased use of interior areas compared to the preceding Early Pre-Latte period. On the southern part of the island, rock shelters have been found within the interior areas of the Fena/Talofofo watershed. On the northern plateau near the project area, a midden was located containing remains from marine food species, indicating that people exploiting the interior brought prepared foods to support short-term use of interior areas. Environmental data supports the more intensive use of interior areas (Dixon and Schaefer 2014). On the southern part of the island, changes in vegetation suggest the anthropogenic burning of native forests, leading to the development of savannas. However, other data from the Pago River area in east-central Guam suggest that species of coconut (*Cocos nucifera*), seedless breadfruit (*Artocarpus altilis*), and pago hibiscus first occur in the interior during this period.

There is little change in material culture between these periods, and the same ceramic styles seen in the Early Pre-Latte period continue into Middle Pre-Latte occupations. The pottery assemblage continues to be dominated by Marianas Redware; however, vessel sizes increase slightly with a noticeable thickening of vessel walls and increased frequency of carinated vessel shapes. The exterior of vessels continued to be finished using red slip, but plain and sometimes burnished/polished finishes are also observed. The use of calcareous sand for temper continues as the most common type of temper, but the use of volcanic sand as well as mixed calcareous and volcanic sand temper first occurs during this period. The best ceramic temporal marker for the Middle Pre-Latte period is the introduction of Ipao Stamped designs, which consist of bold linear designs

filled with lighter colored lime. These designs feature deeper and wider lines with simpler patterns than those of the earlier Achugao Incised and San Roque Incised vessels of the Early Pre-Latte period (Moore and Hunter-Anderson 1999). Other artifacts follow the same shift to more utilitarian designs, with many of the shell ornaments and beads, as well as the chert adzes of the earlier period, disappearing from the archaeological record. Isolated human burials are found at some Middle Pre-Latte sites, but this period marks the first appearance of formal burial grounds. This is seen at the Naton Beach site on Tumon Bay, where 155 Pre-Latte and 212 Latte period burials were found, possibly in association with pole and thatch structures and now absent latte sets (defined below) (DeFant 2008; Walth 2016:358).

Late Pre-Latte Period

The transition from the Middle to the Late Pre-Latte period sees a continued drop in sea levels, which stabilized late in the period, allowing for the expansion of beach areas and coral reefs. Redeposition of eroded highland sediments to valley and coastal settings created fertile areas that Late Pre-Latte populations exploited. The continued expansion of savanna areas can be attributed to expanding use of interior areas and a shift from a primarily marine subsistence strategy to a more diversified pattern. Habitation sites expanded into previously unoccupied coastal areas and inland areas along the major river valleys of southern Guam.

The Late Pre-Latte period is marked by a significant shift in ceramic technology from the smaller, finer vessel forms of the earlier periods to large bowls and pans with flat bottoms and thick walls. Pottery rims are usually vertical or slightly flaring. Ipao Stamped ceramics are rare during the early part of the period and disappear by the end.

Decorative designs, consisting of impressed or stamped designs on vessel rims, are rare by the end of the period. Calcareous sand temper remains most common, with some mixed temper observed (Tomonari-Tuggle et al. 2018:14).

Transitional Period

During the Transitional period (500–800 CE), sea levels stabilized, resulting in beach and reef areas resembling modern conditions. Most coastal wetlands, however, disappeared during this time. Evidence of habitation sites from this period are found within coastal areas around Guam, although there is increasing evidence that coastal residents were beginning to use areas in the interior of the northern plateau. The Late Pre-Latte sites observed within the Ylig and Fena/Talofofo watersheds during the Pre-Latte period in southern Guam continue to be used, and occupations at these localities seem to become more permanent.

There are no temporally diagnostic artifacts mark this period, making it difficult to distinguish components dating exclusively to the Transitional period from multicomponent sites containing artifacts from both Pre-Latte and Latte occupations. Ceramic technology is in a transitional state between Pre-Latte and Latte styles, with elements of both. The thick, flat-bottomed pans of the Late Pre-Latte period disappear early in the Transitional period along with the use of lime-filled incised decorative elements. Vessel shapes shift to hemispherical bowls with thin walls and rounded bases. Rim styles vary, ranging from thickened to unthickened, and decorative rim designs remain uncommon. Temper materials include calcareous, mixed, and volcanic sand, the latter of which will become the most common temper during the Latte period (Moore and Hunter-Andersen 1999; Tomonari-Tuggle et al. 2018:15).

Latte Period

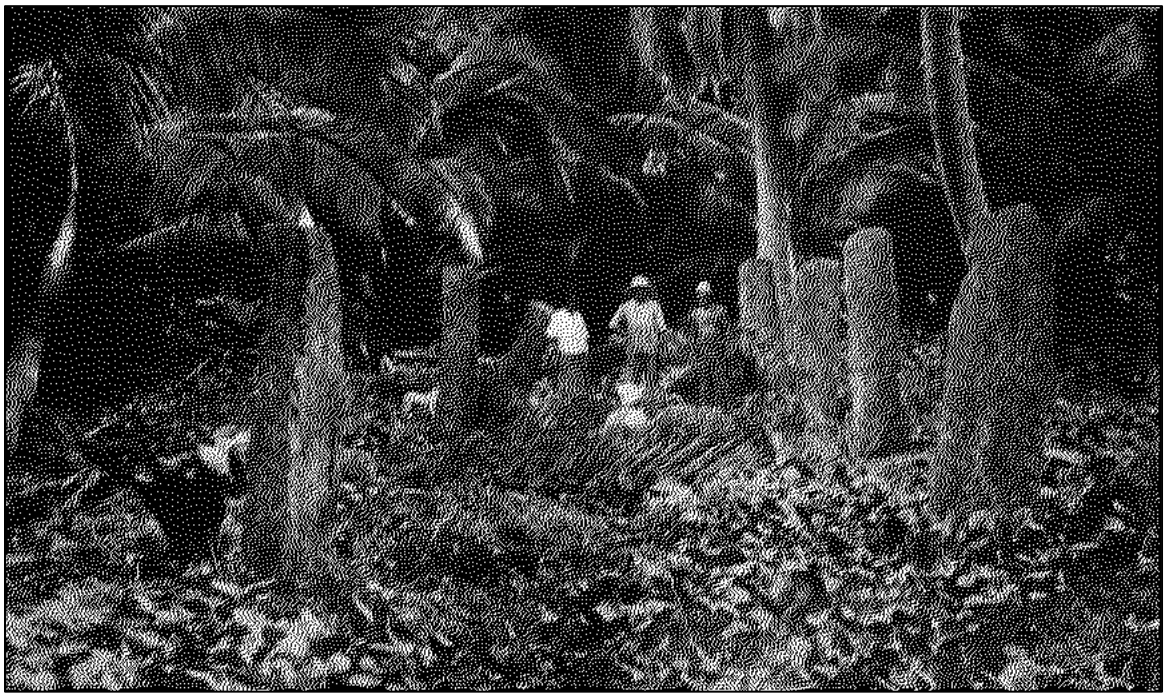
The Latte period began between 800 and 1000 CE, marked primarily by changes to ceramic decoration styles and the appearance of Marianas Plain pottery circa 800 CE. During this time, the appearance of slingstones, the use of basalt mortars (lusong), and the construction of megalithic Latte architecture became common by 1000 CE. This period is broken into three divisions: Early Latte, Middle Latte, and Late Latte/Pre-colonial European Trade periods.

By the beginning of the Early Latte period, Guam's environment was similar to modern conditions. One of the most distinctive features of this period is the introduction of *latte*, an architectural feature consisting of a vertical stone shaft (*haligi*) capped by a semi-hemispherical capstone (*tasa*). Together, these elements constitute a latte pillar (Figure 5). Latte pillars occur in pairs with sets of 6, 8, 10, or 12, with 8 pillars being the most common size (Figure 6). Latte pillars vary from approximately 50 cm (19.7 in) to 5 m (16.4 ft) in height and most likely served as the foundations for raised superstructures of perishable materials (Tomonari-Tuggle et al. 2018:15).

Structures that include a larger number of latte sets may represent the social ranking of individuals or groups (Graves 1986) or may reflect different activities participated in by different social or gender groups as seen on other Pacific islands. For example, Hawaiian households usually had multiple structures where gendered activities were segregated (e.g., separate male and female eating houses, boat sheds, men's houses) (Bayman et al. 2012; Peterson 2012).

Figure 5. Latte from Epau, Guam (left), and Lieutenant H.G. Hornbostel next to a latte stone on Guam (right) (Gill 1924:162–164).

Figure 6. Latte set at Hinapsau, Guam (Gill 1924:155).



Latte sites are most commonly found in coastal settings with easy access to marine resources. Every sheltered embayment on Guam with a freshwater supply supported a Latte village. Interior sites also increase in density throughout the period. By the Late Latte period, the size of latte sets in the interior were often larger than those in coastal communities. The interior latte sets are concentrated along the rivers and streams of southern Guam. Latte sets in the interior of northern Guam are rare and were concentrated around Mount Santa Rosa and Mount Mataguac, where dependable water was available. Unfortunately, most latte sets identified during the early twentieth century (Gill 1924) were destroyed by construction and military activities during and immediately after WWII (Osborne 1947).

Due to the comparative rarity of latte sets, ceramic artifacts are the most common temporal marker for Latte period sites. The most common pottery type for the Latte period is Marianas Plainware, which replaced the Marianas Redware types of the Pre-Latte period. Marianas Plainware exhibits thicker sidewalls, thickened rims, and minimal surface treatment or decoration. Other artifacts that appear during the Latte period are basalt lusong, lommok (pestles), bone spear points, and slingstones (Tomonari-Tuggle et al. 2018:15–17).

The University of Guam conducted a systematic survey and excavations at a Latte period site at Tarague in 1980-1981 (Kurashina et al. 1981). The survey included the backshore area and extended into the adjoining tidal area, where a latte stone quarry was identified. Excavations revealed a shallowly buried cultural layer containing characteristic Latte artifacts, as well as a sherd of possible Spanish pottery. The bottom of this stratum appears to date to the Transitional period. Seven additional cultural

strata underlying the Latte component were identified, all dating to the Pre-Latte period. The total depth of cultural strata was more than 3 m (9.8 ft). As discussed above, a radiocarbon date from the oldest cultural stratum produced a date of 3435±70 BP (Beta-4897), one of the earliest dated cultural deposits on Guam (Kurashina et al. 1981); however, the reliability of this date is in dispute (Athens 1986:9–14).

Initial Spanish contact, beginning with the landing of the Magellan expedition in 1521 CE, occurred during the Late Latte period. The island served as a stopping point on the Manila trade galleon route until the late seventeenth century, when significant Spanish colonization occurred. Colonization marked the end of the Latte period (Tomonari-Tuggle et al. 2018).

Pre-contact Population Dynamics on the Northern Plateau

Summed probability distributions (SPDs) of calibrated archaeological radiocarbon dates have been used for at least two decades to represent Pre-contact population trends. However, they should be approached with caution because they do not represent a quantifiable measure of population; the artifacts inherent in the radiocarbon calibration curve affecting its shape are acknowledged and compensated for (Gilmore et al. 2023; Gilmore 2008; Hinz 2020; Kelly et al. 2025; Surovell and Brantingham 2007; Surovell et al. 2009). SPDs are presumed to reflect general trends in population and provide a qualitative measure of the size of the Pre-contact population. Thus, SPDs can be used as a tool to examine the relationship between a dynamic human population and adaptations brought about as human groups react to changes in climate that affect carrying capacity. The narrowing of the margin between population and carrying capacity should be reflected in the archaeological record by changes in technology

related to subsistence, site function, and the size and distribution of sites on the landscape (Gilmore et al. 2020).

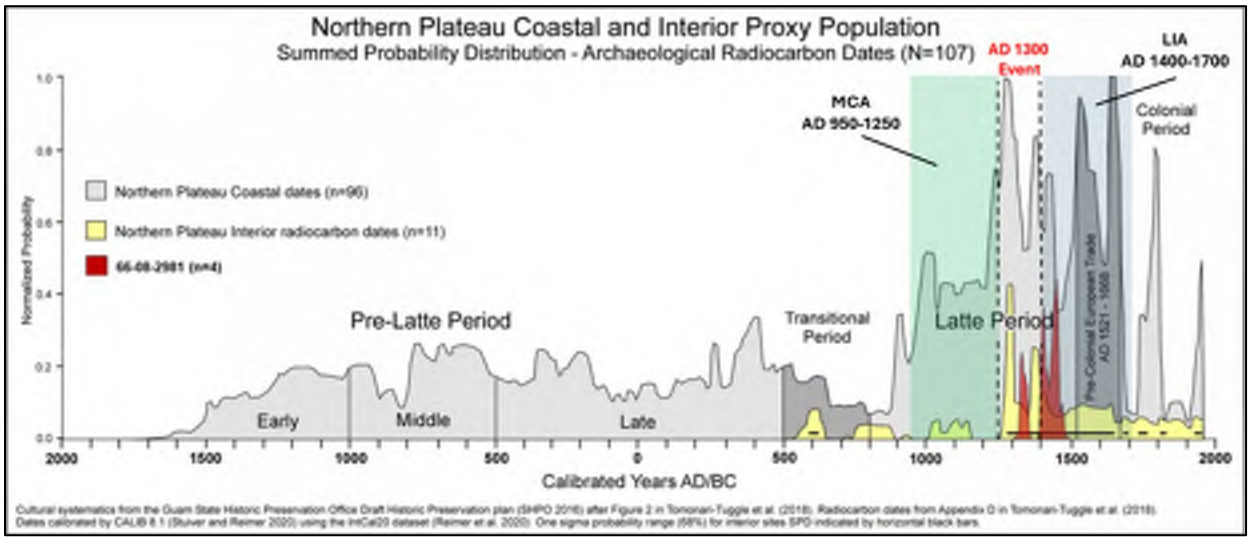
There has been much discussion of what can cause deviations in SPDs, including taphonomic factors, site formation and preservation, relative visibility on the landscape of archaeological sites of different ages, and research bias resulting in more research of sites dating to a particular period with a resulting disproportionate number of radiocarbon dates from those periods (Surovell et al. 2009). Whatever the factors that affect the shape of the curve in general, these curves should reflect the size of the Pre-contact population and therefore can be used to examine interactions between humans and their environment.

The archaeological radiocarbon dates for northern Guam were compiled from the code for five Bayesian models in Appendix D from Tomonari-Tuggle et al. (2018). The dates from the "Northern Plateau Coast-West," "Northern Plateau Coast-North," "Northern Plateau Coast-East," and "Northern Plateau Interior-North" datasets were employed to generate SPD curves that were then used as Pre-contact population proxies for two areas in northern Guam: coastal sites and sites on the limestone plateau (Figure 7). Only dates on samples from terrestrial contexts were used; the eight samples using the "Marine13" calibration curve from the "Northern Plateau Coast-West" dataset were not incorporated into the SPDs for northern Guam. However, these dates (ranging between 3480±30 and 2570±41 BP) date to the Pre-Latte period and therefore do not affect the interpretation of Latte period population, which is the period of interest for the project area. The SPD was generated using the relatively small number (n=107) of radiocarbon dates available for northern Guam from Appendix D of Tomonari-Tuggle et al. (2018).

Because of the relatively small number of radiocarbon dates, the small fluctuations in the SPD likely reflect the fluctuations of the calibration curve for the last 3,500 years as much as they represents any changes in population, but the overall shape of SPDs reflects trends in population, and as such provides a useful starting point for examining prehistoric population in the northern plateau and the surrounding coastal areas.

The earliest point in the two-sigma probability ranges in the proxy population (ca. 1200 BCE) compares favorably with the date range proposed for the initial settlement of Guam ca. 1500–1100 BCE by Carson (2017) and the Bayesian modeled 95% probability range (1280–1135 BCE) for the initial colonization of the Mariana Islands proposed by Rieth and Athens (2017). Based on this proxy, the population remains relatively stable for approximately 2,000 years after the initial colonization. At that point population begins to increase significantly in coastal settlements (with apparently minimal occupation in the interior of the limestone plateau) soon after the beginning of the Latte period, ca. 800–900 CE. This population increase roughly correlates to the beginning of the MCA (950–1250 CE) as defined by Mann et al. (2009) and the “time of plenty” that Nunn et al. (2007, 2011) hypothesized as a period of social changes and continued reliance on relatively abundant littoral resources. Starting ca. 1200 CE, there is a steep increase in coastal population through the beginning of the AD 1300 Event, when it begins to decline as precipitously as it increased at the beginning of the previous century. This decline in coastal population continues through 1450 CE, and correlates to a concurrent increase in occupation in the interior, ca. 1250–1450 CE.

Figure 7. Proxy Pre-contact population for the Northern Plateau. Two-sigma probability ranges are indicated by horizontal black bars. The green rectangle indicates the temporal limits of the MCA and the blue rectangle indicates the limits of the LIA according to Mann et al. (2009).



This apparent movement of population inland may have been in response to the decreased productivity of littoral resources associated with the increased temporal variability in temperature and precipitation associated with the AD 1300 Event. Increased temporal variability coupled with an increased amplitude in climate extremes would have resulted in a sharp decline in the predictability of resources that were relatively stable and plentiful during the previous centuries of the MCA. This decrease in the predictability of critical resources would have increased food stress in a rapidly growing population and would have necessitated the movement of a portion of the growing population into less productive areas in the interior of the limestone plateau. Such a movement would have led to increased utilization of and reliance on forest resources and expansion of agriculture into less conducive environments with shallow, less fertile soils that may have required amendments to boost yields. This could explain the presence of burned coconut in midden deposits in Sites 66-07-1113, 66-07-1117,

66-07-1118 (Gilmore et al. 2023), and 66-08-2981 (Fafalog) (Gilmore et al. 2025). Charred coconut shell found in agricultural contexts in sites in Guam (Dixon et al. 2012; Moore 2005) and Tinian (Dixon et al. 2006) suggest that Pre-contact Chamorros recognized the value of coconut shell and likely coconut husk (both burned and unburned) as effective soil amendments. Coconut shell charcoal has been demonstrated experimentally as a valuable soil amendment (Wasis et al. 2019), as has coconut husk ash (Bonneau et al. 2010). The dates on burned coconut endocarp from midden deposits or possible soil amendments at Site 66-08-2981 (Fafalog) fall into the latter half of the AD 1300 Event and extend to ca. 1450–1500 CE immediately after the AD 1300 Event (Gilmore et al. 2025).

The multiple steep peaks and deep troughs in the SPD curve beginning in the Latte period and extending into the Pre-Colonial Trade period probably reflect the configuration of the INTCAL20 calibration curve, which contains a reversal in 1300–1400 CE, a plateau in 1500–1600 CE, and multiple reversals and plateaus in 1660–1950 CE (Reimer et al. 2020), rather than actual fluctuations in population. However, the general trend in the SPD does suggest that the population increased from the beginning of the Latte period, peaking around 1300 CE, decreasing to 1450 CE, and then recovering between 1500 and 1650 CE. After 1650 CE, proxy population decreases significantly. This may be the signal of the Spanish instituted policy of reduccion in the late seventeenth century, which involved the reorganization of settlements in the north, and ultimately the removal of the Chamorro population to the south (Sanz 1991 in Tomonari-Tuggle et al. 2018:18).

Post-contact Period

The Post-contact period is divided into periods reflecting the outside colonial power in control of Guam at the time. The Spanish Colonial period extends from the late seventeenth century until the United States' acquisition of the island in 1898, following the Spanish-American War. During the Spanish Colonial period, epidemic European diseases drastically reduced the Chamorro population of the island, as did Spanish military actions to quell Chamorro unrest and forcibly resettle them into the parish villages of Agat, Hagåtña, Inaraian, Merizo, Pago, and Talofofo. The population became integrated into the logistical system supporting the Manila trade, with most of the island's economic activity geared toward supporting the yearly trans-Pacific trade. The Manila trade collapsed during the early nineteenth century, when Spain's New World possessions gained independence and Guam's importance as a way station declined (Tomonari-Tuggle et al. 2018).

Following the United States' acquisition of the island, Guam served as a coaling station and communication hub for the U.S. Navy until the fall of the island to the Japanese on December 10, 1941. The Japanese occupation of the island lasted until July 1944, when American forces recaptured the island. Destruction associated with the battle to retake the island, combined with the construction of massive air bases and logistical facilities on the island after it was recaptured from the Japanese, resulted in widespread disturbance of many Pre-contact sites. The period of American occupation after the recapture of Guam until the 1949 transfer from U.S. Navy to civilian control is referred to as the Second American Territorial period (Tomonari-Tuggle et al. 2018).

Ray (1981) theorizes that since "Taragüe" is derived from the ancient Chamorro "talage," which means "to look," it is possible that the Taragüe embayment may have served as a lookout for galleons approaching from the north (Ray 1981:27 in Liston 1996:34). During the Spanish Missionization period, the embayment area was one of the last strongholds for Chamorros rebelling against Spanish rule. But by the late seventeenth century, the Spanish were in complete control of Taragüe; by the mid nineteenth century, no villages remained in Taragüe, and in their place were numerous ranchos and coconut groves that employed immigrants from the Caroline Islands, the Philippines, China, Japan, and other Pacific islands (Liston 1996).

The United States acquired Guam from Spain in 1898 as a result of victory in the Spanish-American War and a payment of $20 million (Liston 1996:42). The American administrators focused on the more populated areas of the island, neglecting much of the northern region, including the Taragüe Embayment. The rich soil of Taragüe attracted the interest of Japan; during the early twentieth century, Japanese interests acquired large tracts of land within the embayment, where they established small-scale copra plantations. These plantations were quite productive, and 560 tons of copra were exported to Japan in 1900. However, because of its strategic importance, the ports of Guam were closed to all foreign commerce vessels in 1912 to enhance the security of the island in the defense of the Philippines, and use of the ports was limited to those granted special authorization. Additionally, foreigners were prohibited from purchasing or leasing land for a period of longer than five years (Liston 1996:43).

By 1917, one of the larger copra plantations within Taragüe was acquired by Atkins, Kroll, and Company of San Francisco, which also started to raise cattle in the coconut

groves (Kroll 1917:12 in Liston 1996:47). At least one or two additional copra plantations were within Tarague, which contributed to the production of 3,000 tons of copra exported in 1929. The following year, the Atkins, Kroll, and Company copra plantation within Tarague closed due to a decrease in the price of copra associated with the economic effects of the Great Depression (Liston 1996:50).

After Japan's attack on Pearl Harbor in 1941, Japanese forces (numbering 5,000) invaded Guam, immediately overwhelming the 340 troops available for combat (Liston 1996:51). During the Japanese occupation of the island, at least one battalion defended Tarague beach; however, the condition of Tarague did not change much during Japanese occupation. After American forces recaptured Guam, the dense jungle, surrounding steep cliffs, and multitude of limestone sinks and caves within Tarague offered Japanese stragglers the possibility of eluding capture, and it was not until 1951 that the last two Japanese stragglers hiding within Tarague were captured. In 1954, the northwestern half of Tarague was acquired by the U.S. Navy to establish a source of water that was required for the Base Development Program of Andersen AFB (Liston 1996).

Andersen Air Force Base

Initial designs for Andersen AFB were drafted in late 1944, and its first airfield became operational in early February 1945. By the end of WWII, both the North and Northwest Fields, in conjunction with similar airfields on the islands of Tinian and Saipan, had been utilized to base B-29s tasked with bombing the Japanese home islands. After WWII, only Andersen survived as an active airbase, being first named North Guam AFB in 1947, then Andersen AFB in honor of Brigadier General James R. Andersen in 1949.

During the 1960s to 1980s, the development of Tarague was focused on the construction of recreational facilities, including pavilions at Tarague, Scout, and Sirena beaches, and a bathhouse at Tarague beach. One major impact on the beach was sand mining for the construction of a nine-hole golf course on the plateau in 1967. During this same period, a rifle range was built within the eastern portion of the embayment as well as an Explosive Ordnance Disposal Range close to Tagua Point (Liston 1996). The base served a logistical role during the Korean War and a significant role during the Vietnam War, serving as the main base for B-52s used during operations Arc Light and Linebacker II. Andersen AFB continues to support DAF operations within the western Pacific (Andersen AFB 2021).

3 Research Methods

Prior to the commencement of fieldwork efforts, the archaeological contractor's field team will review this data recovery plan to understand the project scope and goals, and all supervisory personnel will have reviewed the previous archaeological survey reports specifically relevant to the APE. The information within this data recovery plan will be presented in the draft and final survey reports.

General Research Questions

Previous archaeological investigations indicate that Pre- and Post-contact indigenous populations, as well as Spanish colonists, utilized Northern Guam. Although many portions of the project area have been disturbed as a result of combat during WWII and subsequent development associated with construction of Andersen AFB infrastructure, HDR determined that a significant portion of the North Ramp project area remains

relatively unaffected, indicating that the possibility of relatively intact evidence of Pre-contact use of the area is high (Gilmore et al. 2023). Although examination of 1944 and 1953 aerial photographs does not reveal any significant changes in the North Ramp area other than relatively minor disturbances likely related to the development of Andersen AFB (Figure 8 and Figure 9), Gilmore et al. (2023) interpreted rectilinear patches in vegetation visible in the 1944 aerial photos for the MSA area (Figure 10) as representing agricultural fields of different ages dating to the pre-WWII period (Figure 10). Despite the significant disturbance to the area that occurred during the late and post WWII period, including construction of munitions storage facilities (Figure 11), Gilmore et al. (2023) hypothesized that there may still be areas in MSA-1 that contain evidence of agricultural activities associated with the occupation of Site 66-08-2981 (Fafalog). This was confirmed during the survey of the MSA-1 supplemental survey area and the discovery of areas containing midden deposits and/or soil amendments (Gilmore et al. 2025). In addition, Site 66-08-2981 was identified in areas of secondary limestone forest in MSA-1 that were minimally disturbed during the construction of the munitions storage facilities (Figure 11).

The following research questions provide a framework for acquiring information useful in addressing archaeological questions regarding site formation processes and cultural questions relevant to the historical and Pre-contact periods in northern Guam:

1. What is the nature of the Latte period occupation of the limestone plateau? Do the sites in the North Ramp and MSA-1 areas represent logistical sites with limited activity areas, or habitation sites representing primary occupation of the limestone plateau?

2. What is the economic and political nature of the relationships between interior sites and coastal settlements? Is there evidence that social stratification played a role in the increased use of the limestone plateau by lower caste people, providing resources to elites in coastal villages during the late Latte period?
3. Do radiometric dates from the North Ramp and MSA-1 sites on the limestone plateau support the hypothesis of population movement from coastal sites to the interior of the limestone plateau in response to increasing population and/or decreased carrying capacity during the AD 1300 Event and early LIA?
4. Does the presence of burned coconut endocarp in the soils of sites in the interior represent accumulation of burned food waste, or does it represent an attempt to intensify food production by using burned material as a purposeful soil amendment?
5. What is the nature of Pre-Latte period use of the APE?

Figure 8. 1944 Aerial photograph of the North Ramp Area.

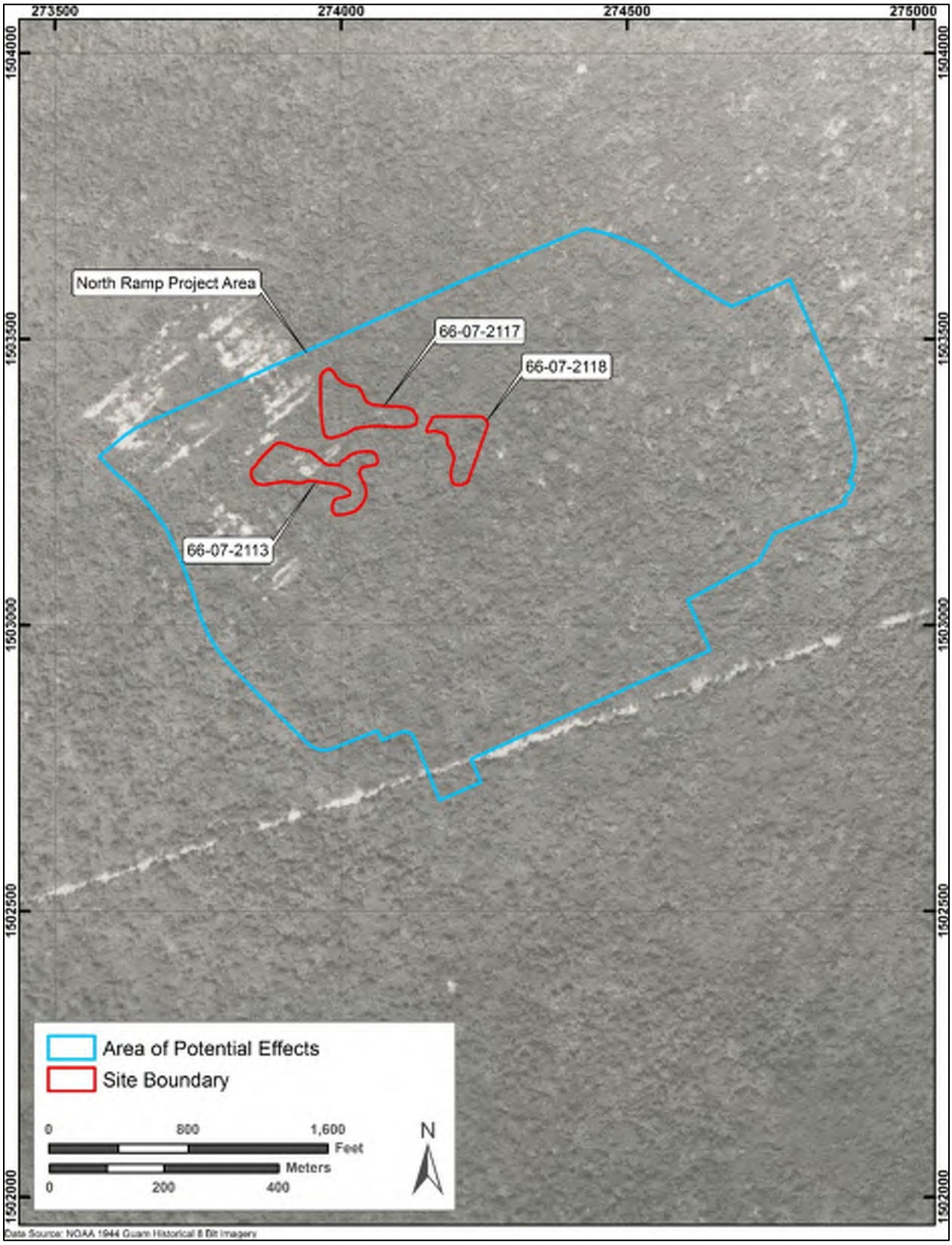


Figure 9. 1953 Aerial photograph of the North Ramp Area.

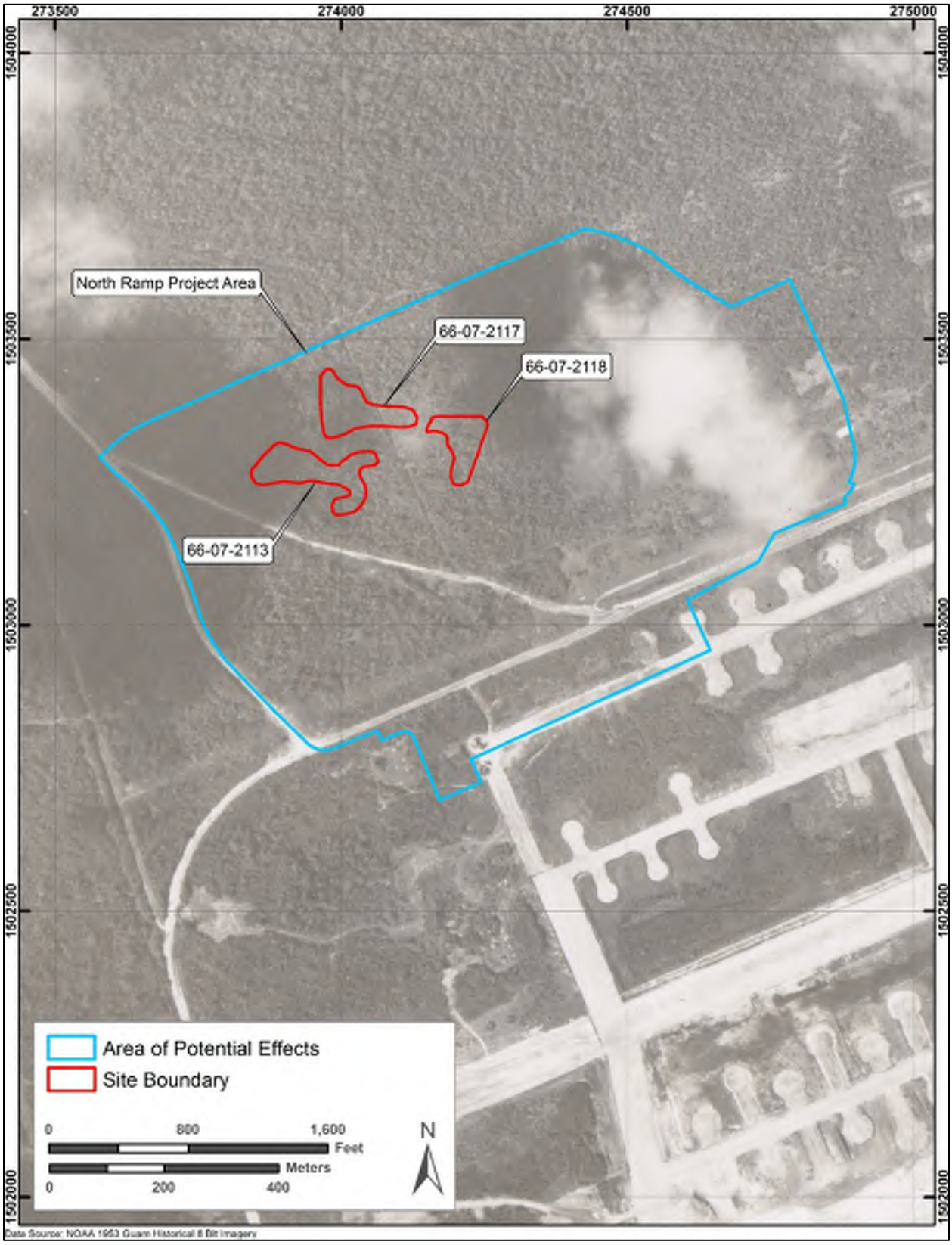


Figure 10. 1944 Aerial photograph of MSA-1.

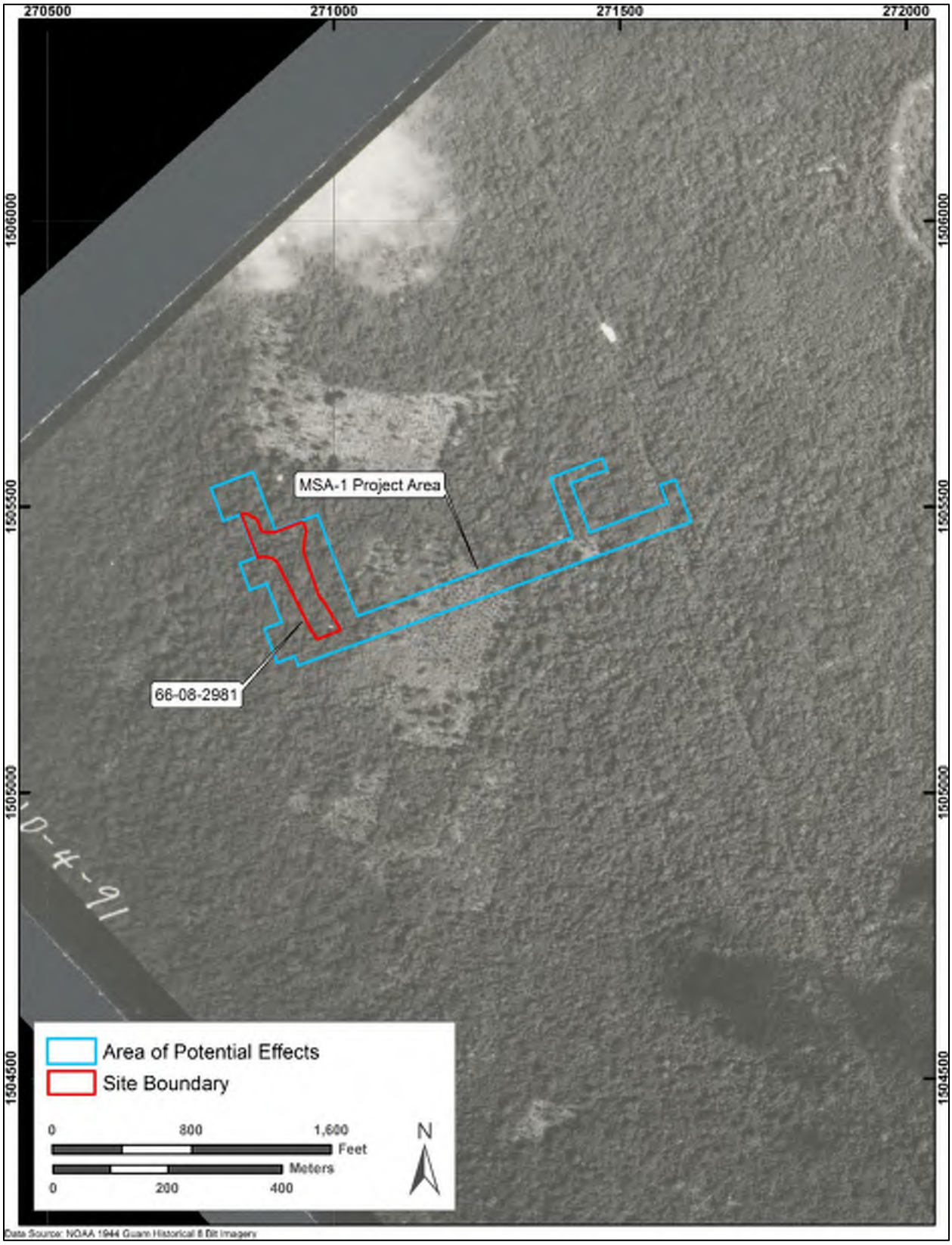


Figure 11. 1953 Aerial photograph of MSA-1.

4 Site-Specific Data Recovery Objectives

This section details the proposed data recovery methodology specific to each site requiring mitigation under this data recovery plan. Each site description includes a summary of previous investigations and specific methods, research objectives, and research questions to be addressed by the data recovery.

Site 66-07-2113

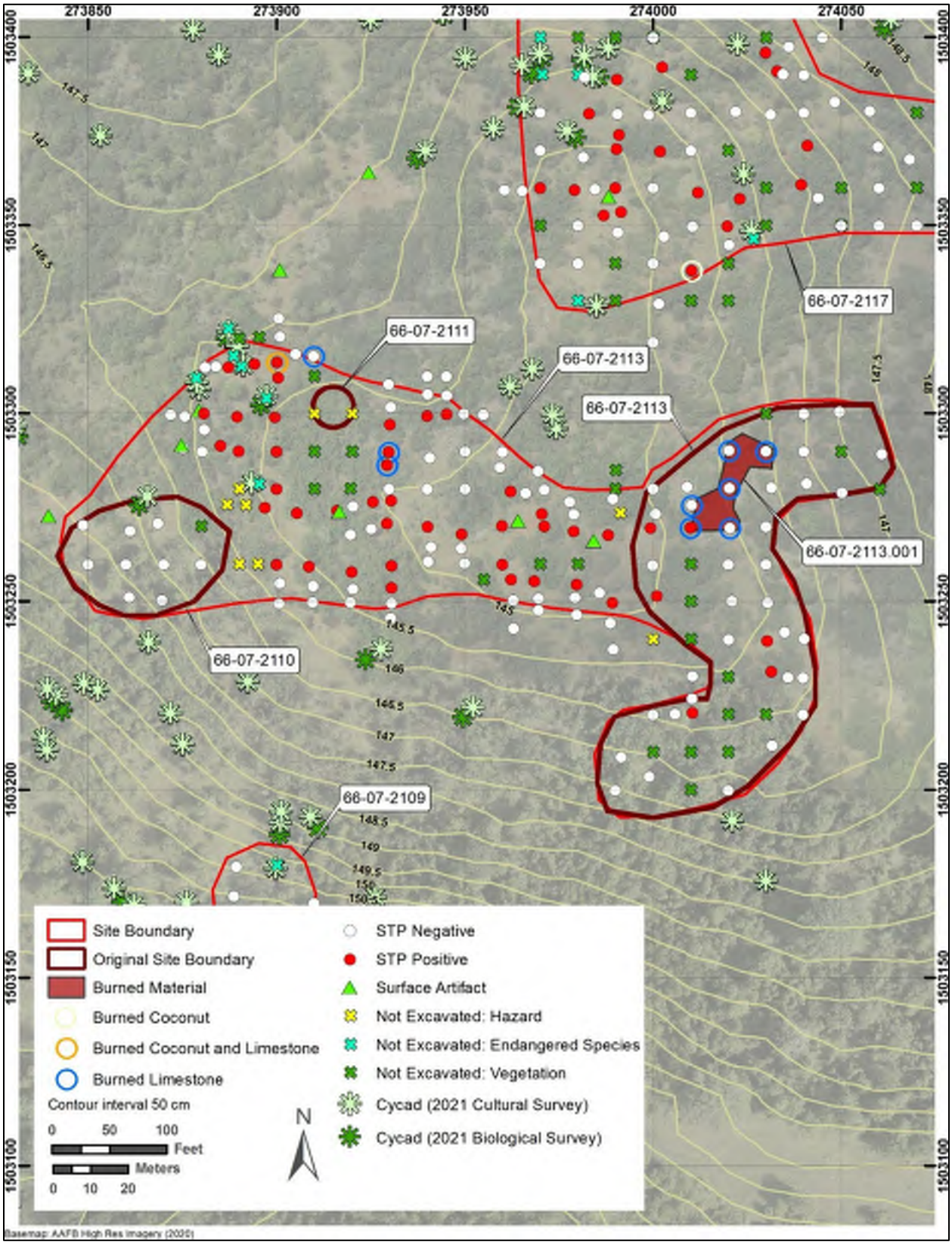
Site 66-07-2113 (Figure 12) is a Latte period artifact scatter associated with a possible earth oven clean out feature and evidence of anthropogenic soil modification. The site has been previously investigated by Grant et al. (2007) and Gilmore et al. (2023), and these investigations identified 264 ceramic sherds, a basalt pestle fragment, an unidentified piece of basalt ground stone, a basalt adze, a limestone abrader fragment, and two unidentifiable bone fragments at the site. Additional cultural deposits at Site 66-07-2113 include a buried deposit of burned coconut shell fragments and small pieces of burned limestone, a possible horticultural feature, and a stained soil feature (66-07-2113.0001) that may represent earth oven clean-out debris (Gilmore et al. 2023).

Site Summary and Previous Investigations

Site 66-07-2113 was first recorded by Grant et al. (2007) in 2006 as three discrete sites (66-07-2110, 66-07-2111, 66-07-2113). The three sites were all described as low-density ceramic scatters in secondary-growth limestone forest. As originally recorded, Site 66-07-2110 had a total site area of 1,156 square m (m^2), Site 66-07-2111 had a site area of 45 m^2, and Site 66-07-2113 had a site area of 4,910 m^2. Grant et al. (2007) conducted systematic subsurface testing on all three sites and excavated a total of 11 STPs at 66-07-2110 (five of which were positive), two STPs at 66-07-2111 (both

positive), and 21 STPs at 66-07-2113 (12 of which were positive). All STPs were excavated to bedrock at depths ranging from 14 to 73 cm (5.5 to 28.7 in). Sediments were consistent between all STPs and consisted of silty clay to silty clay loam, although isolated areas of loam or silt loam were also observed. A total of 41 sherds (17 from the subsurface) and one basalt adze fragment were identified at 66-07-2110; 12 sherds (7 from the subsurface) were observed at 66-07-2111; and 75 sherds (47 from the subsurface), along with a possible limestone abrader fragment, were found at 66-07-2113 (Grant et al. 2007). Surface artifact density at the sites was generally low, and most artifacts were recovered within the top 20 cm (7.9 in) of STPs. Ceramic sherds recovered by Grant et al. (2007) were dominated by plain, smoothed surfaces. One sherd with a scraped exterior was encountered at 66-07-2110 and 66-07-2113, while seven sherds with combed finishes were identified at 66-07-2113. The ceramic assemblage for all three sites included 12 rim sherds, all consistent with Type B rim styles, apart from one Type A rim from 66-07-2111. Given the comparatively low artifact density and limited functional diversity encountered during their investigations, Grant et al. (2007) interpreted the sites as representing short-term resource collection and/or processing loci and recommended each site as not eligible for inclusion in the NRHP.

Figure 12. 66-07-2113 site map.



In 2021, HDR conducted additional subsurface testing at Sites 66-07-2110, 66-07-2111, and 66-07-2113 (Gilmore et al. 2023). HDR excavated 147 STPs across all three sites, yielding 46 positive STPs that expanded the boundary for Site 66-07-2113 defined by Grant et al. (2007) approximately 160 m to the west of its original extent. The expanded boundary incorporates Sites 66-07-1110 and 66-07-1111, and all three sites were consolidated within a single boundary designated as Site 66-07-2113 (Gilmore et al. 2023). The combined site boundary encompasses 12,310 m^2, doubling the total site area for 66-07-2110, 66-07-2111, and 66-07-2113 as defined by Grant et al. (2007). HDR's subsurface testing revealed a low-density but extensive scatter of shallowly buried ceramic artifacts across the site. Bedrock was encountered at depths that ranged from 0 (rock located immediately underneath leaf litter) to 75 cm (29.5 in). However, STPs that exceeded 50 cm (19.7 in) in depth were partially dug into decomposing limestone bedrock. HDR's systematic subsurface testing identified 136 sherds, a basalt pestle fragment, an unidentified piece of basalt ground stone, and two unidentifiable bone fragments at Site 66-07-2113 (Gilmore et al. 2023). Three rim sherds were found, all of which were Type B. Smooth exterior finishes were observed on 83 of the sherds, with one sherd exhibiting a scraped exterior. Of the remaining sherds, 52 were too weathered to determine surface treatment. Body sherd thickness ranged from 0.44 cm to 2.02 cm (0.17 to 0.80 in) with a mean of 0.92 cm (0.36 in), although 61 sherds were too deteriorated to obtain accurate thickness measurements. Similar to Grant et al.'s (2007) findings, sherds were located at depths of up to 50 cm (19.7 in), but most sherds (n=100, 75.2%) were found at depths of 20 cm (7.9 in) or less. Depths of 20 to 30 cm (7.9 to 11.8 in) also yielded additional sherds (n=29, 21.8%). One possible basalt pestle

fragment was discovered on the surface, and one unidentified basalt ground stone fragment was recovered from an STP. In addition to these artifacts, Gilmore et al. (2023) reported evidence of possible anthropogenic soil modification based on fragments of burned coconut shell and small pieces of burned limestone encountered in STP 300E; 515N. The burned coconut shell and limestone fragments were identified in the top 15 cm (5.9 in) of the profile within a possible anthroposol comprising a darkened organic-rich horizon (2.5 YR 3/4, dark reddish brown) that overlies undisturbed native soil (10 R 3/4, dusky red). The possible anthroposol deposit may represent soil amendments added to a swidden field or garden plot (Gilmore et al. 2023).

HDR's investigations also identified one previously undocumented feature at Site 66-07-2113, a large charcoal stain containing fragments of burned limestone (Gilmore et al. 2023). Feature 66-07-2113.0001 is an approximately 10 x 20 m (32.8 x 65.6 ft) area of dark-stained soil that was first observed on the surface and thought to be evidence of a recent wildfire or the result of historical brush burning. Although few artifacts were recovered from the STPs excavated within this surface stain, many STPs did contain numerous fragments of burned limestone and diffuse charcoal. The quantity of burned limestone and the thoroughness of its heat alteration suggest sustained exposure to high temperatures for an extended period. These characteristics are inconsistent with vegetation clearance burning and coupled with the depth of burned limestone debris, suggest that this feature represents the cleanout of a Pre-contact cultural feature, possibly an earth oven (Gilmore et al. 2023). The dark-stained soil is located east of the densest concentration of artifacts at the site, indicating that discrete activity areas may be present at Site 66-07-2113. Given the identification of Feature 66-07-2113.0001 and

its potential to provide samples for chronological and macrobotanical analyses, HDR recommended Site 66-07-2113 as eligible for inclusion in the NRHP under Criteria D. This recommendation received SHPO concurrence on November 23, 2021 (Lujan 2021).

Mitigation Requirements and Data Recovery Plan

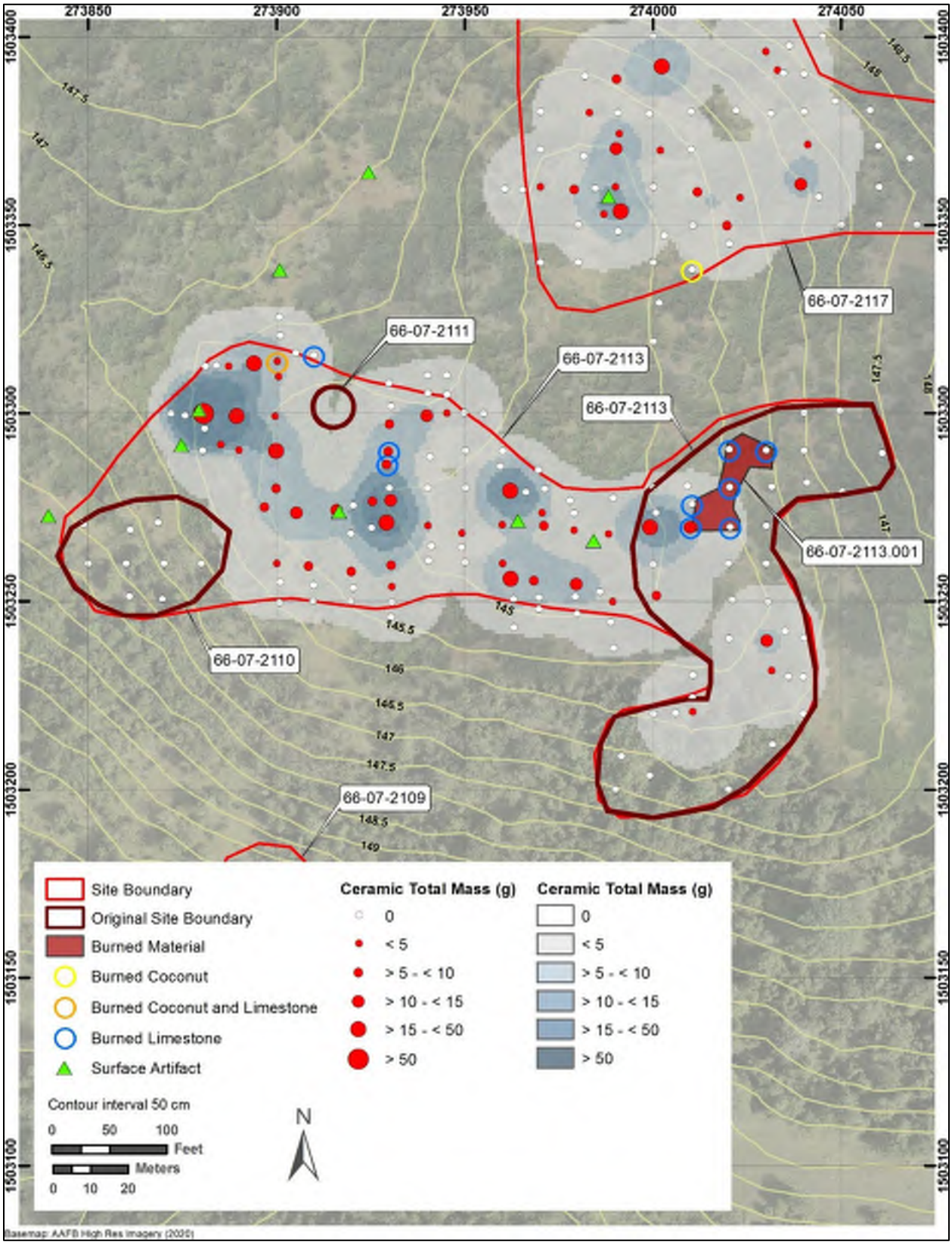
Mitigation for Site 66-07-2113 will focus on recovering data from Feature 66-07-2113.0001 and STP 300E; 515N. This will be accomplished with an excavation unit ranging from 2 m x 2 m to 4 m x 4 m, or an equivalent area, in Feature 66-07-2113.0001, and a 4 m x 4 m excavation unit or an equivalent area at the location of STP 300E; 515N and the area of higher artifact density in the 280-300E; 485-515N area south and west of STP 300E; 515N (Figure 13). The goal of the excavation will be to define the horizontal and vertical extent of Feature 66-07-2113.0001 to verify its configuration and possible function. The excavation of Feature 66-07-2113.0001 should yield multiple samples of the burned remains of annual plants (such as coconut shell) or small diameter carbonized twigs for accelerator mass spectrometry (AMS) dating to enable a Bayesian analysis to determine the minimum date range for use of the feature and the occupation of the site. Bulk soil samples will be retained from the feature fill from both locations for macrofloral and phytolith analysis to determine the crops that were grown. Any ceramic sherds recovered from the subsurface will be evaluated for their potential to provide data on vessel use. No additional fieldwork for site delineation is required, and previous systematic subsurface testing completed by Gilmore et al. (2023) has sufficiently defined the resource boundary.

Laboratory and Data Analysis

Bulk soil samples will be collected for flotation analysis to identify macrobotanical and phytolith remains that can provide data regarding the use of the potential agricultural field, and possibly information on the surrounding vegetation community at the time of site use. Charred macrobotanical remains, such as burned seeds, small-diameter carbonized twigs, or fragments of coconut endocarp, will also be considered as potential sources for AMS dating. Select recovered artifacts will be considered for starch or other residue analysis to determine what economic plant species were processed and used on-site.

Ceramic artifacts recovered during the project will be analyzed following the methods developed by Moore (2012). Moore studied pottery collections from the Latte period sites in Guam to determine which attributes (rim thickness, rim stance, orifice diameter, and exterior surface treatment) were most temporally sensitive. The archaeological contractor will compare the results of the analysis with the information derived from the analysis of the previously recorded artifact assemblage (Gilmore et al. 2023) to determine if multiple periods of occupation are present and possibly what the function of different vessels was (cooking, storage, etc.).

Figure 13. 66-07-2113 ceramic density map.



Research Objectives

The primary research objectives for Site 66-07-2113 are to determine the date of use of the site, what resources of the limestone plateau were being used by the occupants of the site during its occupation as indicated by the AMS dates, and whether sites on the limestone plateau represent permanent occupation of the area or limited activity logistical use by people living in coastal villages. These data will allow us to answer whether the increased use of the area was driven by population expansion and environmental deterioration, leading to food stress. The collection of multiple samples for AMS dates will allow the construction of Bayesian models to determine with as much precision as possible the site's period of use.

Site 66-07-2117

Site 66-07-2117 is a Latte period artifact scatter associated with a subsurface pit feature and evidence of possible anthropogenic soil modification. The site has been previously investigated by Grant et al. (2007) and Gilmore et al. (2023), and these investigations identified 133 ceramic sherds, eight pieces of ground stone, two *Tridacna* shell adzes, a basalt cobble manuport, and a basalt flake. Ecofacts identified included 14 pieces of unaltered shell (Grant et al. 2007). The 2006 investigations by Grant et al. (2007) did not identify any features at the site, while the subsequent investigation in 2021 identified a pit feature (Feature 66-07-2117.0001) in the profile of STP 370E; 620N (Gilmore et al. 2023). Site 66-07-2117 is within the North Field project area (Figure 14).

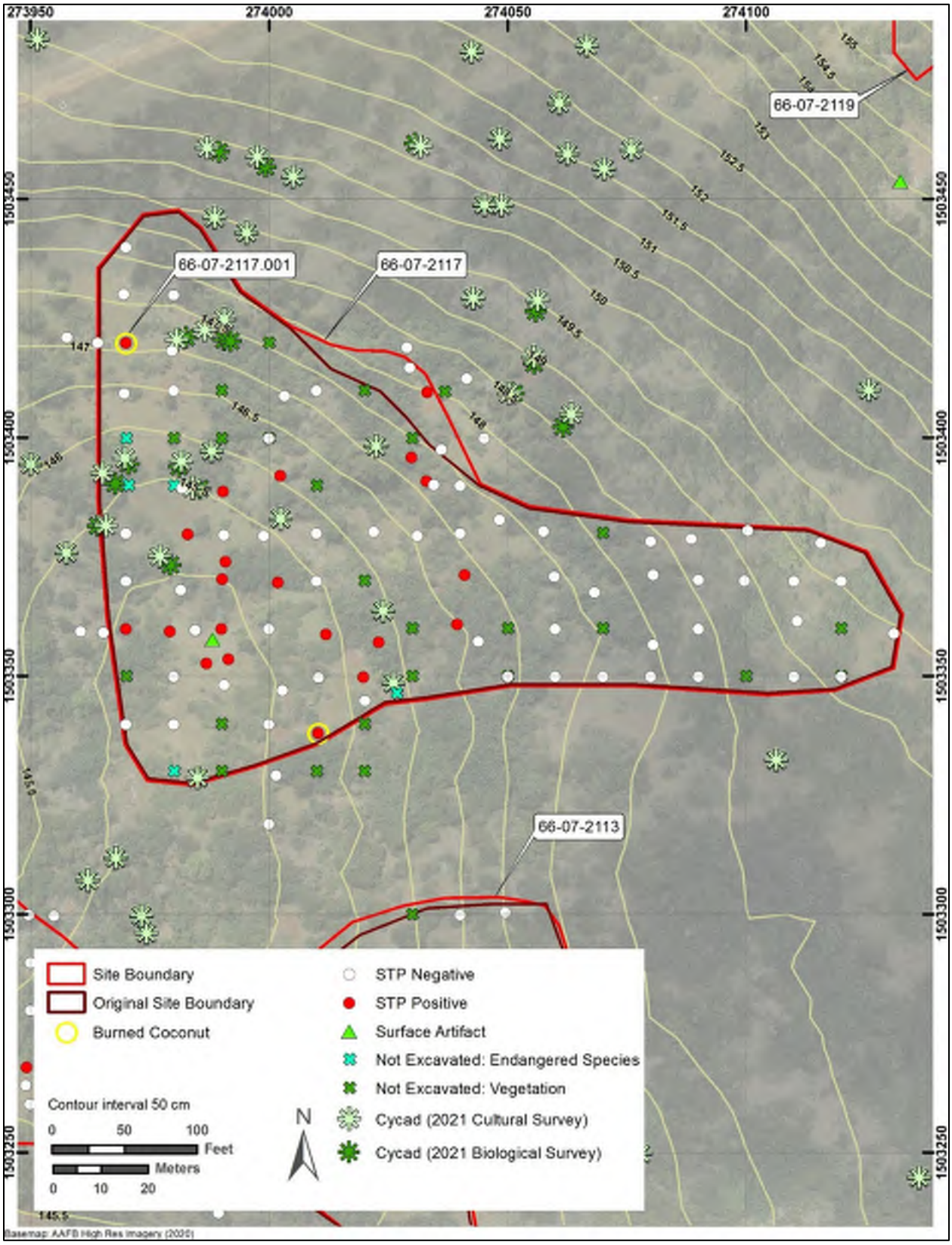
Site Summary and Previous Investigations

Site 66-07-2117 was first recorded by Grant et al. (2007) in 2006. The site was described as an artifact scatter spread over 10,106 m^2 in secondary-growth limestone

forest. Grant et al. (2007) excavated 29 STPs at the site, of which nine were positive. All STPs were excavated to bedrock, which was encountered at depths ranging from 8 to 50 cm (3.1 to 19.7 in). Observed sediments comprised a silty clay loam, though areas of isolated silt loam, silty clay, and sandy clay loam were also present. A total of 88 sherds, eight pieces of ground stone, one lithic artifact, one basalt manuport, and 16 shell artifacts were found at 66-07-2117 (Grant et al. 2007). Surface artifact density at the site was generally low, and most artifacts were recovered within the top 20 cm (7.9 in) of STPs. The deepest artifacts were recovered at depths of 35 cm (13.8 in). Grant et al. (2007) reported that the ground stone artifacts recovered consisted of a basalt adze fragment, three limestone adze fragments, a basalt metate fragment, a basalt abrader fragment, and two indeterminate fragments of ground basalt. The sole lithic artifact was a piece of basalt debitage. One unworked basalt cobble manuport was also recorded. Shell artifacts consisted of two *Tridacna* adzes and 14 unworked marine shell fragments consisting of unidentified bivalves (n=5), unidentified gastropods (n=6), indeterminate shell fragments (n=2), and a *Tridacna* shell. Ceramic sherds identified by Grant et al. (2007) were dominated by plain, smooth exterior surfaces, while seven sherds had combed exterior surfaces, and one additional sherd had a scraped surface. The remaining 13 sherds were too deteriorated to determine surface treatment. A total of 10 rim sherds were included in the assemblage, all consistent with characteristics of Type B rims. Based on surface inventory and subsurface testing results, Grant et al. (2007:213) interpreted the sites as representing a “briefly occupied but fairly diverse resource collection, processing, and tool manufacturing locus.” The site was recommended as not eligible for inclusion in the NRHP due to its low artifact density

and the apparent absence of features or “temporally or functionally divergent cultural strata” (Grant et al. 2007:213).

Figure 14. 66-07-2117 site map.



In 2021, HDR conducted additional subsurface testing at Site 66-07-2117 (Gilmore et al. 2023). HDR excavated 90 STPs across the site, yielding 21 positive STPs that slightly expanded the northern extent of the original boundary defined by Grant et al. (2007). Observed sediments were predominantly clay loam, although small pockets of sandy clay loam to sandy loam were noted. All STPs were excavated to bedrock, which was encountered at depths ranging from 10 to 94 cm (3.9 to 37.0 in). Gilmore et al. (2023) identified 45 ceramic sherds and one pumice abrader across surface and subsurface contexts. Most of the sherds (n=39) had smooth exterior finishes, while one showed a combed exterior. The remaining six sherds were too deteriorated to determine surface treatment. No rim sherds were noted. Sherds were found at depths of up to 63 cm (24.8 in), but most (n=24, 52.2%) were located in the top 20 cm (7.9 in), and an additional 43.5% (n=20) were found between 20 and 30 cm (7.9 to 11.8 in). One abrader manufactured from pumice was observed on the surface. Gilmore et al. (2023) also identified quantities of burned coconut endocarp in two of the STPs (STP 370E; 620N and STP 410E; 540N), which was interpreted as representing evidence of soil amendments added to a swidden field or other agricultural feature.

Gilmore et al.'s (2023) investigations also identified one previously undiscovered feature at Site 66-07-2117, a subsurface pit. Feature 66-07-2117.0001 is a pit feature with charcoal-stained fill exposed in the west profile of STP 370E; 620N (Figure 15). The top of the feature was encountered 42 cm (16.5 in) below the surface and extended to a maximum depth of 76 cm (29.9 in). A few limestone cobbles were observed in the feature and the overlying matrix. Burned coconut shells and charcoal were located in the overlying soils. Relatively little of the feature is exposed within the narrow profile of

the STP, suggesting that only a small section of the features edge was intersected by the STP, and the actual feature is likely much larger. Given the burned coconut shell, the feature was initially interpreted as a possible planting pit for root crops; however, considering its depth, it may have been too deep to have served this purpose. One sherd came from the STP at the same level as the feature. Given the identification of Feature 66-07-2117.0001 and its potential to provide samples for chronological and macrobotanical analyses, HDR recommended Site 66-07-2117 as eligible for inclusion in the NRHP under Criteria D. This recommendation received SHPO concurrence on November 23, 2021.

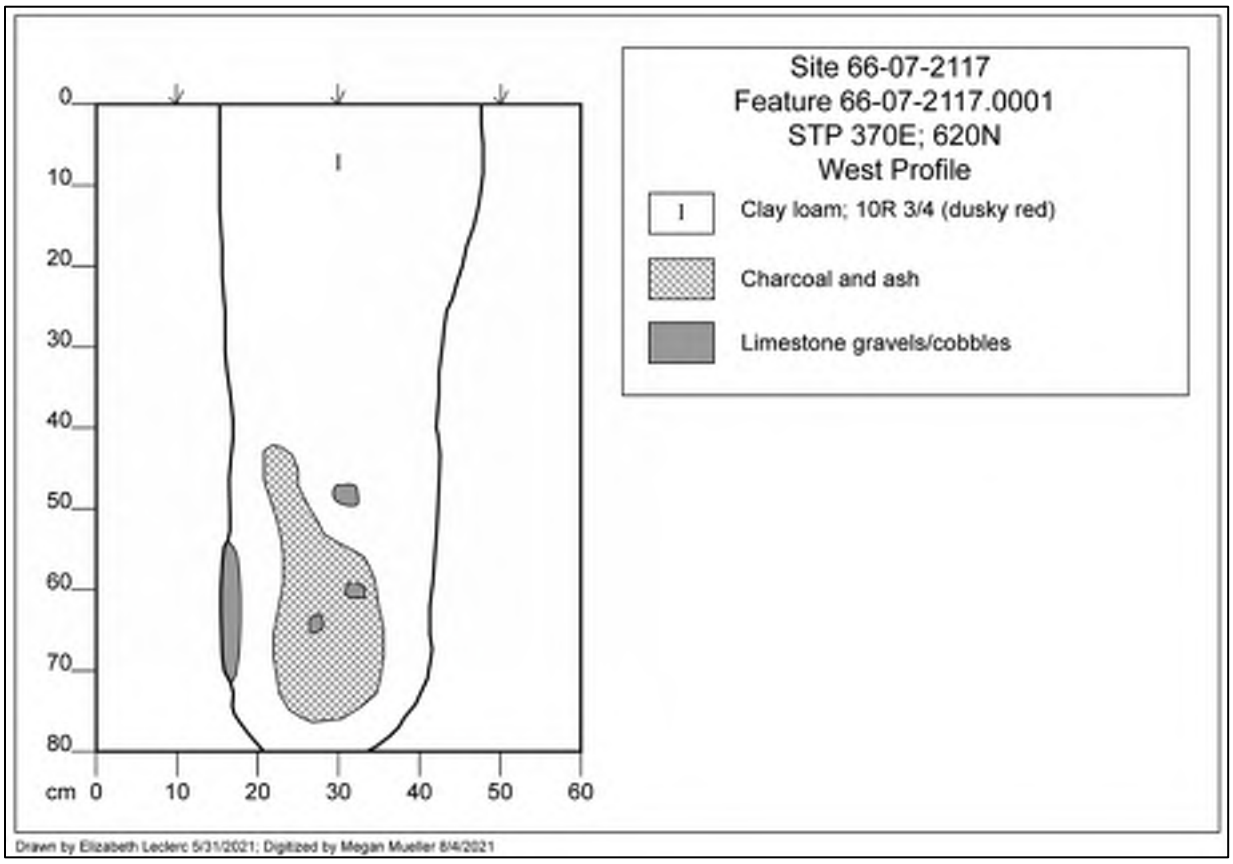
Mitigation Requirements and Data Recovery Plan

Mitigation for Site 66-07-2117 will focus on recovering data from Feature 66-07-2117.0001 and STP 410E; 540N. This will be accomplished with an excavation unit ranging from 2 m x 2 m to 3 m x 3 m or an equivalent area, in Feature 66-07-2117.0001, and a 1 m x 2 m excavation unit or a comparable area at the location of STP 410E; 540N. Because the artifact scatter at the site is relatively sparse without obvious activity areas (Figure 16), there is no need to define the nature and function of any artifact concentrations. The goal of the excavation will be to determine the horizontal and vertical extent of Feature 66-07-2117.0001 to verify its configuration and possible function. In addition, the excavation will yield multiple samples of the burned remains of annual plants (such as coconut endocarp) or small diameter carbonized twigs to provide multiple AMS dates that will enable a Bayesian analysis to determine the minimum date range for use of the feature and the occupation of the site. Bulk soil samples will be retained from the feature fill from both locations for macrofloral and phytolith analysis to

determine the crops grown. Any ceramic sherds recovered from the subsurface during the excavation of features will be evaluated for their potential to provide residue data indicating vessel use.

No additional fieldwork for site delineation is required, and previous systematic subsurface testing completed by Gilmore et al. (2023) has sufficiently defined the resource boundary.

Figure 15. Site 66-07-2117, Feature 66-07-2117.0001, STP 370E; 620N west profile.



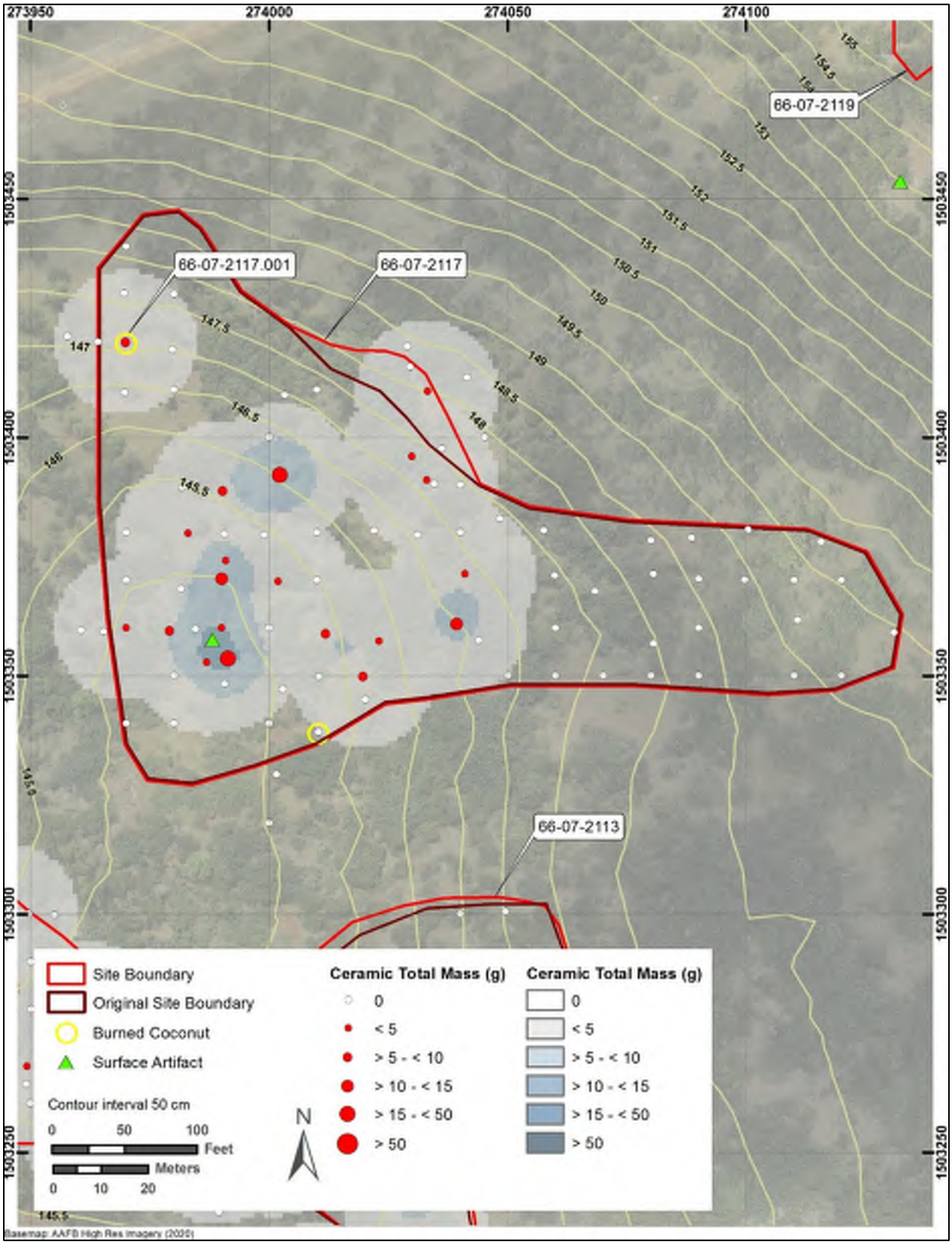
Laboratory and Data Analysis

Bulk soil samples will be collected from the excavation for flotation analysis to identify macrobotanical and phytolith remains that can offer data regarding Site 66-07-2117, and possibly information on the surrounding vegetation community at the time of site

use. Macrobotanical remains, such as burned seeds, will be considered potential sources for radiocarbon samples for AMS dating. Select recovered artifacts could also be considered for starch analysis to determine what plant species were processed and used on-site. Suitable samples of burned annual plants, small-diameter carbonized twigs, and/or macrobotanical samples obtained during soil sample testing will be sent for AMS dating to refine the period of use for the feature.

Ceramic artifacts recovered during the project will be analyzed following the methods developed by Moore (2012), who studied pottery collections from Latte period sites in Guam to determine which attributes (rim thickness, rim stance, orifice diameter, and exterior surface treatment) were most temporally sensitive. The results of the analysis will be compared with the information derived from the analysis of the previously recorded artifact assemblage (Gilmore et al. 2023) to determine if multiple periods of occupation are present.

Figure 16. 66-07-2117 ceramic density map.



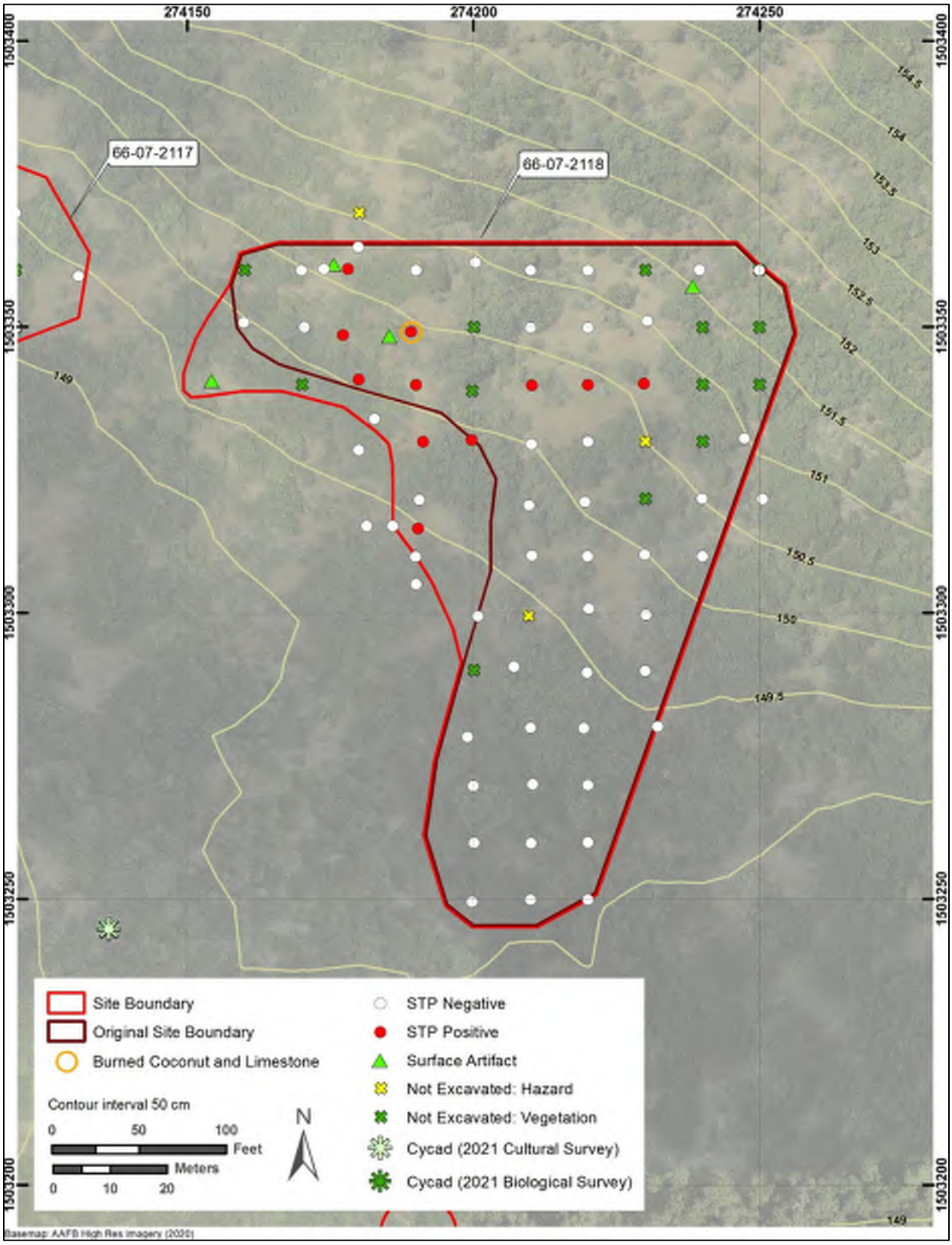
Research Objectives

The primary research objectives for Site 66-07-2117 are to determine the date of use of the site, what resources of the limestone plateau were being used by the occupants of the site during its occupation as indicated by the AMS dates, and whether sites on the limestone plateau represent permanent occupation of the area or limited activity logistical use by people living in coastal villages. These data will allow us to answer whether the increased use of the area was driven by population expansion and environmental deterioration, leading to food stress. The collection of multiple samples for AMS dates will allow the construction of Bayesian models to determine with as much precision as possible the site's period of use.

Site 66-07-2118

Site 66-07-2118 (Figure 17) is a Latte period artifact scatter associated with evidence of possible horticultural soil modifications. The site has been previously investigated by Grant et al. (2007) and Gilmore et al. (2023), and these investigations identified 175 ceramic sherds, a *Tridacna* shell adze, and a basalt cobble with ground surfaces (Gilmore et al. 2023; Grant et al. 2007). The 2006 investigations by Grant et al. (2007) did not identify any features at the site, while the subsequent investigation in 2021 identified fragments of burned limestone and burned coconut endocarp in STP 290E; 350N that may represent soil amendments added to a swidden field or garden plot.

Figure 17. 66-07-2118 site map.



Site Summary and Previous Investigations

Site 66-07-2118 was first recorded by Grant et al. (2007) in 2006. The site was described as an artifact scatter spread over 6,191 m^2 in secondary-growth limestone forest. Grant et al. (2007) excavated a total of 19 STPs at the site, of which nine were positive. All STPs were excavated to bedrock, which was encountered at depths ranging from 10 to 56 cm (3.9 to 22.0 in). Observed sediments comprised a silty clay loam, while an underlying stratum of sandy clay loam was noted in two STPs. A total of 115 sherds, a *Tridacna* shell adze, and a basalt cobble with ground surfaces were found at 66-07-2118 (Grant et al. 2007). Surface artifact density at the site was generally low, and most of the artifacts were recovered within the top 20 cm (7.9 in) of the STPs. The deepest artifacts were encountered at depths of 50 cm (19.7 in). Most artifacts recovered from subsurface contexts were concentrated in the upper 20 cm (7.9 in) of the profile. The *Tridacna* shell adze was recovered from an STP at a depth of approximately 19 cm (7.5 in). Most (n=102) sherds had smooth exterior surfaces, while three had combed exteriors, one had a scraped exterior, and one had an incised surface. Eight sherds were too deteriorated to determine surface treatment. Rim sherds (n=23) within the assemblage were all classified as Type B. The ground stone fragment was an indeterminant fragment of a basalt cobble that exhibited grindings on multiple surfaces. Based on the results of surface inventory and subsurface testing, Grant et al. (2007:213) interpreted the sites as representing a “briefly occupied resource collection or processing locus” with evidence of plant processing and woodworking. However, the site was recommended as not eligible for inclusion in the NRHP due to its low artifact density and the absence of features or “temporally or functionally divergent cultural strata” (Grant et al. 2007:213).

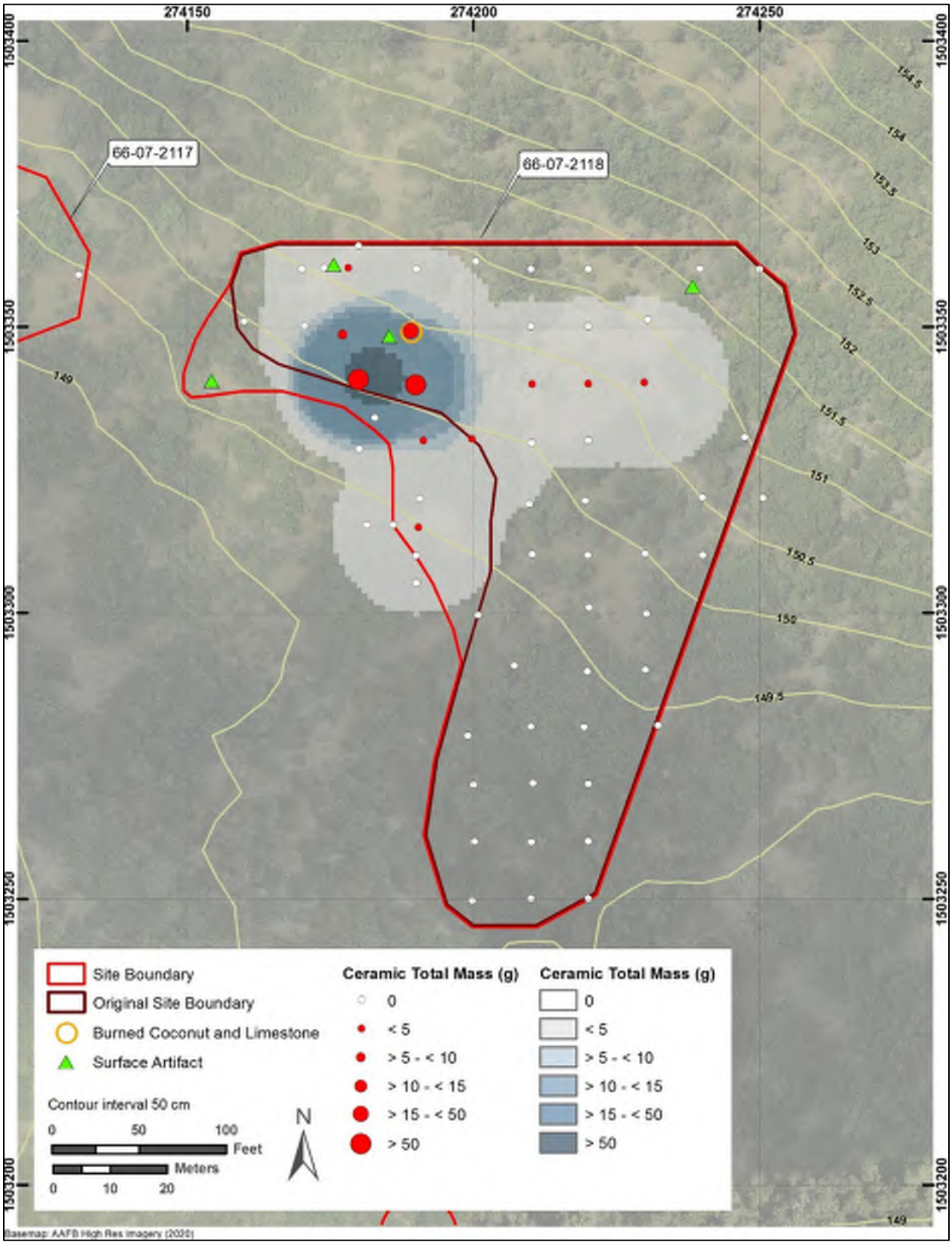
In 2021, HDR conducted additional subsurface testing at Site 66-07-2118 (Gilmore et al. 2023), excavating 63 STPs across the site, of which 11 STPs were positive for cultural materials. Based on the results of a surface inventory and systematic subsurface testing, HDR slightly expanded the western extent of the original boundary defined by Grant et al. (2007). Sediments observed in STPs were predominantly clay loam, although one STP exhibited a silty clay loam surface stratum. All STPs were excavated to bedrock, which was encountered at depths ranging from 2 to 58 cm (0.8 to 22.8 in). Gilmore et al. (2023) identified a total of 60 ceramic sherds across both surface and subsurface contexts. Most of the sherds (n=41) had smooth exterior finishes, while the remainder were too deteriorated to determine surface treatment. Sherds were located at depths of up to 58 cm (22.8 in), but most (n=51, 85%) were found at depths of 20 cm (7.9 in) or less, with five (8%) at depths between 20 and 30 cm (7.9 and 11.8 in). Only a single rim sherd, classified as a Type B rim, was encountered. Gilmore et al. (2023) also identified quantities of burned coconut endocarp in STP 590E; 550N, which was interpreted as representing evidence of soil amendments added to a swidden field or other agricultural feature. Given the identification of possible anthropogenic soil modification at the site and its potential to provide samples for chronological and macrobotanical analyses, HDR recommended Site 66-07-2118 as eligible for inclusion in the NRHP under Criteria D. This recommendation received SHPO concurrence on November 23, 2021 (Lujan 2021).

Mitigation Requirements and Data Recovery Plan

Mitigation for Site 66-07-2118 will focus on defining the nature of the one artifact concentration on the site in the 580-590E;535-545N area (Figure 18) and recovering

additional fragments of burnt coconut endocarp from the potential anthropogenic soil identified within the artifact concentration during subsurface testing. This will be accomplished with a 4 m x 4 m to 6 m x 6 m excavation block, or an equivalent area, in the center of the artifact concentration, including the location of STP 590E: 550N. The goal of the excavation will be to define the nature of this ceramic concentration and the horizontal and vertical extent of the area of anthropogenic soil. The excavation will yield multiple samples of the burned remains of annual plants (such as coconut endocarp) or small diameter carbonized twigs for AMS dating to enable a Bayesian analysis to determine the minimum date range for use of the feature and the occupation of the site. Bulk soil samples will be obtained from the feature fill from both locations for macrofloral and phytolith analysis to determine the crops that were grown. Any ceramic sherds recovered from the subsurface will be evaluated for their potential to provide data on vessel use. No additional fieldwork for site delineation is required and previous systematic subsurface testing completed by Gilmore et al. (2023) has sufficiently defined the resource boundary.

Figure 18. 66-07-2118 ceramic density map.



Laboratory and Data Analysis

Bulk soil samples will be collected from the excavation for flotation analysis to identify macrobotanical and phytolith remains that can offer data regarding the use of Site 66-07-2118, and possibly information on the surrounding vegetation community at the time of site use. Macrobotanical remains, such as burned seeds, will also be considered as potential sources for radiocarbon samples to be used in AMS dating. Select recovered artifacts could also be considered for starch analysis to determine what plant species were processed and used on-site. Suitable samples of burned annual plants, small-diameter carbonized twigs, and/or macrobotanical samples obtained during soil sample testing will be sent for AMS dating to refine the period of use for the feature.

Ceramic artifacts recovered during the project will be analyzed following the methods developed by Moore (2012). Moore studied pottery collections from Latte period sites in Guam to determine which attributes (rim thickness, rim stance, orifice diameter, and exterior surface treatment) were most temporally sensitive. The results of HDR's analysis will be compared with the information derived from the analysis of the previously recorded artifact assemblage (Gilmore et al. 2023) to determine if multiple periods of occupation are present.

Research Objectives

The primary research objectives for Site 66-07-2118 are to determine the date of use of the site, what resources of the limestone plateau were being used by the occupants of the site during its occupation as indicated by the AMS dates, and potential to clarify whether sites on the limestone plateau represent permanent occupation of the area or limited activity logistical use by people living in coastal villages. These data will allow us

to answer whether the increased use of the area was driven by population expansion and environmental deterioration, leading to food stress. The collection of multiple samples for AMS dates will allow the construction of Bayesian models to determine with as much precision as possible the site's period of use.

Site 66-08-2981 (Fafalog)

Site 66-08-2981 is a Latte period artifact scatter that was assigned the traditional Chamorro name of Fafalog (Lujan 2021). The site was initially recorded by Gilmore et al. (2023) in 2021 when 59 STPs were excavated to define the boundary of Site 66-08-2981. Table 2 lists the 188 artifacts documented within surface and subsurface contexts. In 2024, a survey in the expanded MSA-1 project area resulted in the expansion of Site 66-08-2981, which was delineated and constrained by the extent of surface artifacts and features, the project area boundary, areas of prior disturbance, and the excavation of 38 STPs. In total, HDR observed two new features, three new artifact concentrations (AC1, AC2, and AC3), and 163 new artifacts or ecofacts within the expanded site boundary (Figure 19 and Figure 20). Due to the expansion of the site area and the designation of three artifact concentrations in the portion of the site recorded in 2024, the southern portion of the site was designated Artifact Concentration 4 (AC4).

Table 2. Site 66-08-2981 artifacts encountered in 2021 and 2024.

Artifact Type	2021 (n)	2024 (n)	Total (n)
Ceramic – Rim Sherd	8	11	19
Ceramic – Body Sherd	170	93	263
Ground Stone – Lusong	0	3	3
Ground Stone – Abrader	1	2	3
Ground Stone – Pestle	1	1	2

Artifact Type	2021 (n)	2024 (n)	Total (n)
Ground Stone – Miscellaneous	3	1	4
Stone Adze	1	0	1
Lithic Debitage – Flake	1	3	4
Lithic Debitage – Debris	0	15	15
Mammal Long Bone	0	1	1
Shell – *Tridacna* sp.	0	1	1
Shell – Unidentified	1	0	1
Charred Endocarp – *Cocos nucifera*[a]	0	25	25
.50 cal BMG Ammunition	0	6	6
Human Molar	1	0	1
Possible Human Bone	1	1	2
Total (n)	188	163	351

Figure 19. Site 66-08-2981 site map (north half).

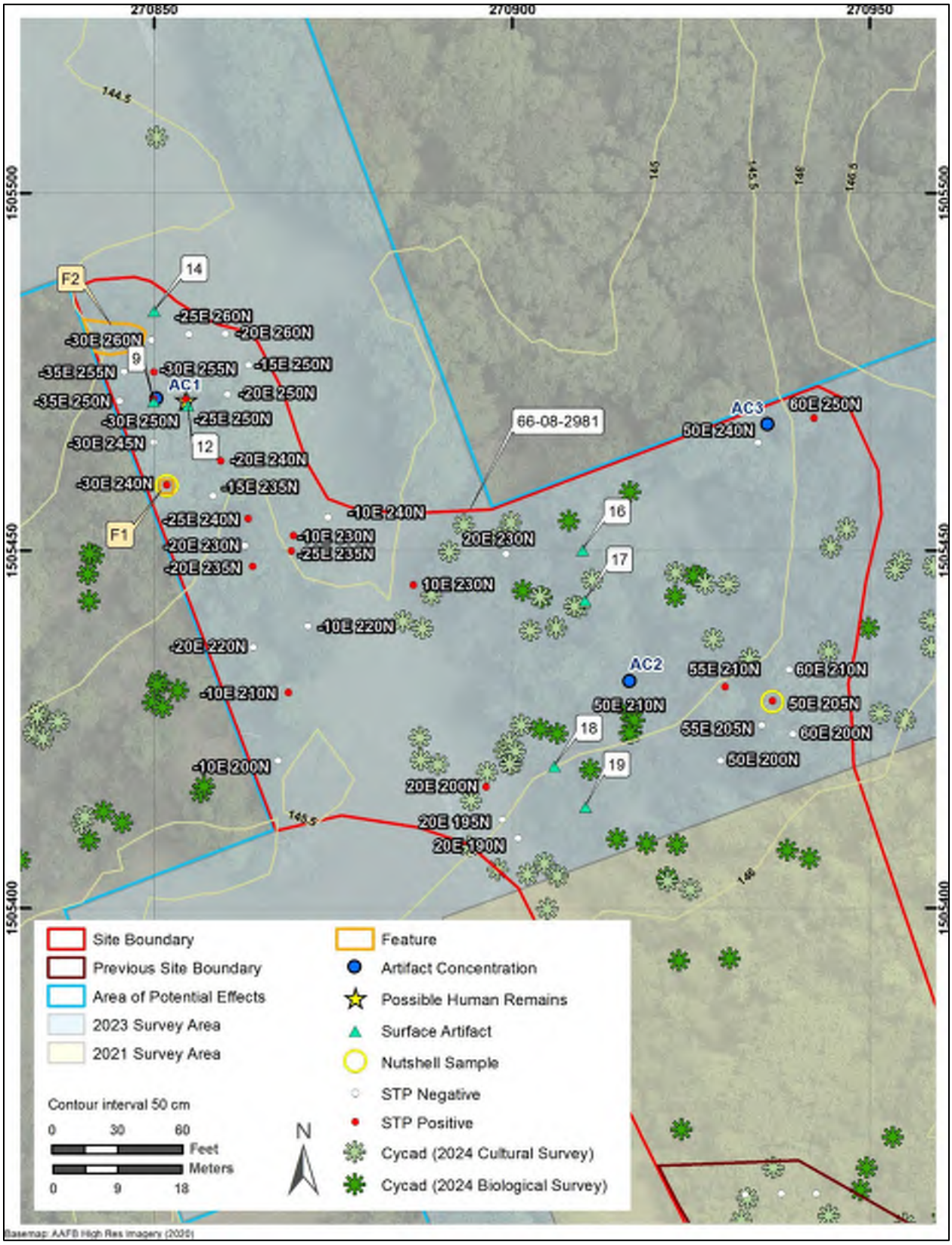


Figure 20. Site 66-08-2981 site map (south half).

Site Summary and Previous Investigations

The 2021 investigation documented 188 artifacts in surface and subsurface contexts, including 170 body sherds, eight rim sherds, one basalt adze, one basalt pestle fragment, one pumice abrader, three pieces of ground stone, one chert retouched flake, and one unidentified shell fragment. Additionally, HDR recovered one unidentified bone fragment and one human deciduous maxillary molar from a single STP that could represent an intact inhumation or scattered disarticulated remains. All of these artifacts were identified in what is now the south half of the site (Gilmore et al. 2023).

Site 66-08-2981 was first recorded by Gilmore et al. (2023) in 2021. The site was described as an artifact scatter that extends over 4,260 m^2 in a limestone forest. Gilmore et al. (2023) excavated 59 STPs to delineate the boundary of the site and evaluate its eligibility for inclusion in the NRHP. Of the 59 STPs excavated by HDR, 31 contained cultural materials. Observed sediments were predominately Guam cobbly loam, although small pockets of deeper Yigo soils were noted. All STPs were excavated to bedrock, which was encountered at depths ranging from 14 to 69 cm (5.5 to 27.2 in). Gilmore et al. (2023) identified a total of 178 ceramic sherds, a basalt adze, a basalt pestle fragment, a pumice abrader, ground stone fragments (n=3), a chert retouched flake, and an unidentified shell fragment at the site. The ceramic assemblage was dominated by body sherds (n=170), with lesser quantities of rim sherds (n=8). Most of the sherds (n=128) exhibited smoothed exterior surfaces while three had combed surface treatment. The remaining sherds (n=39) were too badly deteriorated to determine surface treatment. Sherds were encountered from the surface to a maximum depth of 50 cm, but most (n=117, 68.8%) were recovered between the surface and 20

cm (7.9 in). An additional 43 sherds (25.3%) were found at depths between 20 and 30 cm (7.9 to 11.8 in). Rim sherds were all Type B rim types. Six of the rim sherds were found on the surface, while the remaining two were recovered from the upper 15 cm (5.9 in) of STPs. One unidentified bone fragment and one human deciduous maxillary molar were also recovered from subsurface contexts (Gilmore et al. 2023). The unidentified bone fragment and human tooth were found in the top 15 cm (5.9 in) of an STP. Following Andersen AFB Standard Operating Procedure 9, Gilmore et al. (2023) halted excavation in the vicinity and no further STPs were excavated within 5 m (16.4 ft). It is unclear if these human remains represent an intact burial or scattered disarticulated remains (Gilmore et al. 2023).

The 2021 Gilmore et al. (2023) investigation identified distinct concentrations of ceramics sherds at Site 66-08-2981, indicative of an intact site structure that could yield vital information on the Pre-contact use of the site. Gilmore et al. (2023) also argued for the potential of reconstructable vessels at the site and that vessel morphology could provide temporal and functional data. Residue analysis of these vessels could provide data on subsistence practices and function. The authors also contend that the proximity of 66-08-2981 to historical agricultural fields suggests it may represent a temporary habitation associated with these fields. Therefore, residential features may be present at the site. Supporting this assessment, Gilmore et al. (2023) conducted a lidar analysis that identified a rectangular anomaly less than 40 m (131 ft) east of Site 66-08-2981 that resembles Post-contact period agricultural features documented elsewhere on the northern plateau. Gilmore et al. (2023) recommend investigating the nature of this anomaly, its association with 66-08-2981, and whether it is an indigenous agricultural

feature. Based on these potential avenues of future research, Gilmore et al. (2023) recommended Site 66-07-2981 as eligible for inclusion in the NRHP under Criteria D. This recommendation received SHPO concurrence on November 23, 2021.

The 2021 investigations by Gilmore et al. (2023) did not identify any features at the site, while the subsequent investigation in 2024 identified an apparent midden feature (Feature 66-07-2981.0001) in STP 370E; 620N and a limestone cobble concentration (Feature 66-07-2981.0002) close to the northern edge of the site (Gilmore et al. 2025). The 2024 investigations identified 163 artifacts and ecofacts in surface and subsurface contexts, including 105 ceramic sherds, one mostly complete and two fragments of rhyolite lusong, two coral abraders, one fragmentary pestle, one piece of miscellaneous ground stone, three rhyolite flakes and 15 pieces of rhyolite angular debris, one mammal long bone, one unmodified *Tridacna* sp. shell, 25 pieces of burned coconut endocarp, six .50 caliber shells, and one possible fragment of a human long bone.

As in the southern half of the site, the ceramic assemblage in the supplemental project area was dominated by body sherds (n=94), with fewer rim sherds (n=11). Just over half of the rim sherds (n=6) exhibited smoothed exterior surfaces, while one had a combed and roughened surface treatment. Two rim sherds were too badly deteriorated to determine surface treatment. Rim sherds were all Type B rim types. Ten of the rim sherds were found on the surface, and the remainder were recovered from 19 cm (7.5 in) below ground surface (bgs) in STP 50E; 205N (Gilmore et al. 2025:90-91).

The possible human long bone fragment was recovered from STP -25E; 250N, and no further work was conducted within the STP or a 10 m (33 ft) radius. It is unclear if these

human remains represent an intact burial or scattered disarticulated remains (Gilmore et al. 2025).

Absolute and relative dating of artifacts from the expanded site boundary supports Gilmore et al.'s (2023) previous interpretation that the Pre-contact component of Site 66-08-2981 dates from the late Latte period. The macrofloral remains of burned *Cocos nucifera* endocarp from STP 55E; 210N and STP -30E; 240N (F1) were sent to the University of Georgia Center for Applied Isotope Studies for AMS dating. Two dates from each location were obtained, and contrary to expectations, when the four dates were tested for significance, the dates between the two locations were determined to be significantly different at the 95 percent confidence level, suggesting the presence of two closely spaced in time but spatially separate occupations (Table 3).

Table 3. Radiocarbon dates and calibrated ages obtained from Site 66-08-2981.

Lab No.	STP/depth	Sample	Radiocarbon Age (BP)	±	$\delta_{13}C$,‰	Calibrated Age (2σ)
75243	55E; 210N 0–10 cm bgs	*Cocos nucifera* endocarp (Charred)	550	20	-23.89	1325–1350 CE, 1390–1420 CE Median probability: 1402 CE
75244	55E; 210N 0–10 cm bgs	*Cocos nucifera* endocarp (Charred)	570	20	-23.78	1320–1360 CE, 1390–1420 CE Median probability: 1348 CE
75245	-30E; 240N 0–22 cm bgs	*Cocos nucifera* endocarp (Charred)	430	20	-22.85	1430–1480 CE Median probability: 1450 CE
75246	-30E; 240N 0–22 cm bgs	*Cocos nucifera* endocarp (Charred)	470	25	-24.95	1417–1455 CE Median probability: 1435 CE

Notes: No. = Number; bgs = below ground surface; cm = centimeters cal. = calibrated

The AMS dates were calibrated at two sigma with the program CALIB 8.1 (Stuiver and Reimer 1993), using the Intcal20 Northern Hemisphere Radiocarbon Age Calibration Curve (Reimer et al. 2020). The pooled means for each location were 560±14 (1325–1353 CE, p=.403; 1394–1418 CE, p=.597, median 1397 CE) and 446±14 (1432–1457

CE, p=1.0, median 1444 CE). Both of these date ranges fall within or just after the AD 1300 Event (1250–1400 CE) as defined above.

Ceramic typologies from the expanded site were also analyzed and are congruent with these AMS dates. Across all features, artifact concentrations, field specimens, and STPs, ceramic sherds (n=105) were the most common artifact class encountered at Site 66-08-2981 (Fafalog). Of the rim sherd assemblage (n=11), HDR collected rim thickness measurements from nine artifacts. The average rim thickness of these artifacts was 15.7 mm (0.6 in), with a range of 9.0 to 23.4 mm (0.4 to 0.9 in). These rim characteristics are consistent with ceramic manufacture trends in the Latte period that produced thicker walled vessels with slightly thickened, incurving rims. Moore (2012) classifies these as Type B rims. All rims were less than 30 mm (1.2 in) thick, indicating they are among the thinner subclassification of Type B rim types, rather than the "exceedingly thick" rims that appear in assemblages by 1400 CE (Moore 2012:126).

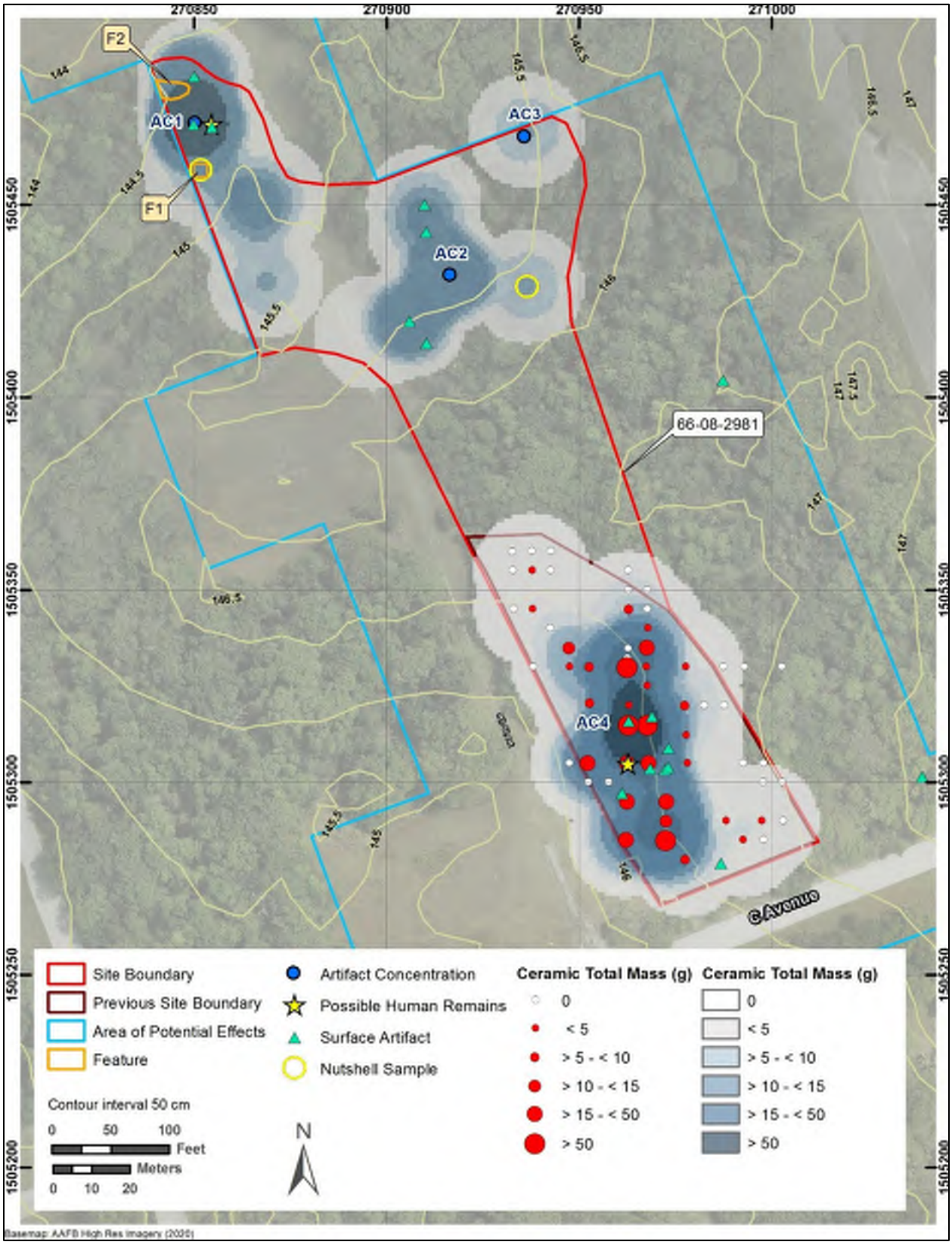
Compared to the North Ramp sites discussed above, Site 66-08-2981 (Fafalog) has more artifact concentrations, which contributes to a more complex site structure, more features, and a greater variety of artifact types and site furniture (lusong), all of which indicate a more prolonged occupation of the site and a greater diversity of activities. The North Ramp sites are perhaps better characterized as limited activity loci (Gilmore et al. 2023). In contrast, Fafalog may represent a habitation site and requires a more complex approach to data recovery. However, the function of these sites will need to be confirmed through data recovery.

Mitigation Requirements and Data Recovery Plan

Mitigation for Site 66-08-2981 will focus on defining the nature of the three Pre-contact artifact concentrations (AC1, AC3, and AC4), and this will consist of placing an excavation unit measuring 4 m x 4 m or 6 m x 6 m, or the equivalent, over the greatest concentration of ceramics in each concentration. An excavation unit measuring 4 m x 4 m or 6 m x 6 m or the equivalent will be excavated to investigate the nature and extent of the Feature 66-08-2981.0001 midden in the STP -30E; 240N vicinity; an excavation unit measuring 2 m x 2 m or its equivalent will be excavated in Feature 66-07-2981.0002 to determine the nature and function of this concentration of limestone cobbles; and an excavation unit measuring 2 m x 2 m or the equivalent will be excavated in the 50E; 205N vicinity to collect more samples of burned coconut endocarp for dating (Figure 21). This will hopefully provide more rim sherds to assist with determining a relative age for the site, and the collection of further sherds (especially rim sherds) will hopefully provide samples from a variety of ceramic vessels for conducting residue analysis to determine the contents and use of the ceramic containers. Excavation units at the location of the Feature 66-08-2981.0001 midden and in the STP -30E;240N vicinity will provide additional burned coconut endocarp samples and possibly other macrobotanical samples to provide additional information on what plant resources the site occupants were cultivating/gathering/ processing and also provide additional samples for AMS dates that will contribute to a refined Bayesian analysis that will further define the occupations at the site. Finally, these excavation units could also provide evidence of post holes or other evidence of the field house or more formal habitation structures at the site, as discussed as a possibility by Gilmore et al. (2023, 2025). Up to two additional 2 m x 2 m excavation units, or their equivalent,

may also be placed at the field director's discretion to investigate any new areas of interest that may be identified. In addition, the linear lidar anomaly to the south of the site boundary should be examined to determine if it is a Chamorro feature. The small portion of this feature adjacent to the original MSA-1 project area should be cleared off to determine its origin and function, whether it represents a Pre-contact or Post-contact indigenous feature, or a much later historical feature associated with the construction of MSA-1. Based on aerial photographs post-dating the original 2021 HDR survey, a recent construction project immediately to the south of the MSA-1 project area appears to have destroyed a large portion of the linear lidar anomaly, and further investigation of this feature and determination of its origin outside the MSA-1 project area may not be possible. Further examination of the lidar anomaly may identify previously unidentified features that would require the placement and excavation of additional excavation units (2 m x 2 m or 4 m x 4 m). Such features would also require the collection of bulk soil samples for macrofloral and phytolith analysis, and the collection of burned annuals or small diameter carbonized twigs to provide additional AMS dates to add to a Bayesian analysis to determine the minimum date range for use and construction of the feature.

Figure 21. Kernel density analysis of Site 66-08-2981.



Laboratory and Data Analysis

Bulk soil samples will be collected from excavations for flotation analysis to identify macrobotanical and phytolith remains that can provide data on the economic plants and animals grown by the site occupants, and possibly provide information on the surrounding vegetation community at the site. Macrobotanical remains, such as burned seeds (and burned coconut endocarp) recovered from flotation, will also be considered potential sources for samples appropriate for AMS dates. Select recovered artifacts could also be considered for residue, starch, pollen, and phytolith analysis to determine what plant species were processed and used on site. Suitable samples of burned annual plants, small-diameter carbonized twigs, and/or macrobotanical samples obtained during soil sample testing will be sent for AMS dating to add to the above-mentioned Bayesian analysis to refine the period of use for the site.

Ceramic artifacts recovered during the project will be analyzed following the methods developed by Moore (2012). Moore studied pottery collections from the Latte period sites on Guam to determine which attributes (rim thickness, rim stance, orifice diameter, and exterior surface treatment) were most temporally sensitive. The results of the analysis will be compared with the information derived from the analysis of the surface assemblage (Gilmore et al. 2023) to determine if multiple periods of occupation are present.

Research Objectives

The primary research objective for Site 66-07-2981 is to determine what the function of the site was and how this may have differed from the North Ramp sites, and determine what economic plants were being used by the site occupants and determine if there is

any evidence of longer-term occupation, like a short term or long-term habitation structure. The unidentified lidar anomaly should be investigated to determine if it is a Post-contact agricultural field. Examination of the remainder of Site 66-07-2981 may clarify if the site is a field house, or other habitation structure associated with the potential agricultural field, or whether it is an unrelated pre- or Post-contact site. If post holes associated with a structure are located at the site, these may provide samples that can be subjected to radiocarbon dating to provide a date for the use of the site.

5 Deliverables and Schedule

During the project, various deliverables will be produced. These documents will summarize project progress and describe the results of the fieldwork and any associated analyses.

Project Reports

The archaeological contractor will produce Preliminary Draft, Draft, and Final data recovery reports for the project. All versions of the report will include:

- An executive summary providing a brief synopsis of the purpose, work scope, and findings of the project;
- An introduction that includes a summary of the project description, physical/environmental setting, study areas (including overview maps), project personnel, report organization, and disposition of field notes and all other data collected;
- A previous investigation section that contains a summary of previous archaeological and historical research within the relevant traditional or historic

regional land division, traditional and historic land use patterns, and current land use;

- A research design section that includes anticipated findings, detailed discussion of research objectives, and methods used to accomplish the fieldwork;
- A results section that includes detailed site descriptions, maps/figures/photographs of resources identified, results of the data recovery, sediment profiles and descriptions, analyses of sediment studies, and detailed descriptions and analyses of all recovered artifact and midden materials with appropriate illustrations/photographs;
- A conclusions section that discusses the results of the findings and presents the preliminary site significance and NRHP eligibility evaluations based on criteria outlined in 36 CFR Part 60; and
- A comprehensive bibliography of all reference materials utilized and cited (formatted per the *Society for American Archaeology Style Guide*).
- Appendices with catalogued artifacts, AMS results, macrobotanical reports, and other relevant ancillary data.

Three complete, bound, printed copies and three complete electronic copies in text-searchable PDF format (on compact disc [CD], not digital versatile disc [DVD]) of the Preliminary Draft report will be submitted to the Contracting Officer (KO). These copies will be sent within 90 days following the completion of the archaeological testing fieldwork. The KO will distribute these copies to the Andersen AFB Cultural Resources

Manager (CRM) and the Naval Facilities Engineering Command (NAVFAC) Pacific archaeologist.

The Andersen AFB CRM and the NAVFAC Pacific archaeologist will review the preliminary draft report for academic excellence, professional quality, and technical accuracy. Review comments for the Preliminary Draft report will be sent to the archaeological contractor within 15 days of receiving the submittals. The archaeological contractor will consider these review comments for the production of the Draft Report.

The archaeological contractor will submit four complete, printed, bound copies and four complete electronic copies of the draft report in text-searchable PDF format (on CD, not DVD) to the KO. The KO will send copies to the Andersen AFB CRM and the NAVFAC Pacific archaeologist within 7 days after receiving review comments on the Preliminary Draft report.

Within five days of receipt, the federal government will review the Draft report to ensure that all Preliminary Draft report review comments have been addressed. The Andersen AFB CRM will then submit the Draft report to the Guam SHPO for a 45-day comment period. Following this period, if no response is received, it will be assumed that SHPO does not wish to submit input on the project and is in agreement with the results. SHPO comments (to be received by the Andersen AFB CRM) for the Draft report will be reviewed by the Andersen AFB CRM and the NAVFAC Pacific archaeologist for applicability. The Andersen AFB CRM and the NAVFAC Pacific archaeologist will forward those comments relevant to the scope of the study to the archaeological

contractor, along with any further review comments from the government, for production of the Final report.

The archaeological contractor will submit four complete, printed, bound copies and four complete electronic copies in text-searchable PDF format (on CD, not DVD) of the Final report to the KO. The Final report will be sent within 10 days of receipt of the government's and Guam's SHPO's review comments on the draft report. The CDs containing the electronic files will include the Final report (in Word and PDF formats), all source files, and Geographic Information System (GIS)/Global Positioning System (GPS) data. The Andersen AFB CRM will send copies of the Final report to the NAVFAC Pacific archaeologist and Guam SHPO.

Artifact Curation

The archaeological contractor will prepare all artifacts and samples recovered during excavations for curation according to the standards contained in 36 CFR Part 79, Curation of Federally Owned or Administered Archaeological Collections on a time and materials basis, the fee of which will be determined after the data recovery fieldwork is complete. The archaeological contractor will obtain a curation agreement with the Sagan Fandipositon Kotturåt Guåhan (Guam Cultural Repository) at the University of Guam for storage of the collections resulting from the data recovery. The DoD will be responsible for any curation fees.

Digital Geospatial Data

All geographic information will be provided in a form that does not require translation, pre-processing, or post-processing. All digital geographic maps and related datasets will be delivered in one of the following software formats:

- Preferred: The information will be provided in a version of Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) compliant personal geodatabase format (Access database file) using the latest version of ArcGIS that has been approved by the Naval Information Technology Center. Currently, this is ArcGIS 10.3.q. The personal geodatabase must be importable to a multi-user geo-database using the latest version of ArcSDE (version 10.3.1), which has been approved by the Naval Information Technology Center .
- Alternative: The information will be provided in double precision, standard Environmental Systems Research Institute shapefile format.

(NOTE: ARC/INFO, ArcGIS, and ArcSDE are GIS software produced by Environmental Systems Research Institute of Redlands, California, and comprise the software suite used by the U.S. Navy.)

The geospatial data structure will be as follows:

- GIS Datasets: The archaeological contractor will develop all geographic information in a structure consistent with the most current version of the SDSFIE, also known as the National Committee for Information Technology Standards 353. The current version is SDSFIE 2.6. The SDSFIE will be followed for geospatial database table structure, nomenclature, and attributes. The archaeological contractor will consult with the government (GeoReadiness Center or GIS Manager) concerning modification or additions to the SDSFIE. The government may approve modifications to the SDSFIE if it is determined that it does not adequately address subject datasets. Copies of the SDSFIE may be

obtained from the CADD/GIS Technology Center's Internet homepage (http://www.sdsfie.org/) or by contacting the SDSFIE Help Desk (phone 1-866-9SDSFIE/1-866-973-7343; email HelpMe@sdsfie.org).

- Data Preference – ArcGIS will be the preferred deliverable data type for all drawings related to the exterior of a facility, with data sent in the latest version of ArcGIS (but compatible with version 9.3).

Geospatial Data Projection

Geographic data (regardless of format) will be provided in World Geodetic System of 1984, Universal Transverse Mercator Zone 55 North. If appropriate, each dataset will have a projection file based on the format. Mapping accuracy for the agreed mapping scales (with the government) will conform to the American Society for Photogrammetry and Remote Sensing, "Accuracy Standards for Large-Scale Maps" and "Interim Accuracy Standards for Large-Scale Maps" (ASPRS 1991). Copies of these standards can be obtained at http://www.asprs.org or by contacting:

American Society for Photogrammetry and Remote Sensing
5410 Grosvenor Lane, Suite 210
Bethesda, MD 2082-2160

As these standards are outdated and no longer maintained, a more recent version of these standards (2008) can be found in the Federal Geographic Data Committee's (FGDC) *Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy (NSSDA)* (FGDC 2008). Copies can be obtained at http://www.fgdc.gov.

Geospatial Data Collection

Geospatial data collection will be done as follows:

- GPS data collection will be performed as specified in the performance work statement (PWS). Accuracy will be at ± 1 to 5 m horizontal accuracy before post-processing with sub-meter accuracy.
- Datasets derived from GPS data collection efforts will include metadata to record descriptions of the receiver and other equipment used during collection and processing, base stations used for differential corrections, software used for performing differential corrections, estimated horizontal and vertical accuracies obtained, and conversion routines used to translate the data into the final geographic data delivery format. All metadata will comply with the format requirements as specified within the PWS and this data recovery plan. The final geographic data delivery format will comply with the specifications stipulated within the PWS and this data recovery plan.

Media for Geospatial Data Deliverables

Geographic data will be delivered on a separate read-only memory CD (CD-ROM) with ISO-9660 format. This media will contain only the value-added datasets. The archaeological contractor's working files and/or original datasets that may have been used to develop the deliverables will not be included. "READ ME" files may be included on the geographic data media if they explain the delivered datasets.

Geographic Data Documentation

For each digital file delivered containing geographic information (regardless of format), the archaeological contractor will provide documentation consistent with the FGDC

Content Standards for Digital Geospatial Metadata. Both “Mandatory” and “Mandatory as Applicable” fields will be completed for each geographic dataset. The documentation will include, but is not limited to, the following:

- The name and description of the dataset/data layer
- The source of the data and any related data quality information, such as accuracy and time period of content
- Description of equipment or instruments used in the data collection
- Type of data coverage (point, line, polygon, etc.)
- Field names of all attribute data and a description of each field name
- Definition of all codes used in the data fields
- Ranges of numeric fields and the meaning of these numeric ranges
- The creation date of the map layer and the name of the person who created it
- A point of contact who can answer technical questions

Metadata generation tools included in the ArcGIS software suite will be used to produce the required metadata in XML format. If none of these tools are used, the contractor must ensure that the metadata is delivered in a format that can be easily translated to the XML format.

Copies of the FGDC metadata standard can be obtained at http://www.fgdc.gov or by contacting:

FGDC Secretariat

c/o U.S. Geological Survey

590 National Center

Reston, Virginia 22092

(703) 648-4627

Ownership

All digital files, final-copy products, source data acquired for this project, and related materials, including those provided by the government, will become the property of Andersen AFB, NAVFAC Marianas, and NAVFAC Pacific and will not be issued, distributed, or published by the archaeological contractor.

Project Schedule

The schedule for the project's archaeology work will depend upon the date of the notice to proceed and the coordination time between the archaeological contractor and the Andersen AFB staff to obtain permission to access the area. Table 4 includes project milestones and the time required to complete the tasks.

Table 4. Project Schedule

Task	Deliverables	Schedule
Initiation of Fieldwork	Not applicable	Once notice to proceed and base access has been granted
Preliminary Draft Data Recovery Report	Three printed and three electronic (CD) copies.	The Preliminary Draft report will be transmitted to the Andersen AFB KO within 90 days of completion of fieldwork. The KO will distribute the copies to the Andersen AFB CRM and the NAVFAC Pacific archaeologist.
Preliminary Draft Data Recovery Report Review Comments	One electronic copy of a comment response matrix will be received from Andersen AFB CRM and the NAVFAC Pacific archaeologist.	Comment response matrix will be received within 15 days of submission of the Preliminary Draft Report to the Andersen AFB CRM and the NAVFAC Pacific archaeologist.

Task	Deliverables	Schedule
Draft Data Recovery Report	Four printed and four electronic (CD) copies.	The Draft report will be transmitted to the Andersen AFB KO within 7 days of receiving the comment response matrix from the Andersen AFB CRM and the NAVFAC Pacific archaeologist; the Andersen AFB CRM will transmit the Draft report to the Guam SHPO.
Draft Data Recovery Report Review Comments	One electronic copy of a comment response matrix will be received from Andersen AFB CRM, the NAVFAC Pacific archaeologist, and the Guam SHPO.	Comment response matrix will be received within 45 days of submission of the Draft report to the Andersen AFB CRM, the NAVFAC Pacific archaeologist, and the Guam SHPO.
Final Data Recovery Report	Four printed copies and four electronic (CD) copies of the report, plus all GIS/GPS data (on a separate CD), all source files, and an addressed draft comment response matrix.	The Final report will be transmitted to the Andersen AFB KO within 10 days of receiving the comment response matrix.

6 References

Allen, M. 2006. New ideas about Late Holocene climate variability in the central Pacific. *Current Anthropology*, 47:521–535.

Andersen AFB (Andersen Air Force Base). 2021. *Andersen Air Force Base History.* Available online at: http://andersen.af.mil/About-Us/Fact-Sheets/Display/Article/414630/andersen-air-force-base-history, accessed February 8, 2021.

ASPRS (American Society for Photogrammetry and Remote Sensing). 1991. "Accuracy Standards for Large-Scale Maps" and "Interim Accuracy Standards for Large Scale Maps." Available online at: http://www.asprs.org

Athens, J. Stephen. 1986. *Archaeological Investigations at Taragüe Beach, Guam*. Report prepared for Base Civil Engineering, Andersen AFB, Guam. International Archaeological Research Institute, Inc., Honolulu, Hawaii.

Atkinson, R.J.C. 1957. Worms and weathering. *Antiquity* 31:219–233.

Balek, Cynthia L. 2002. Buried Artifacts in Stable Upland Sites and the Role of Bioturbation: A Review. *Geoarchaeology: An International Journal* 17(1):41–51.

Bayman, James M., Hiro Kurashina, Mike T. Carson, John A. Peterson, David J. Doig, and Jane A. Drengson. 2012. Household economy and gendered labor in 17th century A.D. on Guam. *Journal of Field Archaeology* 37(4):259–269.

Bonneau, Xavier, Irfan Haryanto, and Triyono Karsiwan. 2010. Coconut Husk Ash as a Fertilizer for Coconut Palms on Peat. *Experimental Agriculture* 46(3):401–414.

Bradley, Ray. 2000. 1000 Years of Climate Change. *Science* 288(5470).

Broecker, Wallace S. 2001. Was the Medieval Warm Period Global? *Science* 291(5508).

Carson, Mike T., and Hiro Kurashina. 2012. Re-envisioning long-distance Oceanic migration: early dates in the Mariana Islands. *World Archaeology* 44(3):409–435.

Carson, Mike T. 2017. Rediscovering Heritage through Artefacts, Sites, and Landscapes: Translating a 3500-year Record at Ritidian, Guam. Archaeopress Publishing Ltd, Oxford.

Clark, Geoffrey R., and Olaf Winter. 2019. Chapter 2 The Ceramic Trail: Evaluating the Marianas and Lapita West Pacific Connection. In *Debating Lapita: Distribution, Chronology, Society and Subsistence,* edited by Matthew Bedford, pp.37–60. ANU Press, Canberra.

Cobb, Kim M., Chris Charles, Hai Cheng, R. Lawrence Edwards. 2003. El Nino/Southern Oscillation and tropical Pacific climate during the last millennium. *Nature* 424:271–276.

DeFant, David. 2008. Early Human Burials from the Naton Beach Site, Tumon Bay, Island of Guam, Mariana Islands. *Journal of Island and Coastal Archaeology* 3:149–153.

DeFant, David, and R. Leon Guerrero. 2006. Archaeological Survey of Seven Parcels within the Munitions Storage Area, Andersen Air Force Base, Island of Guam.

Department of the Navy (DON). 2022. *Integrated Natural Resources Management Plan for Joint Region Marianas.* Prepared for Joint Region Marianas and NAVFAC Marianas, Guam. Cardno, Honolulu.

Dickinson, William. R. 2001. Paleoshoreline record of relative Holocene sea levels on Pacific islands *Earth-Science Reviews* 55:191–234.

Dickinson, William. R. 2003 Impact of mid-Holocene hydro-isostatic highstand in regional sea level on habitability of islands in Pacific Oceania. *Journal of Coastal Research* 19:489–502.

Dixon, B., T. Meiser, R. Jones, and I. Nelson. 2018. Final Technical Report: Cultural Resources Survey within the Munitions Storage Area, Andersen Air Force Base, Yigo, Guam. Prepared for Department of the Navy by TEC, Inc.

Dixon, Boyd, and Richard Schaefer. 2014. Archaeological investigation of caves and rock shelters on Guam and Tinian: A synthesis of their use through time. *Journal of Pacific Archaeology* 5(1):52–71.

Federal Geographic Data Committee (FGDC). 2008. *Geospatial Positioning* Accuracy *Standards Part 3: National Standard for Spatial Data Accuracy (NSSDA).* Available online at: http://www.fgdc.gov

Fitzpatrick, Scott M. 2010. A Critique of the 'AD 1300 Event', with Particular Reference to Palau. *Journal of Pacific Archaeology* 1(2):168–173.

Fitzpatrick, Scott M. 2011. Defending the Defensible or Offending the Sensible? A Response to Nunn & Hunter-Anderson. *Journal of Pacific Archaeology* 2(1):100–105.

Gill, Lorin Tarr. 1924. The Coral Tombstones of the Marianas. *Art and Archaeology.* 18(July-December):154–166.

Gilmore, Kevin P. 2008. The Context of Culture Change: Environment, Population, and Prehistory in Eastern Colorado, 1000 B.C. – AD 1540. Unpublished Ph.D. dissertation, Department of Geography, University of Denver.

Gilmore, Kevin P., Paul H. Buckner, Andrew Mueller, and Katherine Lemberg. 2025. Cultural Resource Report for the MSA-1 Supplemental Archaeological Survey at Andersen Air Force Base, Guam. Prepared by HDR for the DAF.

Gilmore, Kevin P., Andrew Mueller, Lars Boyd, Megan Mueller, and Thomas Lux. 2020. *Mitigation Report for Sites 5ME13127 and 5ME21668 for the PSCo 5509 Parachute to Cameo Transmission Line, Mesa County, Colorado*. Prepared by HDR for the Bureau of Land Management, Grand Junction Field Office.

Gilmore, Kevin P., Andrew Mueller, Lars Boyd, and Katherine Lemberg. 2023. Archaeological Investigations of the Proposed Infrastructure Upgrades at Andersen Air Force Base, Guam, Mariana Islands. Prepared by HDR for the DAF.

Gingerich, Stephen B., Victoria Keener, Melissa L. Finucane. 2015. *Climate Trends and Projections for Guam.* U.S. Geological Survey, Pacific Islands Water Science Center. Honolulu, Hawaii.

Grant, M., M. Travisano, S. Wenzlau, and M. Durst. 2007. Results of Cultural Resource Inventories for Establishment and Operation of an Intelligence, Surveillance, Reconnaissance, and Strike Capability and the Deployment of Red Horse Squadron, Andersen Air Force Base, Guam. Prepared for Department of the Air Force, Headquarters Pacific Air Forces, by Geo-Marine, Inc.

Graves, Michael W. 1986. Organization and Differentiation within Late Prehistoric Ranked Social Units, Mariana Islands, Western Pacific. Journal of Field Archaeology 13(2):139–154.

Griffiths, Michael L., Alena K. Kimbrough, Michael K. Gagan, Russell N. Drysdale, and Julia E. Cole Kathleen R. Johnson, Jian-Xin Zhao, Benjamin I. Cook, John C. Hellstrom and Wahyoe S. Hantoro. 2016. Western Pacific hydroclimate linked to global climate variability over the past two millennia. *Nature Communications* DOI: 10.1038/ncomms11719.

Hinz, Martin. 2020. *Sensitivity* of Radiocarbon Sum Calibration. *Journal of Computer Applications in Archaeology* 3(1):38–252.

Hlatky, Nicholas M., and Justin J. Maxwell. 2018. Archaeological Survey and Subsurface Testing for Proposed Construction of P-290 Earth Covered Magazines and Ordnance Pads, Andersen Air Force Base, Guam.

Kelly, Robert L., Madeline E. Mackie, Spencer R. Pelton, and Erick Robinson. 2025. Spatiotemporal distribution of the North American Indigenous population prior to European contact. *Proceedings of the National Academy of Sciences* 122(6):e2419454122 https://doi.org/10.1073/pnas.2419454122

Kroll, Clifton H. 1917. Letter to W.A. Schlebehm from Clifton H. Kroll of Atkins, Kroll and Company, dated December 7. San Francisco. In MARC, Seventy Years of Atkins Kroll on Guam: A Compilation of Papers, Documents, Interviews and Photographs. On file in the Micronesian Area Research Center, University of Guam, Mangilao.

Kurashina, Hiro and Russell N. Clayshulte. 1983a Site Formation Processes and Cultural Sequence at Tarague, Guam. *Bulletin of the Inda-Pacific Prehistory Association* 4:114-122.

Kurashina, Hiro and Russell N. Clayshulte. 1983b *Site Formation Processes and Cultural Sequence at Tarague, Guam*. Miscellaneous Publications No. 6. Micronesian Area Research Center, University of Guam, Mangilao.

Kurashina, Hiro, Darlene Moore, Osamu Kataoka, Russell Clayshulte, and Erwin Ray. 1981. Prehistoric and Protohistoric Cultural Occurrences at Tarague, Guam. *Asian Perspectives.* 24(1):57–68.

Lavigne, Franck, Jean-Philippe Degeai, Jean-Christophe Komorowski, Sébastien Guillet, Vincent Robert, Pierre Lahitte, Clive Oppenheimer, Markus Stoffel, Céline M. Vidal, Surono, Indyo Pratomo, Patrick Wassmerj, Irka Hajdas, Danang Sri Hadmoko, and Edouard de Belizal. 2013. Source of the great A.D. 1257 mystery eruption unveiled, Samalas volcano, Rinjani Volcanic Complex, Indonesia. *Proceedings of the National Academy of Sciences* 110(42):16742–16747.

Liston, Jolie. 1996. *The Legacy of Tarague Embayment and its Inhabitants,* Andersen AFB, Guam Volume I: Archaeology. Prepared by International Archaeology, Inc. for Environmental Flight Andersen Air Force Base, Guam.

Lujan, Patrick. 2021. Letter from Patrick Lujan (Guam State Historic Preservation Officer) to Amanda Murphy (Cultural Resource Manager, Andersen AFB) with subject line "Review of: Eligibility Determinations and Draft - Final Archaeological Investigations Report of the Proposed Infrastructure Upgrades at the North Ramp and SMA-1 Areas, Andersen Air Force Base, Guam, Mariana Islands" dated November 23, 2021. On file at 36 Civil Engineer Squadron Unit 14007, Andersen AFB, Guam.

Mann, Michael E. and Phillip D. Jones. 2003. Global Surface Temperatures over the Past Two Millennia. *Geophysical Research Letters* 30(15).

Mann, Michael E., Zhihua Zhang, Scott Rutherford, Raymond S. Bradley, Malcolm K. Hughes, Drew Shindell, Caspar Ammann, Greg Faluvegi, and Fenbiao Ni. 2009. Global Signatures and Dynamical Origins of the Little Ice Age and Medieval Climate Anomaly. *Science* 326(5957):1256–1260.

Mason Architects, Inc. 2004. Historic Building and Associated Landscape/Viewsheds Inventory and Evaluation for Andersen Air Force Base, Guam.

Miller, Gifford H., Áslaug Geirsdóttir, Yafang Zhong, Darren J. Larsen, Bette L. Otto-Bliesner, Marika M. Holland, David A. Bailey, Kurt A. Refsnider, Scott J. Lehman, John R. Southon, Chance Anderson, Helgi Björnsson, and Thorvaldur Thordarson. 2012. Abrupt onset of the Little Ice Age triggered by volcanism and sustained by sea-ice/ocean feedbacks. *Geophysical Research Letters* 39 http://dx.doi.org/10.1029/2011GL050168.

Mitrovica, J. X. and W. Peltier. 1991. On postglacial geoid subsidence over the equatorial oceans. *Journal of Geophysical Research* https://doi.org/10.1029/91JB01284

Moore, Darlene R. 2005. Archaeological Evidence of a Prehistoric Farming Technique on Guam. *Micronesica* 38(1):93–120.

Moore, Darlene R. 2012. What's New and What's Cooking in Latte Period Pots. *Micronesica* 42(1/2):121-147.

Moore, Darlene R. and Rosalind L. Hunter-Anderson. 1999. Pots and pans in the Intermediate Pre-Latte (2500 – 1600 bp) Mariana Islands, Micronesia. In *The Pacific from 5000 to 200 BP – Colonization and transformations.* Ed. Jean-Christophe Galipaud, Ian Lilley. Éditions de IRD – Institut de Recherche Pour le Développement, Paris.

Nunn, Patrick D., and Michael T. Carson. 2015. Sea-level fall implicated in profound societal change about 2570 cal yr BP (620 BC) in western Pacific Island groups. *Geo: Geography and Environment* 2:17–32. doi: 10.1002/geo2.3

Nunn, Patrick D., and Rosalind Hunter-Anderson. 2011. Defending the Defensible: A Rebuttal of Scott Fitzpatrick's (2010) Critique of the AD 1300 Event Model with Particular Reference to Palau. *Journal of Pacific Archaeology* 2(1):92–99.

Nunn, Patrick D., Rosalind Hunter-Anderson, Mike T. Carson, Frank Thomas, Sean Ulm, and Michael J. Rowland. 2007. Times of Plenty, Times of Less: Last-Millennium Societal Disruption in the Pacific Basin. *Human Ecology* 35:385–401.

Nunn, Patrick D. 2000. Environmental Catastrophe in the Pacific Islands around A.D. 1300. *Geoarchaeology* 15(7): 715-740.

Osborne, Douglas. 1947. Archaeology on Guam: A Progress Report. *American Anthropologist.* 49(3):518–524.

Peterson, John A. 2012. Latte villages in Guam and the Marianas: Monumentality or monumenterity? *Micronesica* 42(1/2):183–208.

Pugach, Irina, Alexander Hübner, Hsiao-chun Hung, Matthias Meyer, Mike T. Carson, Mark Stoneking. 2021. Ancient DNA from Guam and the Peopling of the Pacific. *Proceedings of the National Academy of Sciences* 118(1) e2022112118; https://doi.org/10.1073/pnas.2022112118

Ray, Erwin R. 1981. *The Material Culture of Prehistoric Tarague Beach, Guam.* Unpublished MA thesis, Department of Anthropology, Arizona State University, Tempe.

Reimer, Paula J., William E. N. Austin, Edouard Bard, Alex Bayliss, Paul G. Blackwell, Christopher Bronk Ramsey, Martin Butzin, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M. Grootes, Thomas P. Guilderson, Irka Hajdas, Timothy J. Heaton, Alan G. Hogg, Konrad A. Hughen, Bernd Kromer, Sturt W. Manning, Raimund Muscheler, Jonathan G. Palmer, Charlotte Pearson, Johannes van der Plicht, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Christian S. M. Turney, Lukas Wacker, Florian Adolphi, Ulf Büntgen, Manuela Capano, Simon M Fahrni, Alexandra Fogtmann-Schulz, Ronny Friedrich, Peter Köhler, Sabrina Kudsk, Fusa Miyake, Jesper Olsen, Frederick Reinig, Minoru Sakamoto, Adam Sookdeo, and Sahra Talamo. 2020. The *Intcal20* Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 Cal Kbp). *Radiocarbon* 62(4):725–757.

Rieth, Timothy M., and J. Stephen Athens. 2017. Late Holocene Human Expansion into Near and Remote Oceania: A Bayesian Model of the Chronologies of the Mariana Islands and Bismarck Archipelago. *The Journal of Island and Coastal Archaeology* https://doi.org/10.1080/15564894.2017.1331939.

Sanz, Manuel. 1991. *Description of the Mariana Islands*. Translated by Marjorie G. Driver. Originally published 1827. Micronesian Area Research Center, University of Guam, Mangilao, Guam.

Schiffer, Michael B. 1987. *Formation Processes of the Archaeological Record*. University of New Mexico Press, Albuquerque.

Seo, Inah, Yong Il Lee, Chan Min Yoo, Hyung Jeek Kim, and Kiseong Hyeong. 2014. Sr-Nd isotope composition and clay mineral assemblages in eolian dust from the central Philippine Sea over the last 600 kyr: Implications for the transport mechanism of Asian dust. *Journal of Geophysical Research: Atmospheres* 119:11,492–11,504, doi:10.1002/ 2014JD022025.

Stuiver, Mintz, and Paula J. Reimer. 1993. CALIB rev. 8.1. *Radiocarbon* 35:215-230.

Surovell, Todd A., and P. Jeffrey Brantingham. 2007. A note on the use of temporal frequency distributions in studies of prehistoric demography. *Journal of Archaeological Science* 34:1868–1877.

Surovell, Todd A., Judson Byrd Finley, Geoffrey M. Smith, P. Jeffrey Brantingham, and Robert Kelly. 2009. Correcting temporal frequency distributions for taphonomic bias. *Journal of Archaeological Science* 36:1715–1724.

Taborosi, Danko, John W. Jenson, and John E. Mylroie. 2005. Karst Features of Guam, Mariana Islands. *Micronesica* 38(1):17–46.

Tomonari-Tuggle, M.J., T.M. Rieth, H.D. Tuggle, M. Bell, and D. Knecht. 2018. A Synthesis of Archaeological Inventory and Evaluation Efforts on the Island of Guam. Volume I: Overview and Initial Settlement to AD 1700. Draft. Prepared for the DON by International Archaeology, LLC. Honolulu, Hawaii.

Tracey, Joshua I., Jr., Seymour O. Schlanger, John T. Stark, David B. Doan, and Harold G. May. 1964. General Geology of Guam: A study of the stratigraphy, structure, and Tertiary geologic history of the southernmost island of the Mariana Arc. Geological Survey Professional Paper 403-A. U.S. Government Printing Office, Washington, D.C.

Uematsu, Mitsuo, Robert A. Duce, Joseph M. Prospero, Liqi Chen, John T. Merrill, and Ray L. McDonald. 1983. Transport of Mineral Aerosol From Asia Over the North Pacific Ocean. *Journal of Geophysical Research* 88(C9):5343-5352.

United States Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2021. Web Site for Official Soil Series Descriptions and Series Classification. Available online at https://soilseries.sc.egov.usda.gov/#, accessed May 14, 2021.

Walth, Cheri (ed.). 2016. Archaeological Investigations at the Naton Beach Site, Tumon Bay, Guam. Volume I: The Archaeological Monitoring, Data Recovery, Burial Recovery, and Artifact Analysis. Prepared for Guam Hotel Okura, Guam Resorts, Inc. SWCA Environmental Consultants, Albuquerque.

Wasis, Basuki, Siti Hanna Ghaida, and Bayu Winata. 2019. Application of Coconut Shell Charcoal and NPK Fertilizer toward *Acacia mangium* Growth on the Soil of Ex-limestone Mining in Bogor, Indonesia. *Archives of Agriculture and Environmental Science* 4(1):75–82.

Welch, D. 2010. Archaeological Surveys and Cultural Resources Studies on the Island of Guam in 2007 in Support of the Joint Guam Build-up Environmental Impact Statement.

Woodroffe, S.A., and P.B. Horton. 2005. Holocene Sea-Level Changes in the Indo-Pacific. *Journal of Asian Earth Sciences* 25(1):29-43.

Yoklavich, A., and D. Tuggle. 2004. Andersen Air Force Base Historic Survey Report.

Young, F.J. 1988. *Soil Survey of the Territory of Guam.* U.S. Department of Agriculture, U.S. Government Printing Office, Washington D.C.

Appendix A.
Munitions and Explosives of Concern Support Work Plan

This page intentionally left blank.

PERMITS RECORD OF DECISION (PROD)			
PERMIT REQUIRED (Check Box)	**PROJECT TITLE: FY24 MCAF PROJECT P-012/AJJY183012, North Aircraft Parking Ramp** ***Note: All permit applications require coordination with AAFB EV and must be submitted to AAFB EV. The AAFB EV will be the permittee and submit the application to the regulators when the application package is completed. However, the Contractor may be required to submit the application upon approval from the Contracting Officer at no cost to the Government.***		
Air Quality	**PERMIT: Construction-Generator**	Date Obtained: N/A	Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): **If the Contractor needs generators during construction**, the Contractor shall obtain a GEPA Air Pollution Control Permit.		
	Issuing Agency: GEPA (Air and Land Division)		
	Special Provisions and Requirements: If the Contractor needs fuel storage tanks to support construction activities, obtain the GEPA AST Permit. The GEPA AST Permit is required if the fuel storage tank is equal to/greater than 500 gallons (≥ 500 gal). Each Tank needs a permit.		
Air Quality	**PERMIT: Construction – Concrete Batch Plant**	Date Obtained: N/A	Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): A concrete batch plant will be required**;** the Contractor shall obtain a GEPA Air Pollution Control Permit. Application Form: 1) Standard Application Form.		
	Issuing Agency: GEPA (Air and Land Division)		
	Special Provisions and Requirements: If the Contractor needs fuel storage tanks to operate concrete batch plants, obtain the GEPA AST Permit. The GEPA AST Permit is required if the fuel storage tank is equal to/greater than 500 gallons (≥ 500 gal). Each Tank needs a permit.		
Air Quality	**PERMIT: Paint Operation**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No): N/A		
	Issuing Agency: GEPA (Air and Land Division)		
	Special Provisions and Requirements: If required, this air permit should be coordinated through the Andersen AFB, 36 CES as part of the base wide air permit. Safety Data Sheets (SDS) and quantities for paints and solvents to be used in Corrosion Control Hangar shall be updated.		
Air Quality	**PERMIT: Amend AAFB Title V Air Permit Modification**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No): N/A		
	Issuing Agency: 36 CES/CEV to amend the inventory of the Title V Air Permit		
	Special Provisions and Requirements: N/A		
Air Quality	**PERMIT: Standby Generator**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No): The project does not include any standby generator to be installed.		
	Issuing Agency: GEPA (Air and Land Division)		
	Special Provisions and Requirements: N/A		
Air Quality	**NOTIFICATION: Asbestos Demolition & Removal**	Date Obtained: N/A	Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): Asbestos containing materials (ACM) will be encountered during demolition and site clearance. The GEPA form of "Notification of Asbestos Demolition or Renovation" shall be completed and submitted to the GEPA, Air and Land Division. Asbestos hazard abatement plan shall be reviewed by the GEPA.		
	Issuing Agency: GEPA (Air and Land Division)		
	Special Provisions and Requirements: N/A		
Water Pollution	**AAFB Internal Coordination: Wastewater Collection System**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No): Wastewater collection system is required.		
	Issuing Agency: Andersen AFB, 36 CES		
	Special Provisions and Requirements: N/A		

PERMITS RECORD OF DECISION (PROD)			
PERMIT REQUIRED (Check Box)	**PROJECT TITLE: FY24 MCAF PROJECT P-012/AJJY183012, North Aircraft Parking Ramp** ***Note: All permit applications require coordination with AAFB EV and must be submitted to AAFB EV. The AAFB EV will be the permittee and submit the application to the regulators when the application package is completed. However, the Contractor may be required to submit the application upon approval from the Contracting Officer at no cost to the Government.***		
Water Pollution ☐	**AAFB Internal Coordination: Wastewater Pump Station/System** Basis of Decision (No): N/A Issuing Agency Andersen AFB Special Provisions and Requirements: N/A	Date Obtained: N/A	Date Closed: N/A
Water Pollution ☐	**AAFB Internal Coordination: Wastewater Treatment Plant** Basis of Decision (No): N/A Issuing Agency: Andersen AFB Special Provisions and Requirements: N/A	Date Obtained: N/A	Date Closed: N/A
Water Pollution ☐	**AAFB Internal Coordination: Pretreatment, i.e. Oil/Water Separator** Basis of Decision (No): If an oil/water separator (OWS) is installed, the Contractor must obtain a GEPA underground oil storage tank (UST) permit to install an OWS equipped with an Underground Storage Tank (UST). Issuing Agency: GEPA Special Provisions and Requirements: N/A	Date Obtained: N/A	Date Closed: N/A
Water Pollution ☐	**PERMIT: Septic System** Basis of Decision (No): N/A Issuing Agency: GEPA Special Provisions and Requirements: N/A	Date Obtained: N/A	Date Closed: N/A
Stormwater Pollution ☒ Responsible Party: Contractor	**PERMIT: US EPA General Construction Permit** Basis of Decision (Yes): The Contractor shall obtain a Construction General Permit (CGP) for stormwater discharges from construction activities from U.S. EPA, Region 9. As part of CGP, a stormwater pollution prevention plan (SWPPP) must be developed and submitted with the permit application form. There will be discharge of hydrotesting water. The Contractor must include the plan for discharge of hydrotesting water in the SWPPP. [https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under#submit] Issuing Agency: US EPA, Region 9 (Pacific Southwest) Special Provisions and Requirements: A Stormwater Pollution Prevention Plan (SWPPP) and Erosion Control Plan must be submitted.	Date Obtained: N/A	Date Closed: N/A
Portable Water ☐	**AAFB Internal Coordination: Water Distribution System** Basis of Decision (No): Issuing Agency: Andersen AFB, 36 CES Special Provisions and Requirements: N/A	Date Obtained: N/A	Date Closed: N/A
Portable Water ☒ Responsible Party: Designers	**GEPA Design Review: Groundwater Management Protection Area** Basis of Decision (Yes): The Project is located within a Groundwater Management Protection Zone (GWMPZ) and will utilize infiltration basins. In addition, fuel hydrants and valve pits will be constructed. GEPA design review (30%, 90%, and final design) is required for the project installing septic tank(s), leaching field(s), sanitary sewer, stormwater disposal, liquid waste storage/disposal/ treatment located within the Groundwater Management Projection Zone. Issuing Agency: GEPA Special Provisions and Requirements: The 30%, 90%, and final design review/approval will be needed from GEPA.	Date Obtained: N/A	Date Closed: N/A

PERMITS RECORD OF DECISION (PROD)			
PERMIT REQUIRED (Check Box)	**PROJECT TITLE: FY24 MCAF PROJECT P-012/AJJY183012, North Aircraft Parking Ramp** ***Note: All permit applications require coordination with AAFB EV and must be submitted to AAFB EV. The AAFB EV will be the permittee and submit the application to the regulators when the application package is completed. However, the Contractor may be required to submit the application upon approval from the Contracting Officer at no cost to the Government.***		
Portable Water	**GEPA Design Review: Potable Water System Design**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No):		
	Issuing Agency: GEPA		
	Special Provisions and Requirements: N/A		
Sewer	**GEPA Design Review: Sewer System**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No):		
	Issuing Agency: GEPA		
	Special Provisions and Requirements: N/A		
Well Drilling and Operating	**PERMIT: Well Drilling Permit**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No):		
	Issuing Agency: GEPA		
	Special Provisions and Requirements: N/A		
Well Drilling and Operating	**PERMIT: Class V Underground Injection Control (UIC) Permit (Disposal of storm water)**	Date Obtained: N/A	Date Closed: N/A
☐	Basis of Decision (No):		
	Issuing Agency: GEPA		
	Special Provisions and Requirements: N/A		
Well Drilling and Operating	**PERMIT: Stormwater Injection Well Abandonment Permit**	Date Obtained:	Date Closed:
☐	Basis of Decision (No): N/A		
	Issuing Agency: GEPA		
	Special Provisions and Requirements: N/A		
Sinkholes	**GEPA Review and Approval for Sinkhole Mitigation/Protection Plan**		
☒ Responsible Party: Contractor	Basis of Decision (Yes): Based on observation of karst features on the site, the University of Guam has been engaged to evaluate the extent of karst features. The Water & Environmental Research Institute (WERI) at the University of Guam has identified 3 sinkholes and additional karst features within the project area. The vast known and suspect sinkholes identified by WERI, along with solution tubes, and channels, requires the P-012 design to treat the entire area as a series of sinkholes and voids. The known and suspect sinkholes are in the drainage path and lowest areas of the site. These karst areas are planned to be filled with structural fill ranging from 8 to 34-feet in depth with a concrete pavement section to support the North Parking Ramp. To identify and determine the extents of these Karst features, Electrical Resistivity (ERT) is required to be incorporated into the Contract Documents and be conducted during site clearing and initial grading.		
	Issuing Agency: GEPA		
	Special Provisions and Requirements: The Contractor shall develop a Sinkhole Mitigation/Protection Plan for the Government and GEPA review and approval.		

PERMITS RECORD OF DECISION (PROD)	
PERMIT REQUIRED (Check Box)	**PROJECT TITLE: FY24 MCAF PROJECT P-012/AJJY183012, North Aircraft Parking Ramp** ***Note: All permit applications require coordination with AAFB EV and must be submitted to AAFB EV. The AAFB EV will be the permittee and submit the application to the regulators when the application package is completed. However, the Contractor may be required to submit the application upon approval from the Contracting Officer at no cost to the Government.***
Sinkholes	**PERMIT: GEPA Sinkhole Encroachment Waiver Request**
☒ Responsible Party: Contractor	Basis of Decision (Yes): Based on observation of karst features on the site, the University of Guam has been engaged to evaluate the extent of karst features. The Water & Environmental Research Institute (WERI) at the University of Guam has identified sinkholes and additional karst features within the project area. Issuing Agency: GEPA Special Provisions and Requirements: An approved sinkhole encroachment waiver request must be obtained from GEPA. The Contractor is responsible for preparing and submitting this request, and GEPA approval of this waiver is required prior to initiating earthmoving activities within the sinkhole buffer boundary. The Contractor must develop a written Sinkhole Mitigation/Protection Plan to document the contractor's approach, procedures and practices to minimize or avoid adverse impacts of earthmoving activities to the sinkhole.
Solid Waste	**PERMIT: Solid Waste Management Unit (SWMU) Closure** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: 36CES/CEV	Basis of Decision (Yes): The IRP compound is listed as a SWMU under the Resource Conservation and Recovery Act (RCRA). 36 CES/CEV shall close the SWMU in accordance with the RCRA requirements. Issuing Agency: U.S. EPA Special Provisions and Requirements: N/A
Hazardous Waste	**PERMIT: Hazardous Waste Treatment, Storage, Disposal, Handling** Date Obtained: N/A Date Closed: N/A
☐	Basis of Decision (No): N/A Issuing Agency: GEPA Special Provisions and Requirements: N/A
Solid and Hazardous Waste	**PERMIT: Landfill Authorizations Permit for Recyclable Products** Date Obtained: N/A Date Closed: N/A
☐	Basis of Decision (No): N/A Issuing Agency: N/A Special Provisions and Requirements: The Contractor shall comply with regulations and requirements under specs Section 01 57 19 Temporary Environmental Controls; Joint Region Marianas Comprehensive Construction and Demolition and Solid Waste Management Plan; and Hazardous Waste Management Plan.
Hazardous Waste	**PERMIT: Hazardous Waste - Construction Activities** Date Obtained: N/A Date Closed: N/A
☐	Basis of Decision (No): N/A Issuing Agency: N/A Special Provisions and Requirements: The Contractor shall comply with regulations and requirements under specs Section 01 57 19 Temporary Environmental Controls; Joint Region Marianas Comprehensive Construction and Demolition and Solid Waste Management Plan; and Hazardous Waste Management Plan.

PERMITS RECORD OF DECISION (PROD)	
PERMIT REQUIRED (Check Box)	**PROJECT TITLE: FY24 MCAF PROJECT P-012/AJJY183012, North Aircraft Parking Ramp** ***Note: All permit applications require coordination with AAFB EV and must be submitted to AAFB EV. The AAFB EV will be the permittee and submit the application to the regulators when the application package is completed. However, the Contractor may be required to submit the application upon approval from the Contracting Officer at no cost to the Government.***
Solid Waste	**PERMIT: Solid Waste- Green Waste Processing Permit (e.g., Compost Permit)** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): The Contractor shall obtain a solid waste management facility permit to process green waste and include the permit in the Waste Management Plan. Vegetation removed during clearing and processed on site will be proceeded for reuse (e.g. compost, mulch, woodchips, soil additive ash or other forms of processed green waste reused onsite). Issuing Agency: GEPA for Green Waste Processing Permit Special Provisions and Requirements: Title 22 GAR Division 4, Chapter 23, Rules and Regulations for the GEPA, Solid Waste Disposal. Comply with the requirements under specs Section 01 57 19.00 20 Temporary Environmental Controls and the Comprehensive Construction and Demolition and Solid Waste Management Plan.
Green Waste	**PERMIT: GEPA Clearing, Grubbing, Grading, and Stockpiling (CGGS) Permit / General Permit Application for Earthmoving Work & Full Construction** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): The Contractor must obtain a GEPA CGGS Permit/ General Permit Application for Earthmoving Work & Full Construction. There will be discharge of hydrotesting water. The Contractor must prepare the permit application including the discharge of hydrotesting water. Issuing Agency: GEPA Special Provisions and Requirements: The permit requires an Environmental Protection Plan (EPP) and Erosion Control Plan, both of which will be reviewed and approved by the GEPA.
Other Permits	**AAFB Internal Coordination: AF103 Digging Permit** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): The contractor shall complete Base Civil Engineering Work Clearance Request (AF 103) for any excavation that breaks the crust of the earth or any work that may disrupt aircraft or vehicular traffic flow, base utility. Issuing Agency: Andersen AFB, 36 CES Special Provisions and Requirements: N/A
Other Permits	**PERMIT: FAA Form 7460 - Notice of Construction/ Obstruction Evaluation and Airport Airspace Analysis (OE/AAA)** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): The Contractor must submit Form 7460-1 and request OE/AAA at least 60 days before the start date of the proposed construction or alteration. Issuing Agency: U.S. Department of Transportation, Federal Aviation Administration Special Provisions and Requirements: N/A
Other Permits	**AAFB Internal Coordination: TACW/TERPS** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): To work on the airfield or near airfield (construction, drilling, earthwork, etc.), TACW and TERPS process shall be completed. The TACW/TERPS process may take at least 75 days. • Temporary Airfield Construction Waiver (TACW 20-16) • Terminal Instrument Procedures (TERPS) Review Notice to Airman (NOTAM) Issuing Agency: Andersen AFB, 36 CES Special Provisions and Requirements: N/A

PERMITS RECORD OF DECISION (PROD)	
PERMIT REQUIRED (Check Box)	**PROJECT TITLE: FY24 MCAF PROJECT P-012/AJJY183012, North Aircraft Parking Ramp** ***Note: All permit applications require coordination with AAFB EV and must be submitted to AAFB EV. The AAFB EV will be the permittee and submit the application to the regulators when the application package is completed. However, the Contractor may be required to submit the application upon approval from the Contracting Officer at no cost to the Government.***
Other Permits	**Fuel/Used Oil Collection Center, Aggregation Point, Storage, Transporter & Transfer Facility** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): Contractor must obtain a GEPA Underground Storage Tank (UST) Permit for fuel pipeline and other oil storage/handling units to be installed. Issuing Agency: GEPA Special Provisions and Requirements: A GEPA UST or AST Permit is required if the fuel storage tank is equal to/greater than 500 gallons (≥ 500 gal). Each Tank needs a permit. The permit is good for one year. The installation shall renew each permit on a yearly basis.
Other Permits	**Fuel Storage Tank for Construction Activities** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): Contractor must obtain GEPA Aboveground Storage Tank (AST) or Underground Storage Tank (UST) Permit if the Contractor utilizes fuel storage tanks to support construction activities (e.g., operation of concrete batch plants) Issuing Agency: GEPA Special Provisions and Requirements: A GEPA UST or AST Permit is required if any fuel storage tank is equal to/greater than 500 gallons (≥ 500 gal).
Other Permits ☒ Responsible Party: Contractor	**AAFB Blazing and Hot Work Permit** Date Obtained: N/A Date Closed: N/A Basis of Decision (Yes): For any blazing and hot work, obtain a hot work permit from 36 CES. Issuing Agency: Andersen AFB, 36 CES Special Provisions and Requirements: N/A
Other Permits	**AFCEC Generator Approval** Date Obtained: N/A Date Closed: N/A
☐	Basis of Decision (No): Issuing Agency: Andersen AFB, 36 CES Special Provisions and Requirements: N/A
Other Permits	**Pesticide Implementation Permit - Pesticide User Certification and Training** Date Obtained: N/A Date Closed: N/A
☒ Responsible Party: Contractor	Basis of Decision (Yes): Obtain all necessary permits to apply pesticides including the GEPA Notice of Intent for Pesticides Application. Provide pesticide user certification and training. Issuing Agency: GEPA Special Provisions and Requirements: Comply with the pesticide implementation requirements

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

Attachment D.

2025 Final Environmental Impact Statement (Final EIS) for

F-15 Beddown and Infrastructure Upgrade at Andersen Air Force Base, Guam

Link to Download: https://www.aafbinfraandf15eis.com/documents

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

Attachment E.

Biological Opinion for Expansions of Aircraft Operations Area at Northwest Field, and Munitions Storage Area (MSA-1), Andersen Air Force Base, Guam, 25 February 2025. The Biological Opinion is provided in the Final EIS, Appendix B.

2025 Final Environmental Impact Statement (Final EIS) for

F-15 Beddown and Infrastructure Upgrade at Andersen Air Force Base, Guam

Link to Download: https://www.aafbinfraandf15eis.com/documents

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

ATTACHMENT F.
NATURAL RESOURCES
PERFORMANCE WORK STATEMENT (NR PWS)

9 January 2026

Table of Contents

1.0 GENERAL 1
1.1 Natural and Cultural Resources Protection Training 1
1.2 Hazard Analysis and Critical Control Point (HACCP) Plan 2
1.3 Cleaning Facility 2
1.4 Pesticide Application Certification 2
1.5 Green Waste Management 2
1.5.1 Onsite Green Waste Management and Reuse 2
1.5.2 Off-Base Green Waste Compost Facility 2
2.0 QUALIFIED BIOLOGIST(S) 3
3.0 MARIANA FRUIT BATS 3
4.0 NATURAL RESOURCES BEST MANAGEMENT PRACTICES (BMP) 4
5.0 NATURAL RESOURCES CONSERVATION MEASURES 5
5.1 T&E Species 5
5.1.1 Success Criteria and Bid Assumptions 5
5.1.2 Draft and Final Natural Resource Work Plans 6
5.1.3 Natural Resource Field Assessment Reports for P-012 Construction footprint and Tarague FEA 7
5.1.4 Salvage, Nurse, and Transplant T&E Species 8
5.1.5 Protect and Monitor ESA-Listed Species to be Remained 10
5.2 Tarague FEA 10
5.2.1 Draft and Final Work Plans for Tarague Forest Enhancement Area 11
5.2.2 Install Ungulate-Proof Fence 11
5.3 Reporting, GIS Maps, Database 11
5.3.1 Weekly Natural Resources Conservation Status Report 11
5.3.2 Monthly Natural Resources Conservation Progress Reports 12
5.3.3 Annual Natural Resources Conservation Progress Reports 12
5.3.4 Draft and Final Natural Resources Conservation Reports 12
5.3.5 Comment Matrix 13

TABLE

Table 1. T&E Species Success Criteria and Bid Assumptions 6

NR PWS ATTACHMENTS

F1. P-012 Figures for Natural Resource Conservation

Figure F1-1. P-012 Construction Footprint T&E Species

Figure F1-2. Tarague FEA Location

Figure F1-3. HMU Location

F2. Sample Accepted Methodologies for Cycad Salvage and Transplantation

F3. Natural Resources GIS Standard for GIS Deliverable

F4. Standard Operating Protocol for the Control and Monitoring of Little Fire Ant (LFA), Wasmannia Auropunctata

F5. Ungulate Fence Specifications

F6. Hawaii Rare Plant Restoration Group Phytosanitation Guidelines

F7. Coconut Rhinoceros Beetle (CRB) and Little Fire Ant (LFA) Management Procedures (Ver4. Revised 08.02.2021, or as amended)

NATURAL RESOURCES PERFORMANCE WORK STATEMENT
FOR
FY24 MCAF PROJECT P-012 / AJJY183012, NORTH AIRCRAFT PARKING RAMP
JOINT REGION MARIANAS (JRM), ANDERSEN AIR FORCE BASE, GUAM

1.0 GENERAL

Comply with and implement the natural resources requirements, including conservation measures and Best Management Practices (BMP), specified in the 2025 Biological Opinion (BO) for the project. Comply with and implement all requirements for the P-012 construction footprint, Tarague Forest Enhancement Area (Tarague FEA), and Habitat Management Unit (HMU). The locations of Tarague FEA and HMU are presented in Attachment F1, Figures for Natural Resources Conservation.

The Contractor must review, understand, and execute the 2025 BO. The PWS provides summaries of the 2025 BO; however, it does not include all requirements of the 2025 BO. The Contractor must be responsible for implementing all BMP and conservation measures specified in the 2025 BO. The Contractor must retain qualified biologists to implement the 2025 BO accordingly. The Government will be responsible for the following long-term monitoring only after Contractor has fulfilled initial obligations.

a. Conduct intermittent monitoring throughout the 20-year period once after the salvaged plants have become established at the Tarague FEA and HMU.
b. Conduct monitoring and maintaining brown tree snake traps for 20 years after the Government accepts the permanent perimeter fencing constructed by the Contractor.
c. Conduct long-term management of the invasive species at the FEA after the 5 years of following transplant of salvaged plants conducted by the Contractor.

The following Endangered Species Act (ESA)-listed Endangered and Threatened (T&E) species are known and will be affected within the P-012 construction footprint:

- Cycas micronesica
- Tabernaemontana rotensis (T. rotensis)
- Bulbophyllum guamense, Dendrobium guamense, and Tuberolabium guamense
- Mariana fruit bats

The locations of these T&E plants have been recorded by the Government during the 2021 and 2024 Biological Surveys. The survey reports and GPS coordinates for the T&E species are available to the selected Contractor.

1.1 Natural and Cultural Resources Protection Training

The Installation Environmental Office will provide the initial biosecurity/natural resources and cultural resources awareness training to protect Natural and Cultural Resources. Ensure all personnel take the training prior to starting work on the project. This education/awareness program will be conducted prior to site preparation and construction activities. The Contractor is responsible for providing additional training for the new construction workers. All construction workers must be aware of biological resources and requirements within the construction footprint, including Endangered Species Act (ESA)-listed species, invasive species, special status species, avoidance measures, and reporting requirements. The qualified biologist retained by the Contractor must provide project-specific training as needed.

1.2 Hazard Analysis and Critical Control Point (HACCP) Plan

Prepare and implement a Hazard Analysis and Critical Control Point (HACCP) Plan to ensure that invasive species are not moved or introduced in association with site preparation, construction, and T&E species salvage and transplantation activities. The HACCP plan must be developed by the contractor and reviewed/approved by the installation and JRM Biosecurity Program Managers.

1.3 Cleaning Facility

Provide a cleaning facility to clean Contractor's vehicles and construction equipment. If the project has multiple sites or entry/exit points, each site must have a designated cleaning facility to prevent/minimize the spread of invasive species. Provide a cleaning facility for Tarague FEA.

1.4 Pesticide Application Certification

If pesticide is used, the Contractor must have a DoD or Guam pesticide applicator's license, report all chemical usage on the NAVFAC Online Pesticide Reporting System (https://noprs.pestlogics.com/), and follow all EPA labeling and local requirements/instructions.

1.5 Green Waste Management

Green waste can be managed onsite or disposed of at off-base permitted green waste compost facilities. Determine the amounts of green waste to be processed onsite or disposed of. Include green waste management plan in the Environmental Protection Plan (EPP).

Green waste generated from the assumed PFAS-Impacted Soil Areas must be processed onsite. Reuse the compost material after processing in the PFAS-relocation Area to support the vegetated cover of the 1-ft clean soil cap. Refer to Section 02 61 13, Attachment A, Soil Management Plan, for the assumed PFAS-Impacted Soil Areas and PFAS-Relocation Area.

1.5.1 Onsite Green Waste Management and Reuse

Onsite green waste processing and reuse must adhere to Coconut Rhinoceros Beetle (CRB) and Little Fire Ant (LFA) Management Procedures attached in the PWS Attachment F7. Process the green waste into compost material that may then be reused on site. The composting material must be suitable for the intended application. It is the Contractor's responsibility to process this green waste to a form suitable for onsite use. Raw feedstock or green waste must be stockpiled once generated (commencing upon mechanical or manual manipulation of vegetative matter) but may not be stockpiled for longer than 30 calendar days without Contracting Officer approval and notification to the Government Biological Monitor. There must be no volume of raw green waste and/or unprocessed or uncured compost upon facility turnover to the government by the construction contractor. Handling of green waste must follow appropriate environmental, health, and safety procedures and USEPA and GEPA requirements and guidelines. Obtain a solid waste management facility permit (e.g. Composting Permit) to process green waste and include the permit in the EPP.

1.5.2 Off-Base Green Waste Compost Facility

Green waste can be disposed of at a permitted off-base green waste facility. Comply with the local regulations and

facility requirements. The facility must have the necessary permits, including the following:

- GEPA Clearing, Grubbing, Grading, and Stockpiling Permit
- GEPA solid waste management facility permit (e.g. Composting Permit)

2.0 QUALIFIED BIOLOGIST(S)

Retain qualified biologists. Submit the qualification of qualified biologist(s) for the Government review and approval. Three references to validate experience are required prior to implementing the 2025 BO requirements. Include the references in the qualification review package. A qualified biologist is defined as a person who:

a. has successfully completed a full 4-year course of study in an accredited college or university leading to a bachelor's or higher degree, which includes a major field (24 semester hours) of study in biological sciences, wildlife biology, botany, natural resources management, environmental sciences, or related disciplines appropriate to this position; AND has a minimum of 20 documented hours of field identification (positive results) of the ESA-listed species or closely related species.

b. has a minimum of 24 semester hours (or equivalent quarter hours) in biological sciences, wildlife biology, botany, natural resources management, environmental sciences, or related disciplines appropriate to this position at an accredited college or university; has 1 year (2,000 hours) of field biology survey experience in the Pacific Islands; AND has a minimum of 20 documented hours of field identification (positive results) of the ESA-listed species or closely related species.

The qualified biologist can be one person or more than one person who meets the qualifications listed above. The qualified biologist(s) must provide as follows but are not limited to:

1. Implement natural resources conservation measures and best management practices as specified in the 2025 BO.
2. Prepare required planning documents and reports.
3. Conduct all required NR surveys and assessments (e.g., field assessment, biological survey/health assessment for T&E species, coconut rhinoceros beetles (CRB) survey, Little Fire Ant (LFA) survey, Mariana fruit bat survey).
4. Implement all activities related to T&E Species (e.g., salvaging, nursing, translocation/maintenance, and monitoring). T&E species monitoring is required for the species to remain onsite and be transplanted to the Tarague FEA or HMU.
5. Implement green waste management requirements.

3.0 MARIANA FRUIT BATS

The qualified biologist must conduct a pre-construction fruit bat survey and train the contractor personnel who will conduct fruit bat monitoring. A qualified biologist or contractor personnel (trained by a qualified biologist) must conduct visual observations for Mariana fruit bats within 492 ft (150 m) of the construction footprint at the start of each day:

1. No earlier than 1 week prior to project initiation, complete a pre-construction fruit bat survey of all forest habitat within 492 ft (150 m) of the aforementioned construction footprint for the presence of any fruit bat colonies and associated day roosts. The survey must be conducted by the Qualified Biologist retained by the Contractor.
2. Methods used to identify a colony and associated roost include watching above the tree canopy to see

where bats are flying from when they take flight at dusk or pre-dawn. The recommended techniques are direct observations and counts of bats during either dawn or dusk. The survey area must be observed from 60 minutes before and at least 30 minutes after sunrise. A minimum of two surveys must be conducted within 1 week to determine the presence of a fruit bat colony and associated day roosts. Do not conduct surveys if the night prior was a moonless night as fruit bats may not forage without sufficient light.

3. If a fruit bat is observed within line of sight up to 492 ft (150 m) prior to the start of construction work, which includes site preparation and vegetation clearance, no work would be conducted within the area that generates noise (e.g., use of heavy equipment, generators) until the fruit bat has left the area of its own volition.
4. If a fruit bat enters within 492 ft (150 m) of the construction footprint after the start of construction work, work would continue but NAVFAC Marianas natural resources staff will be notified to document any instances of incidental take.

During nighttime work, perform biological monitoring on site while nighttime work is underway to observe Mariana fruit bats.

4.0 NATURAL RESOURCES BEST MANAGEMENT PRACTICES (BMP)

Implement all BMP measures specified in the 2025 BO. The section summarizes the list and does not include all BMP specified in the 2025 BO. The Contracting Officer and AAFB Environmental will inspect the contractor's work to ensure that BMPs are implemented for the entire project duration.

a. For off-site fill material, obtain aggregate/soil from contractors/vendors who have local permits. Imported sand and other quarried products from abroad are subject to inspection by the Guam Department of Agriculture, which issues an importation permit. All sand and aggregate material imported must be accompanied by official records indicating chemical composition, pest-free certification, treatment certification, and certificate of origin. Treatment (disinfection) must be conducted at the point of origin. Fill material and aggregate must be inspected again for little fire ants (LFA) at the destination site prior to off-loading from the barge and will be rejected if found to be infested.
b. Conduct site preparation, vegetation clearance, construction, salvage, and transplant using the Government-approved work plan. Process green waste and mulch piles to prevent the spread of LFA, CRB, and other invasive species, in accordance with green waste protocols. Control their spread if present. A qualified biologist or a biological monitor with supervision of the qualified biologist must inspect the work sites to confirm that vegetation debris is properly managed in accordance with green waste protocols.
c. Conduct LFA surveys throughout the construction duration to ensure that construction activities do not introduce LFA to the construction footprint and Tarague FEA. There is no known presence of LFA at the P-012 construction footprint and Tarague FEA. Provide the initial and recurring 4-month surveys.
    i. If LFA or other invasive species (not previously present) are discovered, proven control and eradication actions must be implemented and followed by post-eradication monitoring. For LFA, comply with Attachment F4, Standard Operating Protocol for the Control and Monitoring of Little Fire Ant, Wasmannia auropunctata (Puliafico et al. 2022).
    ii. Conduct a thorough initial survey of the project and Tarague FEA prior to construction to confirm the presence (or absence) of invasive species that could be transported by these activities, including but not limited to LFA, brown tree snake, new species, or invasive plants.
d. Install and maintain silt fences, straw wattles, or another Government-approved BMP method to prevent soil erosion into adjacent areas. Use dust screens to shield ESA-listed plants that are within 10

ft (3 m) of the construction clearing line. When a major storm or high-wind event (greater than 39 miles/hour) is anticipated, remove silt fences and dust screens to prevent damage to ESA-listed species. After the event is over, reinstall the BMP method.

e. Deploy brown tree snake traps every 65 feet (20 meters) on the temporary construction fencing and permanent perimeter fencing of the North Ramp. Monitor and maintain the traps until the Government accepts the permanent perimeter fence.
f. Do not conduct site preparation during nighttime as part of this project. All site preparation must end 30 minutes before sunset.
g. Nighttime Construction
    i. Nighttime Construction will be required for specific activities, including, but not limited to, removal of Munitions and Explosives of Concern (MEC) and Unexploded Ordnance as well as pouring and cutting of concrete. Provide the nighttime construction schedule to the Contracting Officer at least 14 days before the activity is required.
    ii. The extent and frequency of working during nighttime must be minimized by ensuring shifts begin on time. Saw cutting must be initiated as soon as the concrete is ready, and night shift work must not be made routine.
    iii. Lighting associated with nighttime work must be hooded, pointed downwards, and directed to not shine toward the known roosting location to minimize potential effects to Mariana fruit bat roosting activities.

5.0 NATURAL RESOURCES CONSERVATION MEASURES

Implement the 2025 BO Conservation Measures. Vegetation clearing at P-012 construction footprint must not begin until the Government approves the salvage and collection of T&E species.

5.1 T&E Species

5.1.1 Success Criteria and Bid Assumptions

The Natural Resource Work Plan must include a detailed NR project schedule and performance period. Monitoring for T&E species must continue until the salvaged plants are established at the Tarague FEA and the Government accepts these established species. Keep detailed records of the outplanting activities and report them in the reports. The Contractor is responsible for the security of the plants and nursery if the individuals are stolen/misplaced/disappear. They must be replaced at the Contractor's expense until plants meet the success criteria.

Successful fulfillment of T&E Species conservation is based on the plants being established in the wild, not requiring any supplemental watering, disease/pest free, fertilizer, or support structures for a period of six months after meeting the individual plant species success criteria. The bid assumptions and T&E species success criteria are presented in Table 1. The salvageable T&E quantities can be adjusted based on the Contractor's pre-construction survey and field assessment.

Table 1. **T&E Species Success Criteria and Bid Assumptions**

T&E Species	Conservation Measures	Bid Assumptions (EA)		
		Salvageable Quantity	Outplanting Quantity (Rate)	Success Criteria - Survival Quantity (Rate) of T&E Species after Transplanting
Cycas micronesica	• Seed collection and salvage preparation • Propagation and nursing • Transplant into Tarague FEA. • Maintenance of transplants and transplant area	120	120 (100 % of salvaged plants)	89 ea (74 % of salvaged plants after 5 yr of transplanting. Assume a 5.8% annual decline.)
Tabernaemontana rotensis	• Seed collection and propagation • Propagation and nursing • Transplant into Tarague FEA • Maintenance of transplants and transplant area	63	63 (100 % of salvaged plants)	63 (100 % of salvaged plants)
Bulbophyllum guamense	• Salvage • Transplant into the HMU. • Maintenance of transplants into the HMU	1	1 (100 % of salvaged plant)	1 (100 % of salvaged plant)
Dendrobium guamense		2	2 (100 % of salvaged plants)	2 (100 % of salvaged plants)
Tuberolabium guamense		50	50 (100 % of salvaged plants)	50 (100 % of salvaged plants)

5.1.2 Draft and Final Natural Resource Work Plans

Submit a Draft Natural Resource Work Plan including the plan for natural resource field assessment and plant salvage and transplant. Submit the draft plan when the Contractor submits the EPP.

Submit a Final Natural Resource Work Plan incorporating the findings from the Natural Resource Field Assessment within 45 days upon completion of the Field Assessment including P-012 construction footprint and Tarague FEA.

The focus of the Natural Resource Work Plan must explain the details and protocols to collect T. rotensis seeds; germination of T. rotensis/cycad seeds; collection of cycad basal shoots; monitoring of plants in the nursery; collection of guamense; maintenance of outplanted plants in the Tarague FEA; and criteria for plants to be deemed established in the wild. The Natural Resource Work Plan must include the following:

a. Cover page
b. Table of contents
c. Introduction, Scope of Work, and Success Criteria
d. List of personnel involved in the project and their role (i.e., job title and area of responsibility)
e. Methods, protocols and survey equipment used during the field assessment including but not limited to:
    i. Spatial layout
    ii. Equipment and supplies needed to conduct transplanting services
    iii. Ecological data

iv. Field data forms that will be used to collect detailed condition of plants during salvage and monitoring and maintenance efforts, database forms, and data entry

f. Methods, protocols, survey equipment, and nursery descriptions to be utilized for salvaging, germination, plant hardening, outplanting, maintenance and monitoring, survival criteria, pesticides to be used, etc.
g. Data analysis and mapping
h. Results of the field assessment including copies of the completed field data forms, figures depicting surveyor tracks of areas surveyed, data analysis and mapping
i. Schedule for field assessment, salvaging, nursing, outplanting, and monitoring
j. Removal and disposal of invasive plant species
k. Survey and removal of invasive species (e.g., CRB, LFA, BTS)
l. Schedule for meetings, draft and final deliverables, and maps

5.1.3 Natural Resource Field Assessment Reports for P-012 Construction footprint and Tarague FEA

After the draft Natural Resource Work Plan is approved, perform a field assessment, by qualified biologists, of construction footprint and a 10-foot (3-meter) buffer as well as Tarague FEA to map the locations of all T&E species, including home/host plant locations.

5.1.3.4 P-012 Construction Footprint

Utilize Government provided maps and coordinates contained in the 2021 and 2024 Biological Survey Reports, Special Status Species Data to locate the federally listed plants that have been identified within the construction footprint.

Determine the current number of individuals and health status assessment of Cycas micronesica, T. rotensis, Bulbophyllum guamense, Dendrobium guamense, and Tuberolabium guamense that cannot be avoided within the construction footprint.

Determine how many individuals can be salvaged through seed collection, plant part salvage, and/or whole plant salvage. Submit a Natural Resource Field Assessment Report with 30 days upon completion of the Field Assessment. The number of plants identified by the Contractor may be different from the numbers reported in the previous Biological Survey Reports. Deviations must be explained and documented in the Field Assessment Report.

5.1.3.4.1 Cycas Micronesica

Refer to the 2025 BO for specific requirements associated with the salvage, collection, transplantation, and maintenance of Cycas micronesica. Utilize Government provided maps and coordinates to locate tagged plants that have been identified in the vicinity of the construction footprint. Conduct a qualitative field assessment to determine how much cycad material (basal shoots and seeds) can be successfully salvaged from the construction footprint. Cycad material classified as good and fair must be considered salvageable and must be included in the collection number.

5.1.3.4.2 T. Rotensis

Refer to the 2025 BO for specific requirements associated with the salvage, collection, transplantation, and maintenance of T. rotensis. Conduct field assessments to identify the number of mature T. rotensis within the

projet footprint and evaluate mature plants. Collect seeds equal to the amount of mature plants lost by construction. Search for flowers/fruit on plants for eventual collection.

5.1.3.4.3 Federally Listed Orchid (Guamense)

Refer to the 2025 BO for specific requirements associated with the salvage, collection, transplantation, and maintenance of federally listed orchid. Determine the current number and health status assessment of Orchids that cannot be avoided within the construction footprint. A health assessment must be performed to determine how many genetically unique individuals can potentially be salvaged and directly transplanted to new host trees

5.1.3.4 Tarague FEA

The health of a subset of the Cycas micronesica in the Tarague FEA was recorded during January and February 2024. The health of all Cycas micronesica was not recorded to expedite surveys, but anecdotal evidence from surveyors noted a higher number of healthy Cycas micronesica than other areas of Andersen AFB and less frequent occurrence of cycad Aulacaspis scale. Trees were also frequently observed to have multiple pups. The health assessment results from a subset of Cycas micronesica in the habitat assessment area are shown in the 2025 BO, Figure 13.

5.1.4 Salvage, Nurse, and Transplant T&E Species

Salvage the T&E species that cannot be avoided within the P-012 construction footprint using the methods described in the Government approved work plan. Transplant salvaged Cycas Micronesica and T. Rotensis within Tarague FEA and the orchids within the HMU.

5.1.4.1 Salvage

5.1.4.1.1 Cycas Micronesica

Refer to the 2025 BO for specific requirements associated with the salvage, collection, transplantation, and maintenance of Cycas micronesica.

Salvage as many healthy cycads basal shoots from adult plants and collect seeds for germination that are suitable for transplantation. Determine the appropriate cycad basal shoots for collection depending on the health, size, and viability of the plant. All collected cycads must be assigned to a unique alpha numeric identifier to track its information and parent plant.

If cycad seeds are available, they must be collected for germination, cleaned of pests, stored in a nursery, propagated, and outplanted. The Contractor may consider implementing the methods to remove basal shoots as described in Attachment F2, Sample Accepted Methodologies for Cycad Slavage and Transplantaion.

If during field collection the number of plants suitable for salvage is less than identified in the Natural Resource Work Plan, provide a detailed explanation in the progress report. The Contractor must keep a record of the number of basal shoots that are collected from the project footprint and document how the basal shoots are handled post collection. Cycads that are outside the construction footprint limits must be avoided. If additional cycads are needed to meet the success criteria, the Contractor may request to collect cycad seeds outside P-012 construction footprint, subject to Government approval.

Cycas micronesica will be considered established when they do not require supplemental watering, fertilizer, or support structures, and show stem growth of at least 0.4 inches (1.0 centimeter) as measured below the base of the existing leaves (fronds).

5.1.4.1.2 T. Rotensis

Monitor mature T. rotensis plants for seeds, collect seeds, germinate and propagate seeds for outplanting. Conduct weekly seed collection surveys within the construction footprint to collect all available seeds up to the start of vegetation clearing. The Contractor must attempt to collect ripe T. rotensis seeds within the P-012 footprint to the maximum extent practicable. Take advantage of seasonal patterns when T. rotensis seeds are available and monitor the development of ripe fruit for seed collection. If seeds are not available, the Contractor may pursue plant collection or plant division. All seeds collected must be germinated and hardened according to the Government approved Natural Resource Work Plan.

T. rotensis will be considered established when they are between 2 and 3 ft (0.6 and 0.9 m) tall; leaves remain turgid on the plant; individuals produce apical stem growth; and individuals no longer require supplemental watering, fertilizer, or support structures.

5.1.4.1.3 Federally Listed Orchid (Guamense)

Orchids will be transplanted into the HMU. After transplantation, provide monitoring and maintenance including watering, fertilizing, pesticide treatment, use of supplemental host tree attachments, invasive species removal, or removal of plant parts to reduce stress following transplantation.

Bulbophyllum guamense, Dendrobium guamense, and Tuberolabium guamense will be considered established following documented observation of new root growth after transplant and root attachment to the host tree.

5.1.4.2 Nursing, Transplanting/Maintenance, and Monitoring

Cycads, T. rotensiss, and guamense plant material salvaged from the P-012 construction footprint must be transported to the Contractor's nursery for hardening and eventual outplanting. Monitor and maintain the plants until they are deemed established at the transplant sites.

5.1.4.2.1 Nursery Storage

Provide a nursery at the Contractor's facility until deemed suitable for transplanting. Propagated plants must be maintained in a nursery that follows Attachment F6, Hawaii Rare Plant Restoration Group's (HRPRG's) Phytosanitation Standards and Guidelines (HRPRG 2010).

Propagation must include supplemental watering, mechanical weed or pest removal, pruning, treatment with fertilizer or pesticide, and other adaptive management techniques to maximize survivorship and plant health. Use the following guidelines for Nursery Storage.

a. Ensure cycads entering the nursery are free of Asian cycad scale and other weeds/ vines/ epiphytes and use pesticide as necessary, following applicable pesticide rules.
b. Prior to removing cycads, complete a soil drench treatment using a product that is on AAFB's Authorized Use List (AUL) around each specimen. The Contractor may propose use of a product not on AAFB's AUL, however, it must be approved by the Contracting Officer and through the NAVFAC Pacific Terrestrial

Applied Biology Department. The applicator must have a DoD certification or Guam certification in Pest Control. All use must be reported using the NAVFAC Online Pesticide Reporting System.

c. To avoid cross contamination between each specimen harvested, wash down all equipment (10% bleach solution) prior to each subsequent removal.
d. Once the specimen has been removed, rid the plant specimen of any remaining debris and loose plant material, followed by the remaining treatments in this order: AUL fungicide, AUL insecticide, a cycad base wash (10% bleach solution), followed by application of a plant sealant (aerosol tree sealant), and root hormone.
e. Once harvested and treated as specified, pot each specimen into potting containers using Government-approved rooting media. Salvaged basal shoots must be processed and transplanted in the nursery in less than one week of salvage. Once potted, ensure safe transport and offload of all potted specimens to a secure Government approved nursery location.
f. During transportation, basal shoots must be covered for protection from sun and wind exposure. A clean blanket can be used to avoid damage during transport.
g. Invasive species within a 20-foot radius around salvaged plants must be removed and maintained to ensure no more that 15 percent of vegetation is invasive species within the plots.

If plants do not meet the survival criteria, implement adaptive management techniques to include, but not limited to, seed collection, tissue germination, and plant division and/or stem cuttings, as suitable to the species, to meet outplanting success targets.

5.1.4.2.2 Transplanting/Maintenance

Determine when plants are ready to be outplanted. Plants must be outplanted before they become root bound in their containers to promote new growth. After transplanting, maintenance of ESA-listed species may include watering, fertilizing, pesticide treatment, use of support structures, or invasive species removal. Invasive species must be removed within a 20-ft (6-m) radius around transplanted vegetation. The maximum percent cover of invasive understory, overstory, and vine plants permitted within the Tarague FEA and details of removal will be determined following the field assessment.

If outplanted plants do not survive, notify the Contracting Officer and AAFB Natural Resource Specialist immediately and provide an explanation for why they died. Alternative techniques may be implemented if it is determined that the Natural Resource Work Plan approved methodology is not successful. Any remaining plant material at the completion of the performance period must be turned over to the AAFB.

5.1.5 Protect and Monitor ESA-Listed Species to be Remained

Protect and monitor the ESA-listed plant species that are not salvaged within 10 ft (3 m) of the construction perimeter once every 6 months during the entire construction period, including site preparation.

5.2 Tarague FEA

Implementing all conservation measures and BMPs for Tarague FEA specified in the 2025 BO. The requirements include the following, but are not limited to:

a. Prepare a work plan for forest enhancement that describes the forest enhancement area preparation, native seed collection, and forest enhancement (transplanting) methods.
b. Conduct a biological survey for the 151-ac (61-ha) FEA. The biological survey may include recording

existing ESA-listed species (including a health assessment), native and non-native canopy trees, and invasive species.

c. Install an approximately 2.5-mile-long permanent ungulate-proof fence along the forest enhancement area.
d. Remove invasive plant species and invasive species (e.g., CRF, LFA, BTS).
e. After the ungulate-proof fencing is installed, eradicate ungulates (pigs and deer) within the fence limit.
f. Any ground-disturbing activities at the Tarague FEA require archaeological monitoring and Munitions and Explosives of Concern (MEC) screening.

5.2.1 Draft and Final Work Plans for Tarague Forest Enhancement Area

Provide Draft and Final work plans for Tarague Forest Enhancement Area that describes the forest enhancement area preparation, native seed collection, and forest enhancement (transplanting) methods. The activities associated with forest enhancement (transplanting), such as, installation of ungulate fence including fence route and specifications; removal of vegetation; water lines, or invasive species removal, must adhere to recommended buffer distances (typically 3 ft [1 m]) to avoid adverse impacts to in-situ ESA-listed species.

5.2.2 Install Ungulate-Proof Fence

Install an approximately 2.5-mile-long permanent ungulate-proof fence along the forest enhancement area. Construction of ungulate-proof fencing must occur prior to, or concurrent with, the vegetation removal at the construction footprint.

Provide approximate alignment of the ungulate fence line and include it in the Work Plans for Tarague Forest Enhancement Area. The approximate alignment must be in accordance with the FEA alignment shown in Figure F1; however, the alignment must be adjusted to avoid sensitive environmental areas such as existing ESA-listed T&E species and potential cultural areas. Removal of vegetation for installation of fencing will adhere to recommended buffer distances (3-ft wide on each side of the fence) to avoid adverse impacts to in-situ ESA-listed T&E species. Thus, a 6-ft wide corridor with the fence must be situated.

Fencing must meet the JRM ungulate fencing standards (Refer to Attachment F5). Provide vegetation clearance and maintenance as needed to ensure integrity of the fence. Four (4) pedestrian gates must be provided. The preferred pedestrian gates are presented in the Attachment F1, Figures. No vehicle access gates are required. The ungulate-proof fencing does not require any controlled area signage.

There will be no salvage/transplanting ESA-listed species along the ungulate-proof fencing area/route since disturbing ESA-listed species will be avoided. Within 72 hours after a major storm or high-wind event (wind speeds equal to or greater than 39 miles per hour or 34 knots), ungulate fencing must be inspected for breaches, and fencing must be repaired or replaced immediately after detection until the contract is completed.

5.3 Reporting, GIS Maps, Database

5.3.1 Weekly Natural Resources Conservation Status Report

During the salvage and transplantation phase, a Weekly Natural Resources Status Report to the Contracting Officer on Monday of the previous week. The report must document the Contractor's diligence in salvaging T&E species, task status, anticipated delays, major milestones, and outlook to the following week's tasks.

In the event that T&E species are no longer salvageable from the time of the field assessment until fieldwork occurs, document how the T&E species no longer meets the criteria established in the Natural Resource Work Plan. Pictures and explanations must be documented in the weekly Status Report and Project Report.

After the completion of salvage operations, the Contractor must identify the actual number of healthy cycads, guamense, and T. rotensis seeds salvaged from the P-012 construction footprint in the weekly Status Report. The Government will review the status report to evaluate any changes in the number of cycads and T. rotensis suitable for salvage and provide acknowledgement of the number of salvageable required to meet the success criteria.

5.3.2 Monthly Natural Resources Conservation Progress Reports

Submit monthly progress reports documenting the status of the salvage, transplantation, maintenance and monitoring efforts except in months no work has occurred. The report must be submitted by the 10th of the month. The report period must cover the first through the last day of each month. The reports must include the project name, contract number, report date, period covered (first day of month through last day of month), personnel involved, work completed during the time period, data collected, problems encountered and resolutions/action items, photo documentation of the T&E species, and work planned for the following month.

5.3.3 Annual Natural Resources Conservation Progress Reports

Submit annual reports summarizing the type of activities (e.g., health status of plants, propagation, transplantation, etc.) conducted on each species and the status of transplantation efforts. Include the number of cycad material collected from the parent plant, the number of T. rotensis seeds collected, propagation methods (number seeds germinated), the number of guamense collected, survival rate, and the number of plants meeting the success criteria.

5.3.4 Draft and Final Natural Resources Conservation Reports

Submit the Draft Natural Resources Conservation Report within 45 calendar days upon completion of the maintenance and monitoring phase for the transplanted T&E species. Address:

a. Title page showing title, date, contact information
b. Subtitle page showing title, prepared by listing, prepared for listing, date and recommended citation
c. Table of contents
d. Executive Summary
    i. Synopsis of qualitative cycad selection and prioritization for transplantation
    ii. Synopsis of T. rotensis seed collection, germination and outplanting
    iii. Synopsis of guamense collection and outplanting.
    iv. Synopsis of plant survival and condition for each specimen.
    v. Synopsis of outplanting and monitoring methods.

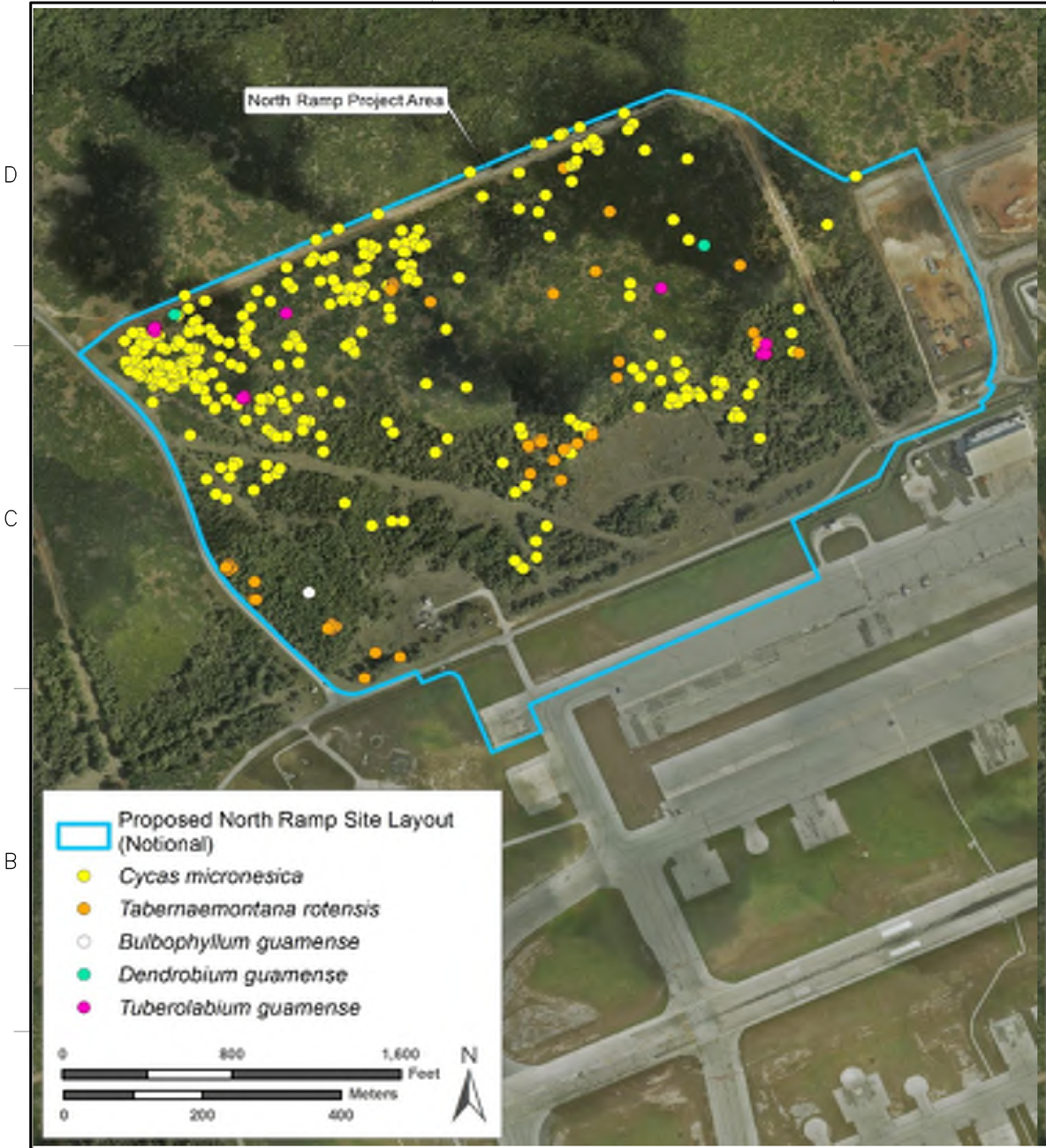
e. Introduction (including background information)
f. Master schedule of all project events.
g. Methodology
h. Results: Provide record, map, and photo of all specimens removed, including identification code associated with GPS coordinates from construction site, in addition to GPS coordinates and maps of each new cycad, T. rotensis, and guamense relocation site. Refer to Attachment G. GIS Standards for GIS deliverable.

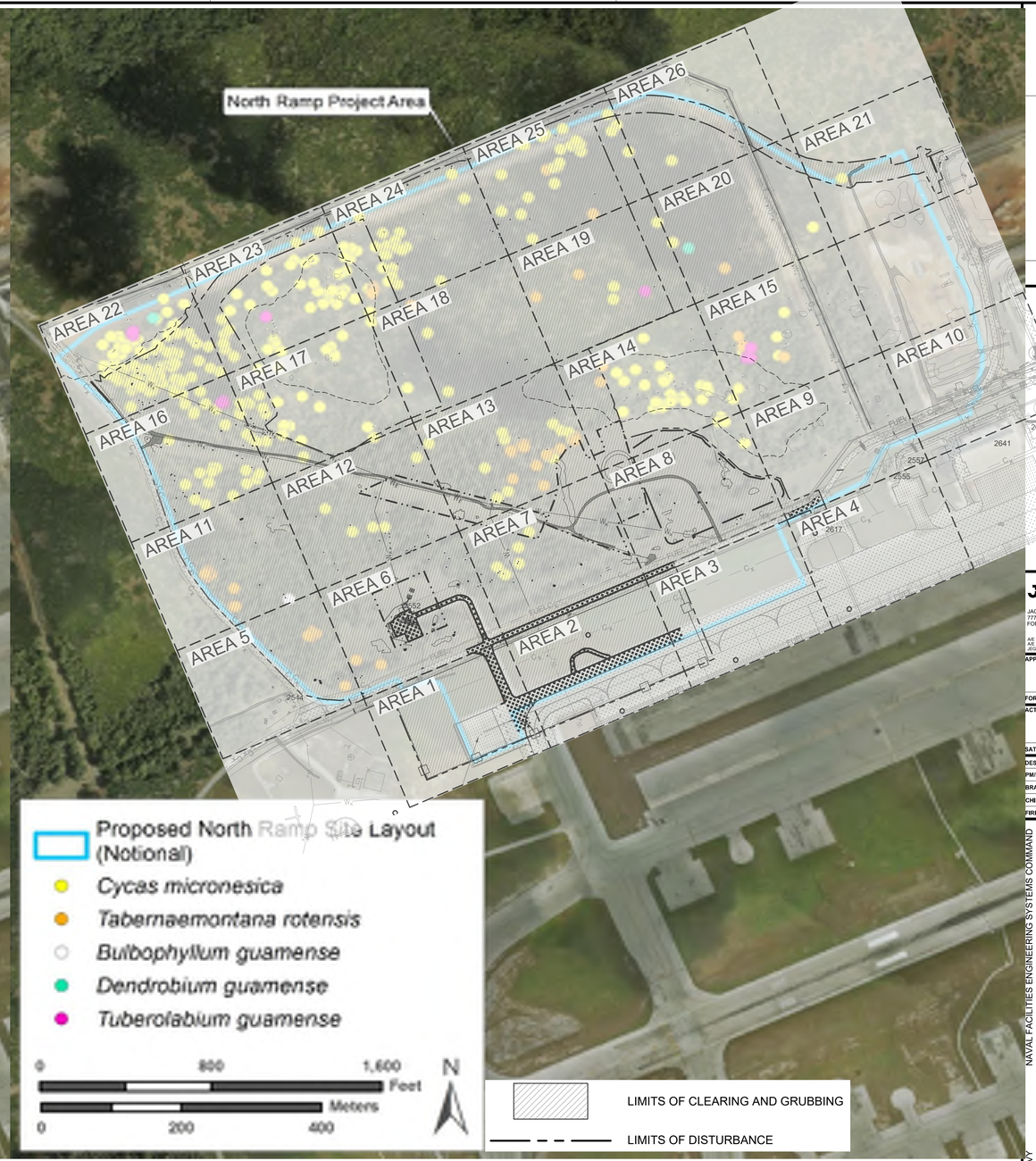
i. Discussion (e.g., notable species presence or absences, include descriptive statistics such as means and standard deviations to document quantitative and qualitative results.)
j. Conclusion (recommendations for future projects or changes to methodology and document any problems encountered)

Submit the Final Natural Resources Conservation Report within 30 calendar days after receipt of Government comments. The Final Report must be submitted in Microsoft Word and Portable Document Format (PDF). In addition, provide all figures, graphics, and GIS data layers used in the report as separately labeled files

5.3.5 Comment Matrix

Incorporate all comments from the Government on all work plans and reports in a comment matrix. The comment matrix must identify how each comment was addressed by the Contractor and where in the document (page number, paragraph, and line) the corrections are to be found. The comment matrix will be used as a quality assurance tool. The comment matrix must be provided with each report submission.





P-012 Project Site Threatened and Endangered (T&E) Species

Comply with and implement the Section 01 57 19 and 2025 BO requirements.

1. GPS locations of T&E species have been recorded by the Government during the 2021 and 2024 Biological Surveys.

2. Determine the current number of individuals and health status assessment of T&E species that cannot be avoided within the construction footprint. Protect and monitor the T&E species that are not salvaged within 10 ft (3 m) of the construction perimeter.

3. Determine how many individuals can be salvaged through seed collection, plant part salvage, and/or whole plant salvage. Salvage, nurse, transplant, maintain, and monitor T&E spices that cannot be avoided within the construction footprint.

Section 01 57 19 Temporary Environmental Control
Attachment F. Natural Resources PWS
Figure F1-1. P-012 Construction Footprint and T&E Species

NAVFAC

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742219T0315
JEG NO. 03430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

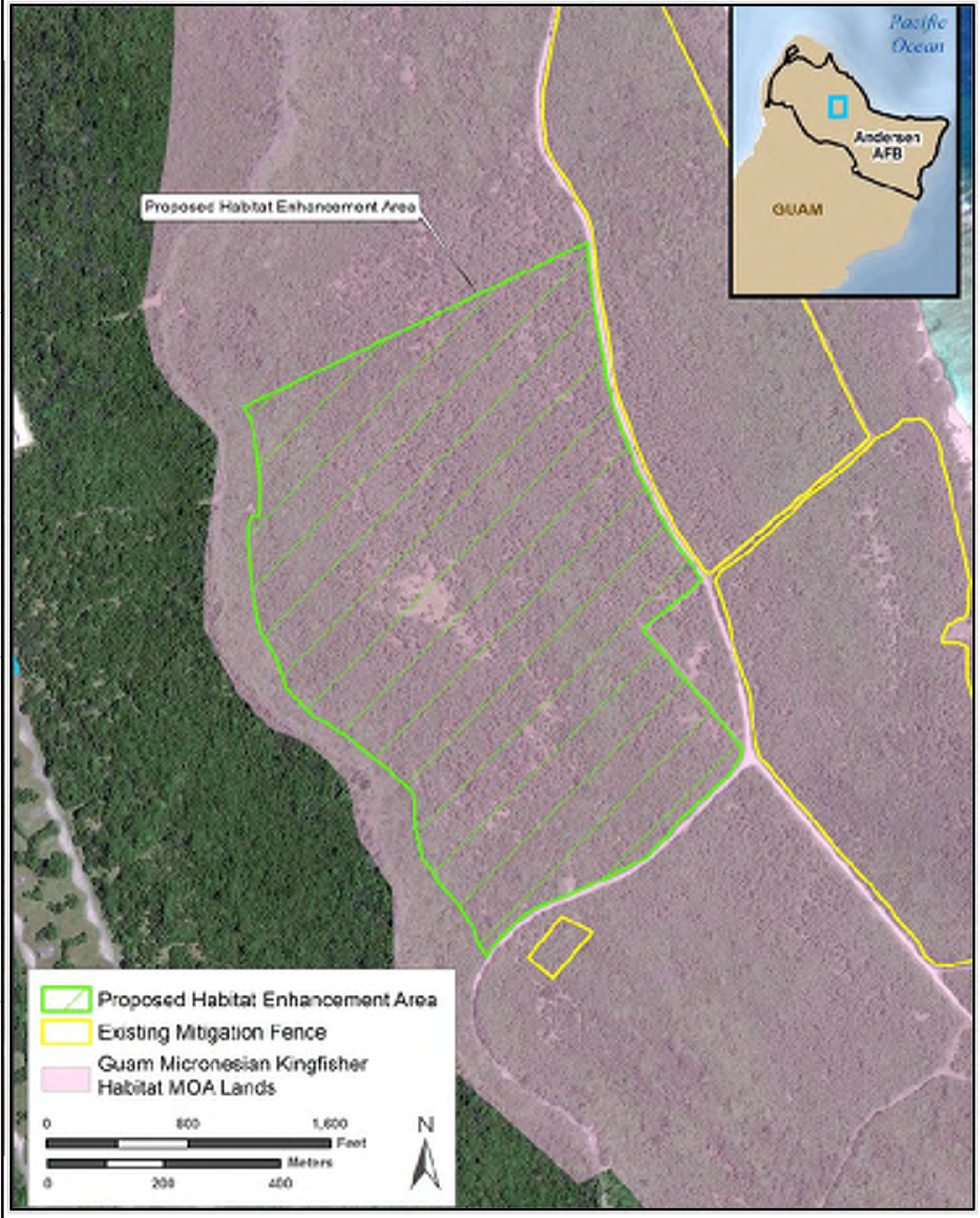
SATISFACTORY TO DATE

DES: HYL	DRW: HYL	REV: JBH
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

SCALE: NTS
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF



Tarague Forest Enhancement Area (FEA)

The following notes provide major requirements; do not include all requirements.

Comply with and implement the Section 01 57 19 and 2025 BO requirements.

1. Prepare a work plan for the Tarague FEA.
2. Conduct a biological survey.
3. Provide archaeological monitoring for all ground-disturbing activities including vegetation clearance.
4. Install a permanent ungulate-proof fence along the FEA.
5. After the ungulate-proof fencing is installed, eradicate ungulates within the fence limit.
6. Transplant salvaged cycads and Tabernaemontana rotensis. Maintain and monitor them until they are established.

Section 01 57 19 Temporary Environmental Control
Attachment F. Natural Resources PWS
Figure F1-2. Tarague FEA Location

Jacobs / BURNS McDONNELL
JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0315
JCG NO. 034306O3
A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: HYL	DRW: HYL	REV: JBH
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

SCALE: NTS
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

Section 01 57 19 Temporary Environmental Control
Attachment F. Natural Resources PWS
Figure F1-3. HMU Location

NAVFAC

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-2LO-0002
A/E Task Order No. N6274221F0315
JCG NO. 034306O3

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: HYL	DRW: HYL	REV: JBH
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
JOINT REGION MARIANAS (JRM)

ANDERSEN AIR FORCE BASE

GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

SCALE: NTS
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

Section 01 57 19, Attachment F2

SAMPLE ACCEPTED METHODOLOGIES FOR CYCAD SALVAGE AND TRANSPLANTATION

1. Cycad basal shoot health is based on a variety of factors including extent of cycad aulacaspis scale (*Aulacaspis yasumatsui*) infestation/damage and current health condition of the parent plant.
2. Basal shoots that are approximately 1.7" in diameter (golf ball size) and larger will be considered for salvage (EA Engineering 2019).
3. Prior to salvage of the basal shoots, pesticides will be applied to treat cycad scale and *Chilades pandava* larvae.
4. Cycads will be visually inspected for little fire ants (LFA) before salvage and transplant. If LFA are observed, LFA Management Procedures will be followed.
5. Basal shoots will be removed from the main trunk to maintain as much of the root mass as possible. All basal shoots will be placed in an appropriate pot for the pup's size and promote drainage.
6. Basal shoots will be tagged prior to removal from the parent plant. The tags will consist of a unique alpha-numeric aluminum tag which will be secured to the individual pots.
7. A pressure washer may be used to remove any remaining debris, loose plant material, and pests (i.e. cycad scales).
8. During transportation, basal shoots will be covered for protection from sun and wind exposure.
9. Once transported to a nursery, commercial root-promoting hormone may be applied to the stem followed by the remaining treatments: fungicide and insecticide applied in accordance with label directions and applicable regulations and law.
10. Each basal shoot will be potted in plastic pots with well-drained potting media such as pumice, perlite or sand and/or soilless and placed in the nursery. Salvaged basal shoots will be processed and transplanted in the nursery within one week of salvage.
11. Cycads will be evaluated monthly or more frequently depending on the conditions of the plants to determine growth and status.
12. Salvaged cycad basal shoots/seeds will be propagated in a nursery until the lead biologist determines they are suitable for transplanting.
13. After transplantation, maintenance will include watering, weeding, fertilizer, pest control, support structures and/or plant protection will occur until the transplants shows stem growth of at least 1.0 cm as measured below the base of the existing leaves (fronds) since planting in the wild.
14. Plants will be weaned of maintenance for a period of 6 months since planting for natural up take of nutrients and water.

Section 01 57 19, Attachment F3
NATURAL RESOURCES GIS STANDARD FOR GIS DELIVERABLE

i. Mapping Grade Global Positioning System Requirements: ESA-listed plant location data must be collected with survey grade GPS data collection. Horizontal accuracy for survey grade GPS data collection must be + 1 centimeter at 1 sigma unless otherwise specified in the PWS. The maximum allowable degree of error for survey grade GPS data collection must be + 100 centimeters. Any features collected that exceed this degree of error will be rejected and tagged for recollection. Every effort must be made to capture feature locations without using offsets unless obstructions are present. Data sets derived from GPS data collection efforts must include metadata to record descriptions of the receiver and other equipment used during collection and processing, base stations used for differential corrections, software used for performing differential corrections, estimated horizontal and vertical accuracies obtained, and conversion routines used to translate the data into final geographic data delivery format.

ii. Geospatial Data Software Format: Geographic data must be provided in a form that does not require translation, pre-processing, or post-processing. All digital geographic maps and the related data sets must be delivered in a Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) compliant file geodatabase format (Access database file) utilizing the latest version of ArcGIS that has been approved by the Naval Information Technology Center (NITC), currently ArcGIS 10.1.

iii. GIS Data Sets: The Contractor must develop all geographic information in a structure consistent with the most current version of the SDSFIE, also known as the National Committee for Information Technology Standards 353. Currently the version used is SDSFIE 2.7. The SDSFIE format must be followed for geospatial database table structure, nomenclature, and attributes.

iv. The Contractor must fit collected GIS data into the named feature classes and populate feature attribute information into provided fields. If the Contractor does not find the appropriate field for their data, fields may be created as needed.

v. All data coordinate systems must be in UTM WGS-84 and projection provided in Universal Transverse Mercator projection, the above zone, and in meters. Dates of surveys and correct scientific species names must be populated in the attribute tables. All spatial duplicates must be removed from GIS data. The Contractor must provide a PDF copy of all maps associated with the GIS data in this Contract.

vi. All constructed maps must have the associated ArcMap Document File (MXD) delivered to allow for future printing and modification. MXDs must use the relative paths option or layer packages. The Table of Contents (TOC) within the MXD must be orderly and contain a logical naming structure.

vii. Geographic data must be delivered on a CD-ROM or DVD-ROM; electronic data delivery must suffice for draft deliverables.

viii. Data dictionaries may be used to assist with data collection in the field, attributes must be coordinated with NAVFAC Pacific/AAFB to ensure proper attribute names to integrate the data generated from this project into their overall GIS database.

ix. Metadata must be included in the final GIS deliverable. Metadata for each individual dataset must be populated to meet basic data population standards as identified in the ESRI standard template. Additional data must be provided as appropriate, including, at a minimum:

- The name and description of the data set or layer.
- The source of the data and any related data quality information such as accuracy and time period of content.
- Description of the data collection method or survey protocols used; a report citation is acceptable.
- Description of the equipment or instruments used in the data collection.
- Scientific names of all the federally listed species to populate in the attribute tables.
- Description of all codes used in the data fields in the appropriate attribute definitions.

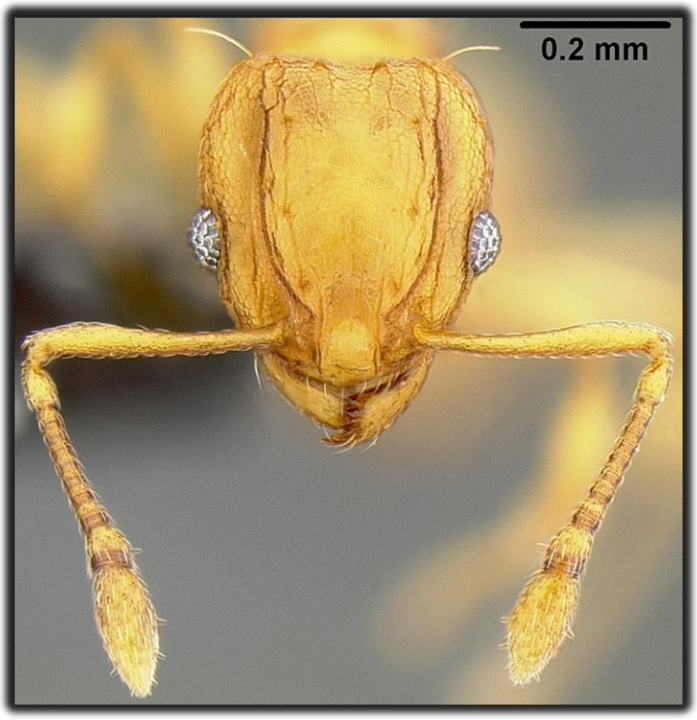
- Description of ranges of numeric fields and the meaning of numeric ranges.
- Description of all fields and attributes not in SDSFIE in the attribute definitions.
- Removal of spatial duplicates from GIS data.
- A point of contact to answer all technical questions.

x. The digital geographic maps, related data, and text documents must be included for review in the draft and final report. The data must be analyzed for discrepancies in subject content, correct format in accordance with these specifications, and compatibility with the existing GIS system. The Contractor must incorporate all responses to review comments to data and text prior to approval of the Final Report.

Attachment 1

F4. Standard Operating Protocol for the Control and Monitoring of Little Fire Ant (LFA), Wasmannia Auropunctata

Standard Operating Protocol for the Control and Monitoring of Little Fire Ant, *Wasmannia auropunctata*



Wasmannia auropunctata (AntWeb).

Prepared for: Naval Facilities Engineering Systems Command Marianas

NAVFAC
Naval Facilities Engineering Systems Command

Prepared by: Center for Environmental Management of Military Lands
Colorado State University

Center for Environmental Management
MILITARY LANDS

March 2022

Version no.	Version Date	Description of Change	Author Name
001	09/29/2017	Initial release	Tom Mathies
002	03/29/2022	Changes were made throughout the document to address NAVFAC comments & update survey protocols for general use.	Jessica Gross, Leela Hospach, Ken Puliafico

Table of Contents

1.0. Purpose 3
2.0. Background 3
3.0. Survey Methods 5
3.1. Visual Survey 5
3.2 Baiting Survey 5
3.3 Population Delimiting Survey 7
3.4 Non-target Invertebrate Survey 8
4.0. Control Methods 8
4.1 Incipient Colonies 8
4.2 Established Colonies 8
5.0 Post-treatment Monitoring 11
5.1 Incipient Colonies 11
5.2 Established Colonies 11
5.3 Post-eradication Monitoring 11
6.0 Evaluating Treatment 11
Appendix 1. Little Fire Ant Quick Sort Guide 13
Appendix 2. Little Fire Ant Look-Alike Key 14
Appendix 3. Pesticide Labels and Web Links 15
Appendix 4: Tango Gel Bait Formulation 21

1.0. Purpose

The purpose of this document is to provide standard monitoring and control protocols to prevent the spread of the little fire ant (*Wasmannia auropunctata*, LFA hereafter).

2.0. Background

LFA is a small ant native to Central and South America, which has been widely introduced in the tropics, including several Pacific Island groups. It is a serious environmental and agricultural pest. Of all species of invasive tropical ants, LFA poses one of the greatest threats to the people and environment in the Pacific region, and has been ranked as one of the world's top 100 worst invasive species. Painful stings and an irritating rash from LFA affect both humans and animals, including pets and livestock. No serious injuries to people from LFA stings have been reported, but it is possible that people with an allergic reaction could experience anaphylactic shock leading to serious harm. The LFA was first discovered on Guam in November 2011, but was likely present between five and ten years prior. It is now found at more than 30 sites across Guam on private and public property and it is likely that more sites have yet to be discovered and reported. There is no organized eradication or control plan for LFA on Guam and it is likely that it is now too widespread to eradicate. Guam and Yap (Federated States of Micronesia) are the only islands in Micronesia known to be infested with LFA. The interdiction of this species and prevention of its spread to other locations in the Mariana Islands and beyond is therefore a high priority.

LFA are easily distinguished from other indigenous and exotic ants found in the Marianas. They are small, yellow-orange, and approximately 1 mm (1/16th inch) in length. They are slow moving, monomorphic (only one form of worker), and easily dislodged from whatever surface they are climbing. Antennae are 11-segmented, terminating in a distinct two-segmented club (Figure 1). Two propodeal spines are located on the posterior mesosoma, and the petiole is two-segmented (Figures 1-3). Two distinct antennal scrobes extend vertically from the antennal sockets on the frons (Figure 2 and cover page). The erect body hairs are long, coarse, and rather sparse (Figures 1 and 3). An illustrated quick sort guide and key for distinguishing among look-alike species developed by the Hawaii Ant Lab (University of Hawaii), is provided in Appendices 1 and 2, respectively.

The LFA is a highly adaptable ant species found in both moist and xeric conditions and seems to thrive equally well in natural and manmade environments. In the wild they can be found under leaf litter, debris, rotten logs, stones, clumps of grass and in the canopy of trees and shrubs. They do not build mounded dirt nests; instead, they form mobile colonies that congregate in sheltered areas. These colonies can easily move towards a resource or away from disturbance. The LFA is polydomous (uses more than one nest) and exhibits high interspecific aggression, with no intraspecific aggression, allowing it to outcompete native species and dominate on a landscape scale, often forming supercolonies. A single colony can vary in size from a few square inches to several acres and consist of multiple queens. Thus, in contrast to many other ant species, extermination of a queen will not necessarily extirpate a colony.

Figure 1. Photograph of Wasmannia auropunctata. Lateral view.
By Eli M. Sarnat (AntWeb).

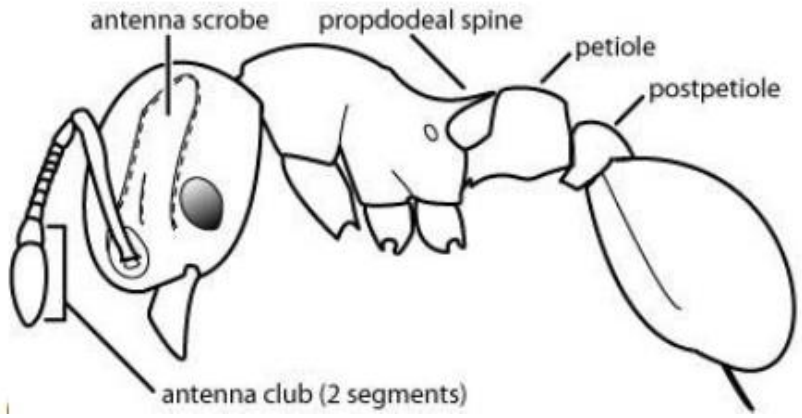


Figure 2. Little fire ant (Wasmannia auropunctata) anatomy
(University of Hawaii – Hawaii Ant Lab).

Figure 3. Photograph of little fire ant (Wasmannia auropunctata). Dorsal view.
By Eli M. Sarnat (AntWeb).

3.0. Survey Methods

3.1. Visual Survey

Due to their distinct appearance and behavior, LFA can be identified visually in the field by trained personnel (Appendix 1). Surveyors should look on lower parts of tree trunks, branches, leaves and bare spots in the understory for trails of slow moving rusty colored ants. Be aware that there are at least three other small ant species that are similar in size and general appearance to LFA (*Tetramorium simillimum*, *Pheidole morens,* and *Solenopsis sp.* (species *S.* HI01); See Appendix 2) that occur on Guam, and at least one (*Tetramorium simillimum*) occurs on Tinian. Appendix 2 depicts a Little Fire Ant Look-alike Key. Visual surveys are rarely adequate for detecting LFA within a large site, but are often useful for quick confirmation of reported colonies where location is known. When LFA or suspected LFA are encountered, their location should be recorded, and representative specimens collected in a sealed Ziploc bag for later species confirmation. Specimens should be rinsed and stored with 70% ethanol to ensure mortality and preservation. Be advised that visual surveys may be unable to detect LFA in areas where their numbers are low; baiting surveys are much more reliable for making detections (see Section 3.2). If LFA are confirmed within a management area delineation surveys should commence as soon as possible (see Section 3.3).

3.2 Baiting Survey

Routine baiting surveys for little fire ant presence/absence are conducted by trained personnel at locations at risk for introduction of LFA. It is recommended that these surveys be conducted at least once per year for early detection of new LFA introductions. Higher

risk areas such as construction sites, base yards, compost facilities, ports and airports may require multiple surveys throughout the year.

Baiting surveys require placing bait sticks at regular intervals along a linear transect along roadsides, forest edges, the base of compost and hard fill piles, and areas where cargo and equipment are stored and staged. Bait stations should be placed where they can be easily seen in shaded vegetation or debris, cracks in pavement or buildings, or under equipment. Placement on bare ground, asphalt and concrete, especially in hot sunny locations should be avoided. Likewise, baiting surveys should not be conducted during the hottest parts of the day (12:00 to 16:00), except on overcast days, because ant activity is greatly reduced during this period due to the risk of desiccation of the worker ants.

A brightly painted chopstick or clothespin (bait sticks hereafter) is placed at each bait station (Figure 4). Chopsticks are placed directly on the ground or vegetation for most survey locations. Alternatively, clothespins are attached to vegetation 1-meter above the ground when animals such as crabs may disrupt the bait during the survey, for example in beach and strand locations. One end of the bait stick is smeared with a small amount of creamy peanut butter. LFA actively forage for protein sources and are highly attracted to low-cost peanut butter. Geographic coordinates of each station are recorded with a handheld GPS. Transect length and placement of stations will vary by site, but a common arrangement is one station every 30 paces or 20m. Placement of stations at regular intervals and color marking the sticks makes relocating them much easier. Colored flagging tape can be used to mark bait stick locations when surveys occur in areas with heavy ground cover.

Bait sticks should be retrieved 45 minutes to 1 hour after placement, but before all bait is consumed. If all the peanut butter has been eaten and there are no ants on the stick the station will have to be resurveyed. Bait sticks are observed for LFA before picking them up as ants will quickly jump off once disturbed. One indication that a small, reddish-colored ant on a bait stick is an LFA is that there are oftentimes numerous individuals present (See Figure 4). Other species of ant are rarely present on a bait stick if LFA are present. Suspected LFA positive bait sticks ants should be placed in individual Ziploc bags with enough 70% ethanol to kill the specimens. Each Ziploc bag with suspected LFA are labelled with a sample number for each GPS point. Specimens will be identified under a dissecting microscope in the lab and kept as vouchers.

It is highly recommended that all the bait sticks without LFA but with other ant species be collected into a separate gallon size Ziploc bag with 70% ethanol. Recording locations that have ants but are negative for the presence of LFA can be used to validate the effectiveness of the survey. After the survey has been completed, these samples should be moved to a vial with fresh alcohol and retained with collection data so that they can be inspected for other invasive ant species.

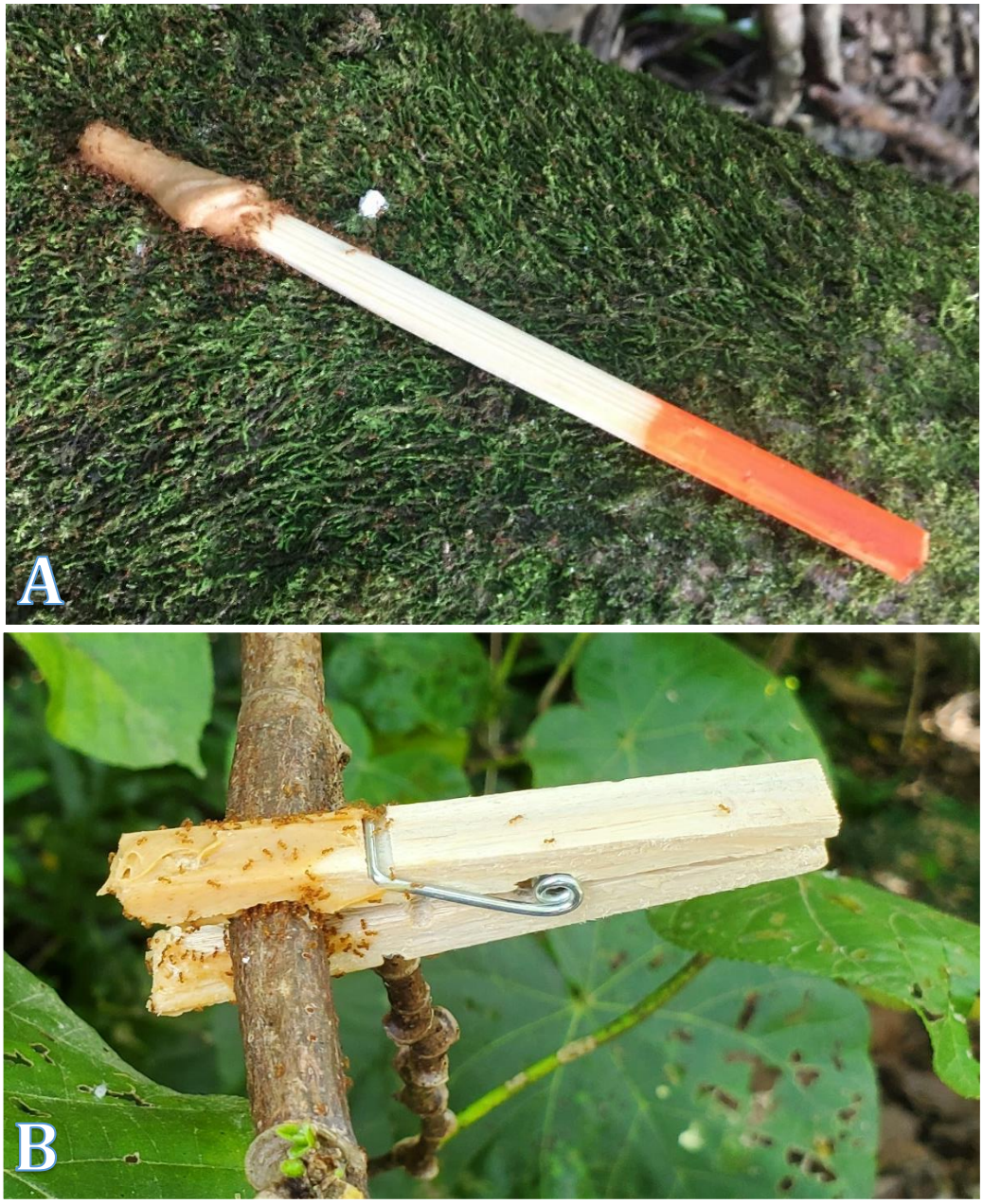


Figure 4. Swarm of little fire ants (*Wasmannia auropunctata*) on a peanut butter-laden bait sticks constructed of A) chopsticks and B) clothespin on Guam. By CSU CEMML.

3.3 Population Delimiting Survey

Once LFA have been identified at a site, the geographic extent of the colony should be accurately determined. The baiting methods described in the section above are used to determine presence/absence throughout an area of concern. Starting with all previously confirmed locations the survey area should include a 40m buffer in every direction. Bait

stations should be laid out in a 10 m x 10 m grid that overlays all previously confirmed locations within the buffer zone. If additional LFA are located within the area delineated, the grid of bait stations is expanded outwards 40m from each station where LFA was detected in an iterative fashion until no further LFA are detected. For greater assurance that the boundaries of a population have been delimited, it is advisable to continue sampling outwards from stations where ants are detected until four consecutive instances of no detections are achieved. When sampling is complete, the limits of the area of infestation can be determined and visualized by plotting the spatial distribution of presence/absence points in ArcGIS. Delineating the geographical extent of the infestation is crucial to developing an effective control plan.

3.4 Non-target Invertebrate Survey

It is important to consider any potential impacts to Federally protected non-target invertebrate species before undertaking LFA control or eradication efforts in order to avoid possibly causing harm to these species. Trained specialist should conduct surveys for threatened and endangered species listed by the U.S. Fish and Wildlife Service using protocols established for each species of concern. If listed invertebrate species are present, then modified treatment methods must be implemented to prevent accidental take of listed species.

4.0. Control Methods

4.1 Incipient Colonies

The following method is appropriate for isolated LFA colonies or colony fragments found in recently transported equipment, packing material, soil, debris, or vegetation. These colonies tend to be small (consisting of less than five hundred individuals) and occupy a space smaller than 0.25 square meters.

A liquid insecticide containing 0.126%, or more, of Carbaryl should be applied to the colony in a sufficient amount that all individuals are covered. Gardentech Sevin Ready-to-Spray Bug Killer is an appropriate product and application method and is commercially available on both Guam and the CNMI. The pesticide works quickly and dead LFA should be evident in minutes. This method requires the applicator to be especially thorough; every LFA must come into contact with the pesticide in order for it to be effective. The applicator is required to read and follow the product label and associated MSDS (Appendix 3).

4.2 Established Colonies

The following method is appropriate for large established colonies of LFA occupying an area greater than 0.25 square meters and consisting of more than five hundred individuals.

These protocols are appropriate for any LFA detected in a natural or manmade setting where more than one nest may occur or when reproduction is considered a possibility.

Based on the results of the delimiting surveys (Section 3.3) a treatment area is drawn around entire LFA infestation. The treatment area should include a 20-m buffer around all known LFA detections to establish a treatment perimeter. Pesticides will be applied to the entire area within the perimeter as a precaution to ensure complete coverage of the population and elimination of all LFA nests is achieved.

To achieve eradication of LFA requires a minimum of **eight** applications of a two pesticide combination at a **six-week interval** (Table 1) are done following protocols first developed by the University of Hawaii – Hawaii Ant Lab. These methods have been adapted by the University of Guam, the Guam Department of Agriculture and CEMML to treat landscape scale LFA infestations in Micronesia. Treatments require applying a combination of insect growth regulators and granular toxicant baits specific to fire ants to an infested area either simultaneously or in sequence one week apart, depending on operational needs. Eradication treatments are considered complete after 48 weeks as long as no LFA are detected during the last two post-treatment surveys (see Section 5.1). However, treatments may need to be continued at the same six-week interval if adequate control has not yet been achieved.

Table 1. Little fire ant treatment schedule

Treatment	Date	Liquid-gel bait	Granular bait
1	Start	Tango	Siesta
2	Six week interval	Tango	Amdro Pro/Probait
3	Six week interval	Tango	Siesta
4	Six week interval	Tango	Amdro Pro/Probait
5	Six week interval	Tango	Siesta
6	Six week interval	Tango	Amdro Pro/Probait
7	Six week interval	Tango	Siesta
8	Assess control and continue as necessary	Tango	Amdro Pro/Probait

Tango® insect growth regulator disrupts insect reproduction and development and gives long-term control of ant colonies and acts over a period of several weeks. Tango is available as a liquid concentrate that should be mixed into a gel bait matrix with a concentration of 0.25% S-methoprene, the active ingredient. The gel bait matrix is applied at a rate 1-2 gallons per acre (Appendix 4). The Tango gel bait uses oil and peanut butter to attract the ants and is especially useful in areas where the granular bait does not adhere well, such as tree leaves, branches and vertical tree trunks. Trees and shrubs in the infested area should be sprayed in a stream of large droplets distributed widely across the foliage to ensure the ant population encounters the bait when foraging in the canopy. In mowed grass areas only

apply Tango to landscaping greater than 1 meter tall since granular baits are more effective on shorter vegetation and lawns.

Siesta® Insecticide Ant Bait, Amdro Pro® and ProBait® are a granular fire ant baits for ground applications, and should be broadcast evenly across the infested area at 1.5 lbs/acre. Granular bait applications can be done on lawns and under the forest canopy since LFA forage actively on the ground in both habitats. Granular baits should only be applied in dry conditions when rain is not expected for 11 hours because the baits degrade quickly when exposed to water. Foraging ants take these products to their nests where they share the pesticide with nest mates, therefore they are most effective in the morning or in early evening when ant activity is highest. The baits are attractive to ants for up to 24 hours. The active ingredients in these products disrupt insect metabolism and cause the death of worker ants within 72 hours of consumption. In order to prevent bait avoidance and to stay under maximum EPA label application rates it is recommended that applications alternate between Siesta and Amdro Pro or ProBait. The active ingredient of Amdro Pro and ProBait is the same (hydramethylnon) but ProBait costs much less per pound. Labels for each pesticide can be found in Appendix 3.

Table 2. Pesticide information for the insecticides to be used for little fire ant management.

Pesticide	***Tango***	***Siesta***	***Amdro Pro/Probait***
EPA Reg. No.	2724-420	7969-232	241-322/73342-1-2724
Active Ingredient	(S)-Methoprene	metaflumizone	hydramethylnon
% AI applied	0.25%	0.063%	0.739%
Type	Liquid	Granular bait	Granular bait
Recommended application rate (per acre)	Up to 8 lbs mix 1 to 2-gal mix 6.5-13 fl oz concentrate	1.5 lbs	1.5 lbs
Maximum total application rate (per acre per year)	200 lbs	6 lbs	8 lbs
Maximum times per year	Not listed	4	4
Minimum interval	Not listed	4 weeks	90 days
Restricted-entry interval (REI)	4 hrs	12 hrs	12 hrs

The active ingredients in all of these products are not restricted use pesticides in Guam or the CNMI. However, application of either pesticide on Guam requires that the applicator possess a certified Guam pesticide license as required under §50107 (d) of the Guam Pesticides Act. Similarly, application of any of the pesticides in the CNMI requires a valid CNMI Pesticide Applicator License. Pest managers outside of these jurisdictions should

consult with local authorities such as their country's Environmental Protection Agency or Department of Agriculture for a list of approved products and applicator licensing. With all pesticides the applicator is required to read and follow the product labels (Appendix 3), EPA guidelines and recommended protocols.

5.0 Post-treatment Monitoring

5.1 Incipient Colonies

After chemical treatment is completed, bait stations are placed in and around the infested area. The number of stations will vary depending on the site. After one hour, the site will be revisited, the bait station checked, and a thorough inspection of the infested area will be made for live LFA. If none detected, then the site will be considered free of LFA. If LFA are found, treatment and monitoring are repeated until no LFA are detected.

5.2 Established Colonies

Post-treatment monitoring requires revisiting an infested area one week after the application of pesticides and conducting a delineation survey throughout the treatment area defined above. Peanut butter-baited bait sticks should be deployed across the entire site to determine the effectiveness of the pesticide treatment and to monitor LFA population decline.

For consistent monitoring throughout the eradication treatment period it is recommended that permanent post-treatment monitoring stations be established using a grid not to exceed 15-m x 15-m. These locations can be marked with flagging tape and recorded on a GPS. Data for each monitoring station should be recorded and compared across treatment periods.

5.3 Post-eradication Monitoring

Post-eradication monitoring occurs after the full eradication treatment protocol for established colonies has been completed (Section 4.2). Post-eradication monitoring requires revisiting the treated area every six months for two years. At these sites, all permanent bait stations used in the post-treatment monitoring of established colonies (Section 5.2) are used to survey for LFA. If permanent bait stations were not used then the entire infested area plus a 20-m buffer should be surveyed using the Delineation survey protocols (Section 3.3). If no LFA are detected during the four post-eradication treatment surveys, then the site is considered free of LFA. If LFA are found, treatment and monitoring will be repeated for the delineated area infested with LFA as before until none are detected.

6.0 Evaluating Treatment

Post-treatment surveys will determine the effectiveness of the control methods. The methods recommended in this document are based on the protocols developed at the Hawaii Ant Lab of the University of Hawaii - Hilo. When these protocols were duplicated on Guam in 2015-2016, they proved to be 100% effective in the areas where entire colonies were treated. Barring unforeseen circumstances, a similar success rate should be expected in other locations.

Appendix 1. Little Fire Ant Quick Sort Guide

LFA Quick Sort

(Field "Guide")

Monomorphic

YES

NO

Polymorphic

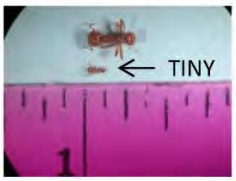
NOT LFA

TINY; 1/16 in or smaller

YES

NO

May be small but not TINY



NOT LFA

"Slow" moving
(very slow to moderate)

YES

NO

VERY fast moving, speedy, zippy

NOT LFA

Solid color: rusty, orange, brown

YES

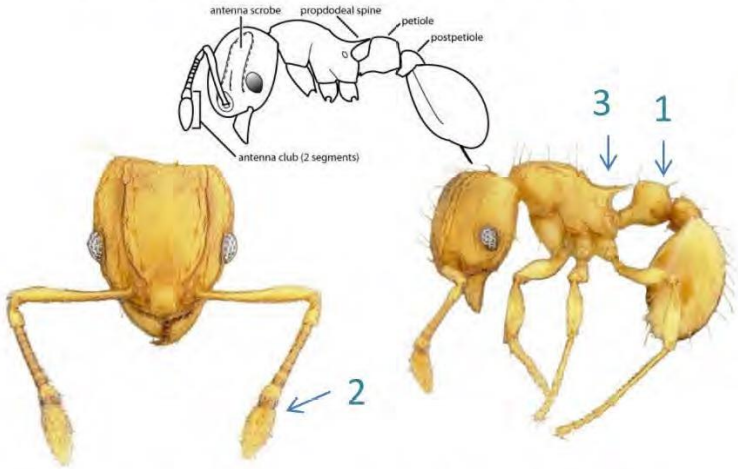
NO

Yellow, black, bi-colored

NOT LFA

WARNING!!!! POSSIBLE LFA or LOOK – A – LIKE BEWARE!!!
look closely under microscope and have someone double check your ID

Is it Little Fire Ant?



Look for the following features in the order listed:

1. They have two "bumps" between the thorax and abdomen (a petiole and post-petiole). Yes?, go to 2

2. the last 2 segments of the antenna are much bigger than all the others (a 2-segmented antennal club). Yes?, go to 3

3. they have two long spines protruding from the end of the thorax that are almost long enough to reach to the first "bump" (long propodeal spines)

So if it has the two bumps AND the 2 bigger antenna segments AND the two long spines that reach all the way back to the bumps, then your ant is very probably a little fire ant.

LFA look-a-likes

These ants are present in Hawaii and look like Little Fire Ants. They are the same size, shape and approximate color

Tetramorium similimum
Different because:
- **3 segmented antennal club**
- **Short spines**
- **Round eyes (not teardrop shape)**

Solenopsis sp HI01
Different because:
- **Pale yellow color**
- **No spines**
- **Tiny eyes**

Pheidole morens
Different because:
- **3 antennal segments**
- **Deep clef in thorax**
- **Polymorphic**
- **Short spines on thorax**

Monomorium pharoahnis
Different because:
- **3 segmented antennal club**
- **No spines on thorax**

Appendix 3. Pesticide Labels and Web Links

Pesticide	Web Link
Tango	https://www.centralantcontrol.com/all-products/tango
Siesta	https://betterturf.basf.us/products/siesta--insecticide-fire-ant-bait.html
Amdro Pro	https://betterplants.basf.us/products/amdro-pro-fire-ant.html
ProBait	https://www.zoecon.com/all-products/premise/probait-formulation-for-professionals
Sevin - Ready to Spray Bug Killer	https://www.gardentech.com/products/sevin/sevin-ready-to-spray-bug-killer

Tango™

AN ANT GROWTH REGULATOR FOR CONTROL OF PROTEIN AND SUGAR FEEDING ANTS INCLUDING ARGENTINE AND PHARAOH ANTS

A LIQUID CONCENTRATE FOR USE IN REFILLABLE BAIT STATIONS THAT CONTROLS ANTS IN AGRICULTURAL CROPS AND STRUCTURES BY STERILIZING EGG-LAYING QUEENS AND PREVENTING LARVAL DEVELOPMENT

SPECIMEN LABEL

ACTIVE INGREDIENT:
(S)-Methoprene (CAS #65733-16-6) 4.9%
OTHER INGREDIENTS: 95.1%
Total. 100.0%

This product contains 0.4 pounds/gallon (48 grams/liter) (S)-Methoprene active ingredient

EPA Reg No. 2724–420

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE ADDITIONAL PRECAUTIONARY STATEMENTS

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS CAUTION

Causes moderate eye irritation. Harmful if absorbed through skin. Avoid contact with eyes, skin, or clothing. Wash thoroughly with soap and water after handling. Remove and wash contaminated clothing before reuse.

Personal Protective Equipment (PPE):

Applicators and other handlers must wear:

• Long-sleeved shirt and long pants • Shoes plus socks
• Chemical-resistant gloves

Follow manufacturer's instructions for cleaning and maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations:

Users should:

Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

FIRST AID

Call a poison control center or doctor immediately for treatment advice.

If in eyes	•Hold eye open and rinse slowly and gently with water for 15-20 minutes. •Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
If on skin	•Take off contaminated clothing. •Rinse skin immediately with plenty of water for 15-20 minutes.

Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact 1-800-248-7763 for emergency medical treatment information.

Siesta®

Insecticide Fire Ant Bait

For control of fire ants

Active Ingredient:	
metaflumizone* (CAS No 139968-49-3):	0.063%
Other Ingredients:	99.937%
Total:	100.000%

* (E/Z)-2-[2-(4-cyanophenyl)-1-[3-(trifluoromethyl)phenyl]ethylidene]-N-[4-(trifluoromethoxy)phenyl]hydrazinecarboxamide

EPA Reg. No. 7969-232 **EPA Est. No.**

KEEP OUT OF REACH OF CHILDREN

CAUTION/PRECAUCION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

See Inside for complete **First Aid**, **Precautionary Statements**, **Directions For Use**, **Conditions of Sale and Warranty**, and state-specific crop and/or use site restrictions.

In case of an emergency endangering life or property involving this product, call 1-800-832-HELP (4357), twenty-four (24) hours per day seven (7) days per week.

Net Contents:

BASF Corporation
26 Davis Drive
Research Triangle Park, NC 27709

BASF
We create chemistry

ProBait®
Formulation for Professionals

- KILLS IMPORTED AND NATIVE FIRE ANTS AND OTHER ANTS
- KILLS THE QUEEN
- DESTROYS THE MOUND

SPECIMEN LABEL

ACTIVE INGREDIENT:	BY WT.
Hydramethylnon (CAS #67485-29-4) . . .	0.73%
OTHER INGREDIENTS:	99.27%
Total	100.00%

EPA Reg No. 73342-1-2724

KEEP OUT OF REACH OF CHILDREN

CAUTION

See additional precautionary statements

GENERAL INFORMATION

ProBait® Formulation for Professionals (ProBait®) is highly attractive to imported and native fire ants, and other ants. Worker ants carry it into the mound as food for the colony. They eat it and feed it to the queen. ProBait® starts to kill ants immediately. In about a week, the queen is dead, which destroys the mound. Further information regarding ants may be obtained from your Cooperative Agricultural Extension Service.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

This product is not for use on vegetable or other food crops, timber or plants grown for sale or other commercial use, or for commercial seed production, or for research purposes.

Application Restrictions: Do not apply this product by any method not specified on this label. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

OUTDOOR USE

TREATMENT	RATE	COMMENTS
Individual Mounds: Imported & native fire ants Harvester ants Bigheaded ants Argentine ants	2 to 5 level tablespoons	Distribute bait uniformly around the mound. Do not disturb the mound. Do not apply more than 2 lb/acre. Do not contaminate kitchen utensils by use or storage.
Broadcast Treatment: Imported & native fire ants Harvester ants	1 – 1.5 lb/acre [2–3 oz/5,000 sq. ft.]	Broadcast bait uniformly with ground equipment (granular spreaders).
Broadcast Treatment: Bigheaded ants Argentine ants	1 – 2 lb/acre [2–4 oz/5,000 sq. ft.]	Broadcast bait uniformly with ground equipment (granular spreaders).

Apply when ants are active (typically when soil temperature is greater than 60° F). Repeat application as needed.

ProBait® controls imported and native fire ants and other ants, such as harvester ants, bigheaded ants, and Argentine ants. This product is for use on lawns, landscaped areas, golf courses, commercial grounds, parks, and other non-cropland areas such as airports, roadsides, cemeteries, commercial grounds, parks, school grounds, picnic grounds, athletic fields and other recreational areas, and as well, on grounds surrounding poultry houses (excluding runs and ranges) or corrals and other animal holding areas. Avoid direct exposure of animals to ProBait® granules.

AMDRO®

PRO Fire Ant Bait

KILLS IMPORTED AND NATIVE FIRE ANTS
and other ants
KILLS THE QUEEN DESTROYS THE MOUND

Active Ingredient:	
hydramethylnon: tetrahydro-5,5-dimethyl-2(1*H*)-pyrimidinone(3-[4-(trifluoromethyl)phenyl]-1-(2-[4-(trifluoromethyl)phenyl]-ethenyl)-2-propenylidene) hydrazone	0.73%
Other Ingredients:	99.27%
Total:	100.00%

EPA Reg. No. 241-322 **EPA Est. No.**

KEEP OUT OF REACH OF CHILDREN
CAUTION/PRECAUCION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

See inside for additional **First Aid**, **Precautionary Statements**, **Directions For Use**, **Conditions of Sale and Warranty**, and state-specific crop and/or use site restrictions.

In case of an emergency endangering life or property involving this product, call day or night 1-800-832-HELP (4357).

Net Contents:

BASF Corporation
26 Davis Drive
Research Triangle Park, NC 27709

BASF
The Chemical Company

WON'T HARM PLANTS, BLOOMS OR LAWNS†
Sevin
INSECT KILLER
READY TO SPRAY
KILLS OVER 500 LISTED PESTS
FOR HOME
FRUIT & VEGETABLE GARDENS, ORNAMENTAL & FLOWER GARDENS, LAWNS, AND AROUND THE HOME
KILLS BY CONTACT AND KEEPS PROTECTING UP TO 3 MONTHS†
KEEP OUT OF REACH OF CHILDREN
Net Contents: 1 Quart (946 mL)

Appendix 4: Tango Gel Bait Formulation

Mixture Rates for Tango® used by Dr. Ross Miller lab at University of Guam with approximate measurements for one gallon of Tango Gel Bait.

		1 GAL	1 GAL	1 GAL
	percent of mixture	Metric	Ounces	Imperial units
Water	53.8%	2037 ml	68.9 fl oz	8.61 qt
Tango	5.1%	193 ml	6.5 fl oz	0.82 cup
Creamy peanut butter	3.0%	114 g	3.8 oz	7.7 Tbsp
Xanthan Gum Powder	0.7%	26.5 g	0.9 oz	1.79 Tbsp
Vegetable oil	37.4%	1416 ml	47.9 fl oz	5.98 cup

Mixing procedures used by CEMML Guam Biosecurity Project

1st Calculate the total treatable area to determine total TANGO mixture needed for the day

2nd Put on PPE and proceed with safety in mind.

3rd Measure Vegetable Oil and pour into the mixing bucket

4th Measure Xanthan GUM Powder and slowly pour it into the mixture while constantly mixing it gradually by hand or with paint mixer attached to an electric drill

5th Measure Water and pour into the mixing bucket mix with a portable drill with a paint mixer attachment

6th Measure TANGO amount and pour it into the mixture while mixing it vigorously into a white gel mixture.

7th Scoop and measure creamy peanut butter Amount (grams) in a glass dish and place into the microwave for about one minute until melted into a thick liquid

8th Carefully and thoroughly mix the hot melted peanut butter into the mixture

9th Add the marker dye until a red color is achieved

TANGO mixture should be used the same day if at all possible. If weather delays application then mixture should be stored in a cool dark place for up to 30 hours.

ATTACHMENT A

JOINT REGION MARIANAS MATERIALS AND CONSTRUCTION STANDARDS FOR UNGULATE FENCING ON GUAM
24 NOV 2021

WORK ELEMENTS

Construction Corridor/Activities

Construction activities along the fence line are to be confined to a corridor maximum of 10 ft. wide. Using the fence line as a center, the corridor is described as 5 ft. on each side of the fence. No construction activity shall be conducted outside this corridor. Cutting down of trees or shrubs should be kept at minimum when constructing the fence.

Fence Construction

2. **Livestock Panel and T-Post Fence Installation**: Ungulate fences with a height of 7 ft. will be constructed with 16 ft. x 50 in. galvanized livestock panels (1/4 in. diameter rod) with deer mesh secured to galvanized, studded T-posts. Galvanized livestock panels are to be used because of their durability and ease of installation on uneven terrain. The panels can be cut to fit the landscape especially in rocky terrain (Figure 1-3). Panels can be flexed to curve around obstacles (trees, rock outcrops, etc.) in the fence lines path (Figure 1).

a. Livestock Panels Installation

- Livestock panels shall be placed flush against the ground surface. The only exception would be when a panel is used as a strategic overhang off a cliff edge.
- Livestock panels should be cut to fit the landscape of karst/rocky areas, where necessary (Figure 1-3).
- Each livestock panel shall overlap with the adjacent panel by two squares or 16 inches on each end. If required, more of an overlap may be used when necessary.
- Each panel overlap shall have a minimum of sixteen (16) 9-gauge galvanized hog rings to secure end panel to panel connection.
- Every livestock panel overlap shall be secured to a galvanized T-post throughout the fence, a minimum of three (3) galvanized T-posts shall be used per 16ft. panel.
- When possible the vertical rods of livestock panels should be lined up with galvanized T-post for securing.
- At least three (3) pieces of 9-gauge galvanized smooth wire (10 in. long) shall be used to attach/secure livestock panels to each galvanized T-post (top, middle and bottom) and not fence clips. The 9-gauge galvanized smooth wire shall be looped through panel(s) and around galvanized T-posts with ends twisted to ensure a tight secure connection (Figure 4).

b. Studded T-Posts Installation

- A minimum of three (3) galvanized T-posts (9 ft.) shall be used per 16 ft. panel, including the panel overlaps. Galvanized T-posts shall be spread evenly along the length of the panel for best stability.

- Nine foot galvanized T-posts shall be driven to depth of at least a 2 foot, resulting in a fence height of 7 feet.
- The depth of each galvanized T-post should be consistent, but may vary slightly depending on terrain. The depth with the most stability and support should be used.
- Studded galvanized T- posts with the spade are to be used in areas where there is sufficient soil depth to support the post.
- Studded galvanized T-posts without spades are to be used in karst/rocky terrain, adjustments will be made accordingly as to the depth the post shall be buried.
- In rocky/karst areas where galvanized T-posts cannot be pounded by hand, the rock can be drilled prior with a bit smaller than the circumference of the galvanized T-post and the galvanized T-post pounded into the drilled hole.
- If needed, concrete (ex. Quikrete) can be applied to the base of the galvanized T-post for stability in rocky/karst terrain.
- Corner bracing can be made with galvanized T-posts bonded together and held at the bottom with galvanized T-posts driven into the ground with 3-4 ft. above the ground (Figure 5-6). Other cornering designs must be approved by the TPOC.
- Galvanized T-posts, including corners can be stabilized where needed with smooth wire anchored to dead men, other galvanized T-posts, or other approved anchors (Figure 6).
- Trees, shrubs, and roots are not to be used as anchors to secure the fence structure.

c. Unexploded Ordnance (UXO) Avoidance

- Once appropriate spacing and placement for galvanized T-posts are determined, the exact spots for placement are to be marked/identified by the contractor so that a UXO Contractor can validate the post hole area is free of metal and cleared for installation.
- If the designated placement of the galvanized T-posts is not approved for driving, a site in close proximity shall be identified by the UXO contractor for final placement of the galvanized T-posts.
- All locations for dead men, concrete pins, corner support galvanized T-posts, etc. must first be cleared by the UXO Contractor.

2. **Polypropylene Deer Mesh Installation**: Install at least 5 ft. tall heavy duty flat extruded polypropylene deer mesh from the galvanized smooth wire (9-gauge) strung between galvanized T-posts at a height of 7 ft. to overlap and secured to the galvanized livestock panel with the remainder of the excess mesh.

- Galvanized smooth wire (9-gauge) shall be stretched between the top of galvanized T-posts (7 ft.) and secured to the galvanized T-posts with fence clips (Figure 2 & 7).
- Tension on the smooth wire shall be such that a lateral force of 20 lbs. applied midway between T-posts shall cause no more than 6 inches of displacement from a straight line between the two adjacent fastening points when pulled laterally.
- Polypropylene deer mesh shall overlap with the galvanized livestock panel by at least 2 ft. and extend upwards to cover the distance between the top of the livestock panel (50 in.) to complete the distance for a total fence height of 7 ft.
- The polypropylene deer mesh shall be secured to the livestock panels and top 9-gauge smooth wire with 12.5-gauge galvanized hog rings, a minimum of three (3) hog rings secured to the smooth wire between T-posts (Figure 2).
- The polypropylene deer mesh shall be secured to each galvanized T-post above the livestock panel

with three (3) fence-clips, spaced equally between the livestock panel and top smooth-wire (Figure 7).

- Any areas of high ground outside/adjacent to the fence that will require additional fence height to deter deer from jumping over the fence, 9 foot T-posts can be secured to with 9-gauge galvanized smooth wire to ground secured T-posts to add fence height. Additional polypropylene deer mesh should be used to gain the height where needed (Figure 3).

3. **Hog Wire Apron/Skirt Installation**: Galvanized hinge-joint hog wire apron/skirting should to be used in areas where the terrain is soil or has the potential to erode. The apron/skirt will be placed along the outside of the livestock panels to discourage pigs from digging under the fence from the outside.

a. Hog Wire Apron/Wire Installation

- The galvanized hinge joint hog wire apron/skirt shall be laid horizontally on the ground outside of the galvanized livestock panels and folded upward with the smallest mesh (~3 in. squares) of the apron/skirt having a vertical overlap on the livestock panels for 16 inches (or attached to the 8th line of a 14 Line Combo livestock panel or the 7th line of a 13 Line Combo livestock panel), the remainder of the hog wire will be spread along the ground (Figure 5). The vertical strands of the apron/skirt should be off-set to be between the vertical strands of the livestock panels.
- The hog wire apron/skirt shall be attached to the livestock panels using 12.5-gauge galvanized hog rings not to exceed 12"spacing.
- Sections of the hog wire apron/skirt shall overlap with adjacent sections by one vertical stay. Cut ends of the wire apron/skirt will be twisted together to secure a seamless end to end connection.
- Galvanized concrete nail stake or studded dead-man posts shall be used to anchor the hog wire apron/skirt to the ground at every other T-post or as needed.
- Hog wire apron/skirt should not be secured to roots, trees, shrubs, or other types of vegetation.
- Sites for installing hog wire apron/skirt should be determined by the TPOC.

b. Unexploded Ordnance (UXO) Avoidance

- All locations for dead men and concrete nail stakes must first be cleared by the UXO Contractor.

4. **Vehicle and Pedestrian Step-Over Gate Construction**: Vehicle gates should 10 ft. wide by 7 ft. tall welded galvanized steel lockable vehicle gates and pedestrian gates should lockable welded galvanized steel step-over gates to allow human access, but prevent pigs and deer from getting into the fenced area (Figure 8 and Figure 9). Gate design changes must be approved by the TPOC.

a. Vehicle Gate Installation

- Vehicle gate height will be at least 7 ft. tall and gate opening at least 10 ft. wide and constructed of galvanized pipe, tubing, and livestock panels.
- Support posts on either side of the gate will be 4 in. diameter galvanized schedule-40 pipe posts set in the ground to a depth of 3 ft. and secured with concrete.
- The frame of the gate shall be constructed of 1-5/8 in. diameter galvanized schedule-40 pipe with galvanized livestock panels welded to the frame.
- Standard vehicle gate measurements (see Figure 8).
- The bottom and sides of the swinging gate shall have a clearance of $\leq$ 2 in. to prevent pigs from passing under and/or through the sides of the gate.

- Gate must have a lockable latch.

b. Pedestrian Step-Over Gate Installation

- The pedestrian step-over gates will be incorporated in the fence line as step-over gates to prevent pigs and deer from getting into the fenced area.
- The frame of the gate will be constructed of 1-5/8 in. diameter galvanized schedule-40 pipe with galvanized livestock panels welded to the frame.
- The step-over gate frame shall be secured in the ground to a depth of 2 ft. with concrete, if necessary.
- Standard pedestrian step-over gate measurements and hardware (see Figure 9 & 10).
- Step-over gates will open outwards only and have a stopper to prevent the gate from swinging inwards.
- Gate must have a lockable latch.

c. Unexploded Ordnance (UXO) Avoidance

- The contractor will be responsible for determining where support posts are to be placed. Once placement for posts are determined, the exact spots for placement are to be marked/identified so the UXO Contractor can validate the post hole area is free of metal and cleared for digging.
- If the designated placement of the posts are not cleared for digging, than an area in close proximity will be identified for final placement of the posts.

Material Specifications

All metal used in construction of the fence shall be galvanized steel. The Contractor shall be responsible for furnishing certificates from manufacturers, suppliers, or others certifying that the materials being furnished under the contract complies with the requirements of these specifications.

- **Polypropylene deer mesh**: Heavy duty flat extruded polypropylene deer mesh at least 5 ft. height with a maximum strength of 890-950 lbs./sq. ft. + 150g/meter weight.
- **Welded livestock Panel**: 16 ft. x 50 in. galvanized livestock panels with Combo 14 Line wires at ¼ in. rod diameter (2 ¾-gauge rod), hot-dipped galvanized to provide a thick zinc coating over all welds. Horizontal rod spacing with graduated (6 - 2 in., 2 – 4 in., 5 – 6 in.) opening from the bottom of the panel to the top. Vertical panel rods at ¼ in. rod diameter (2 ¾-gauge rod) spaced at 8 in. apart (see Figure 11). If Combo 14 Line galvanized livestock panels (16 ft. x 50 in.) are not available, then Combo 13 Line galvanized livestock panels (16 ft. x 50 in.) can be used as an alternative with horizontal rod spacing (3 – 2 in., 2 – 3 in., 2 – 4 in., 5 – 6 in.; see Figure 11).
- **Studded T-Posts**: 9 ft., class three galvanized, studded T-post with and without spade.
- **9-gauge galvanized hog rings**: 9-gauge galvanized hog rings for securing livestock panels together.
- **12.5-gauge galvanized hog rings**: a) used to secure polypropylene deer mesh to galvanized 9-gauge top smooth wire, b) used to secure bottom of polypropylene deer mesh to galvanized livestock panel, and c) used to secure galvanized hog wire apron/skirt to galvanized livestock panels
- **Smooth wire**: 9-gauge bezinal coated smooth wire, Class 3 galvanized
- **Hog wire**: 32 in. hinge joint hog wire. Class 3 galvanized 12-1/2 gauge Hi-tensile stay/line wires. 9-gauge top/bottom wires. Horizontal spacing graduated from 3 in. at the bottom to 6-8 in. at the top. Vertical wires are spaced 6 in. apart (Figure 12 & 13).

- **Studded "dead-man"**: 1.5 ft. class three galvanized anchor with spade and hole.
- **Concrete nail stake**: galvanized stake ¾ in x 18 in.
- **Galvanized fence clips**: a) used to secure the polypropylene deer mesh to each T-post, and b) used to secure 9-gauge galvanized smooth wire to the tops of each galvanized T-post.
- **Galvanized vehicle gate**: 10 ft. wide by at least 7 ft. tall, frame constructed of 1-5/8 in diameter galvanized schedule-40 pipe with galvanized livestock panels welded to frame. Gate support posts: 4 in. diameter galvanized schedule-40 pipe.
- **Galvanized pedestrian step-over gate**: 4 ft. wide by at least 7 ft. tall step-over gate frame constructed of 1-5/8 in. diameter galvanized schedule-40 pipe with livestock panel weld to the frame bottom to a height of 3 ft., with swinging gate, 41-5/8 in. wide by 46 in. tall with welded livestock panel.

Figure 1. Livestock panels cut to fit topography and flexed to fit the terrain.

Figure 2. Fence livestock panels cut to fit topography with deer mesh secured to smooth wire with hog rings.

Figure 3. Fence livestock panels cut to fit topography.

PHOTO PENDING

Figure 4. 9-gauge galvanized smooth wire twist securing T-post and livestock panel(s).

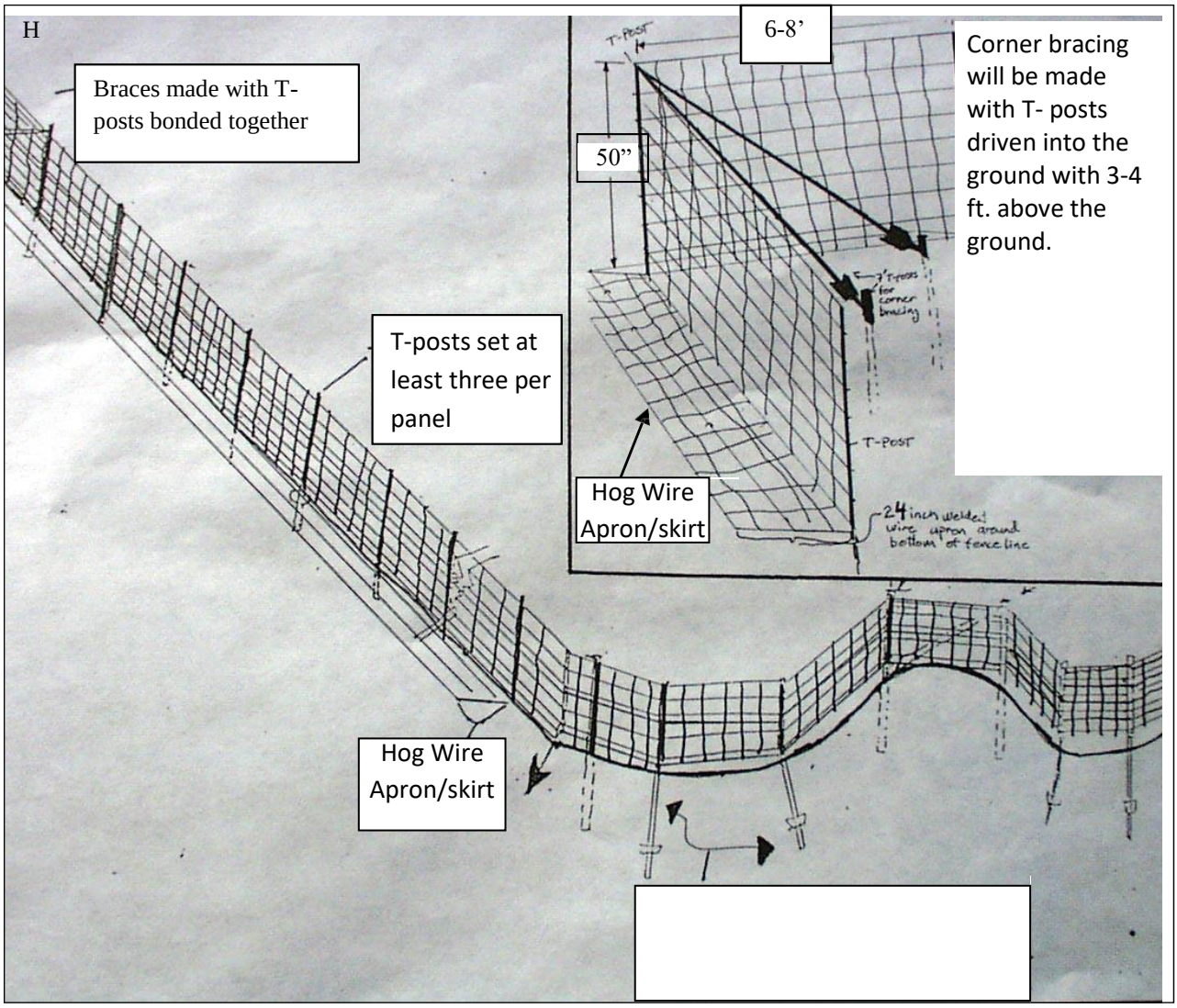
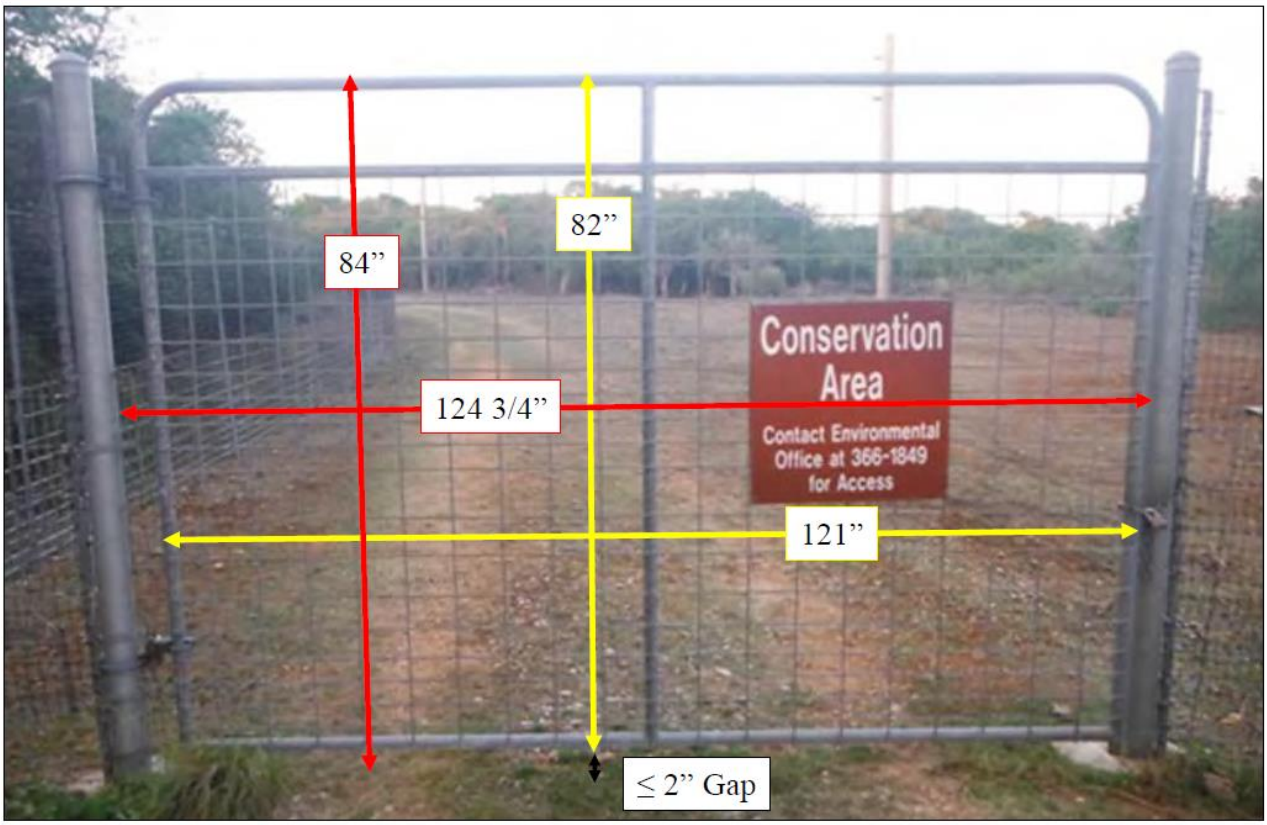


Figure 5. Schematic of fence design with corner bracing, post placement, and hog wire apron/skirt.

Figure 6. Example of how to corner brace from hand drawn schematic in Figure 1.

Figure 7. Securing of deer mesh to T-posts with three fence clips and shows how the smooth wire is secured to the top of the T-post with a fence clip.



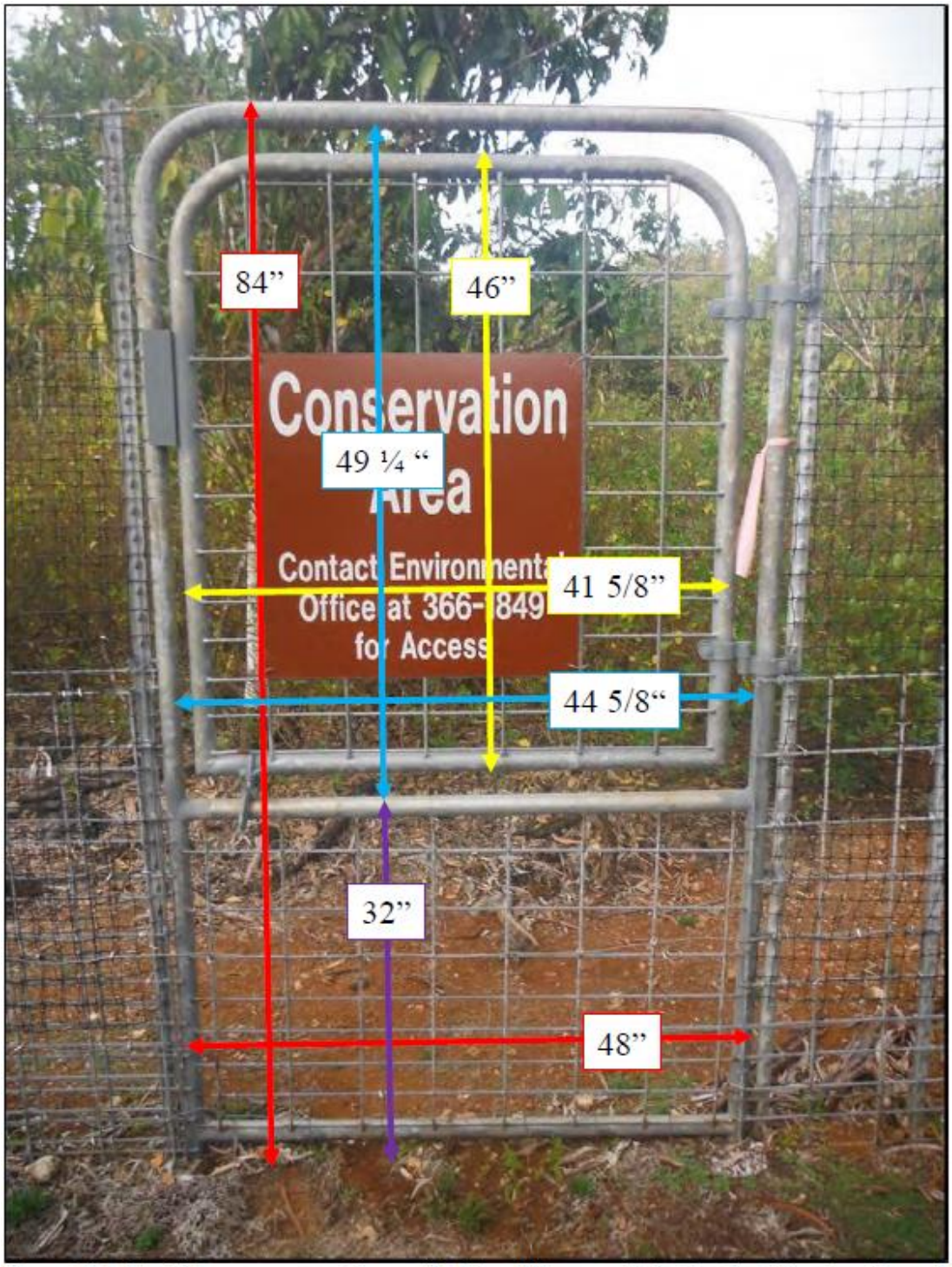
Overall Opening Height = 84” (Including 2” bottom gap)
Swinging Gate Height = 82”

Overall Opening Width = 124 3/4”
Swinging Gate Width = 121”

Galvanized Gate Tubing Pipe 1-5/8” diameter

Galvanized Gate Support Pipe Posts 4” diameter

Figure 8. Vehicle gate design with measurements.



Frame Height = 84” **Frame Width = 48”** **Swinging Gate Opening Above 32”**
Swinging Gate Weight = 46” **Swinging Gate Width = 41 5/8”**
Gate Opening Height = 49 ½” **Gate Opening Width = 44 5/8”**

Figure 9. Pedestrian step-over gate design with measurements

Figure 10. Pedestrian step-over gate hardware.

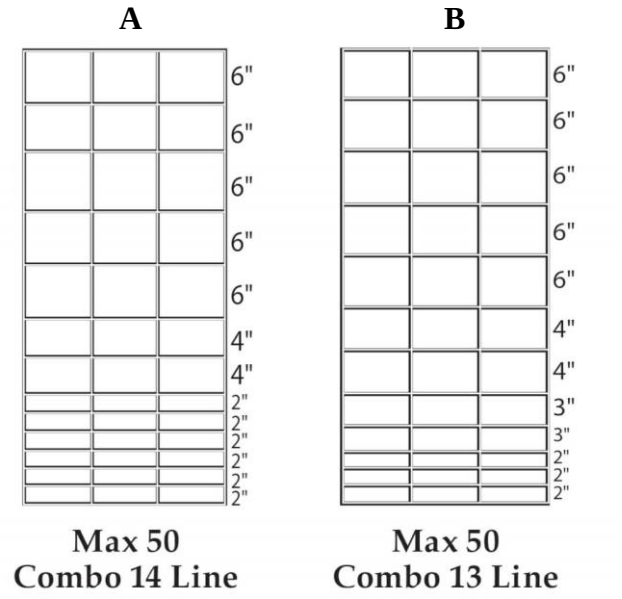


Figure 11. Welded livestock panel (hot-dipped galvanized) (A) Combo 14 Line panel 16 ft. x 50 in. ¼ in. rod diameter (2 ¾-guage rod) with graduating horizontal rod spacing from bottom to top (6 – 2 in., 2 – 4 in., 5 – 6 in.) and (B) Combo 13 Line panel 16 ft. x 50 in. ¼ in. rod diameter (2 ¾-gauge rod) with graduating horizontal rod spacing from bottom to top (3 – 2 in., 2 – 3 in., 2 – 4 in., 5 – 6 in.).

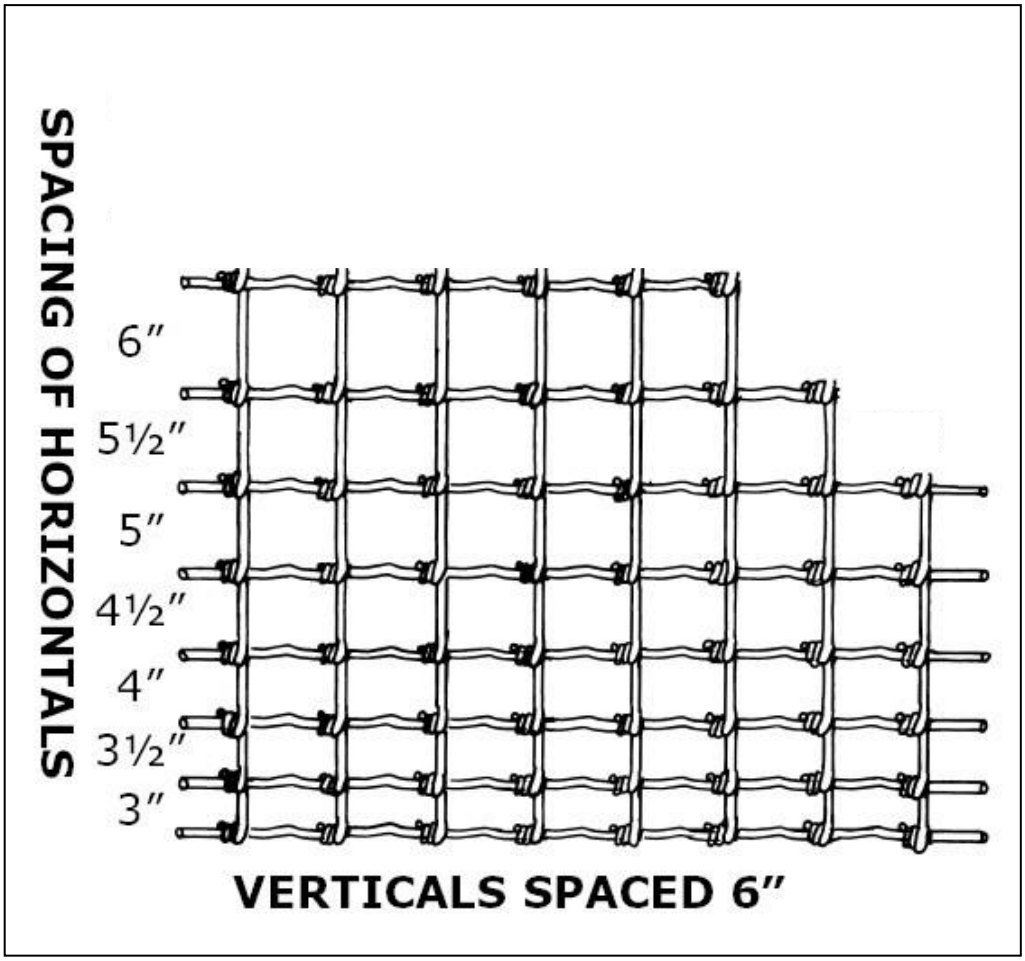


Figure 12. Hog wire: 32 in. hinge joint hog wire. Class 3 galvanized 12-1/2 gauge Hi-tensile stay/line wires. 9-gauge top/bottom wires. Horizontal spacing graduated from 3 in. at the bottom to 6-8 in. at the top. Vertical wires are spaced 6 in. apart.

Figure 13. 32-inch hinge joint hog wire skirting (Class 12.5-gauge Hi-tensile stay/line wires. 9-gauge top/bottom wires).

Hawai‘i Rare Plant Restoration Group
Phytosanitation Standards and Guidelines
December 2010

The objective of this document is to state the level of sanitation that will be required during *ex situ* operations, and the transition into natural habitats via reintroduction or augmentation projects. Sanitation is a key factor in reintroductions or augmentations by preventing the introduction of foreign organisms into the wild. Plants must be visibly weed-free, pest-free, and pathogen-free. All plants to be used for reintroduction or augmentation projects must be rigorously checked for compliance with the requirements described in the narrative below. If the plants do not meet the standards stated in the guidelines at the time of inspection, they should not be used. The infected plants must be treated so that all alien plant species, pests, and pathogens are eliminated before the plants can be reconsidered for reintroduction or augmentation projects. If any plant becomes infected with a virus that plant must be immediately removed from the growing area and destroyed. The surrounding plants should be monitored or tested (if available) for signs of virus infection as well.

The phytosanitation checklist outlines the range of threats that must be monitored and controlled in the nursery setting. Threats to be monitored and controlled are arthropods, alien plant species, mollusks, pathogens, small mammals, and other pests. These threats are major problems that affect the overall health of the plants and can cause possible contamination to the environment if transported into the wild. The table below summarizes the threats and suggested actions to eliminate these problems.

Summary of pests and diseases commonly found in *ex situ* propagation facilities. Prevention and monitoring procedures are identified below.

Prevention and Monitoring Planning & Procedures	Virus, Bacteria, Fungi	Nematodes	Arthropods	Mollusks	Weeds	Small Vertebrates
Nursery design			X	X	X	X
Plant media preparation and handling		X			X	
Plant and nursery sanitation	X	X		X	X	X
Pest and disease control program	X	X	X	X	X	X
Nursery and plant inspection	X	X	X	X	X	X
Threat monitoring and control	X	X	X	X	X	X

REQUIREMENTS

1. Nursery Facility/ Adjacent Growing Area

- The nursery and it's adjacent area must be kept free from alien plant species, any encroaching live roots from nearby trees or shrubs, and other foreign plant material. The floor shall be paved or covered with coarse gravel to ensure that no dirt areas are exposed. The walkways must be paved with concrete, black top, or gravel.
- A six foot buffer zone around any growing area or greenhouse building must be maintained and kept free from any vegetation to minimize insect pest and disease infestations.
- The plants should be grown in an enclosed area to prevent weed seeds from blowing into pots.
- Plants should be grown in sterilized or disinfected pots, containers, or beds or use new containers for each plant.
- Plants must be placed on disinfected benches or disinfected supports which are at least 18 inches above the ground or floor level.
- Plants and aerial roots should not be grown lower than 18 inches from the ground level to top of benches.
- Water hoses must be stored off the ground.
- No plants are to be placed over the propagative stock (hanging containers or secondary benches), nor under the benches to prevent contamination to plant material.

2. Media

- See Approved Growing Media Section for a list of approved growing medium that can be used singularly or in media mixes.
- Media should be new and sterilized or pasturized if they are not sold sterlized. Do not reuse plant media.
- All medium and media mixes must be stored in closed bins or containers.
- Care should be taken if inoculating with mycorrhiza to prevent the introduction of new mycorrhizal stains to areas where not previously known.
- Fungal pathogens must be treated even in mychorrhizal inoculated plants; reinoculation of the plants may be necessary before reintroduction.

3. General Sanitation

- The grower must sterilize/disinfect tools regularly, ideally before moving to a new batch of plants.
- The grower must keep all growing areas, benches, and work surfaces clean to minimize threats (*i.e.*, alien plant species, pathogens).
- Benches, plant boxes, used pots, flats, and implements must be washed free of soil and plant matter, and disinfected prior to use.
- All dead, diseased, or infected material in or around the pots should be appropriately disposed of on a daily basis.
- Dead, diseased, or decaying plant material should be pruned off with sterilized tools (and re-sterilized between cuts) to prevent further contamination (*i.e.*, flaming tools).
- Adequate spacing between plants is necessary in order to have good air circulation between and around the plants to minimize pest problems.
- Propagules must be free from threats (*i.e.*, pathogen). Use appropriate methods to clean plants (*i.e.*, bleach solution). Do not use any propagules that are infested with a virus.
- Plants and growing media should be sampled using methods approved by the Department of Agriculture.

4. Threat Control Program

*NOTE: The use of pesticides is governed by state and federal regulations. Ensure pesticide use is in compliance with the law and follow all label directions. If there are any questions, please contact the State of Hawaii, Department of Agriculture Pesticide Division for further information.

- Insure that pesticide applicator personnel are properly trained and outfitted.
- It should be noted that if restricted pesticides are used, the applicator must be a certified pesticide applicator or supervised by a certified applicator.
- The grower must have a monitoring and treatment program for each threat category.
- Maintain records of all monitoring and spraying schedules, plant species treated, threat/pest treated, last time sprayed, and chemicals and rate of application.
- See Threat Monitoring and Control Section for more information on specific threats.
    a) Monitor on a weekly basis for signs and symptoms of infestation.
    b) Identify the target pests.
    c) Monitor for pests presence and their levels of abundance.
    d) Familiarize yourself with seasonal infestation trends and pest life cycles.

e) Contact your local agriculture extension agent, CTAHR, DOA agent, or other experts for proper identification, up-to-date chemicals and current control practices.

5. Nursery and Plant Inspections

- The nursery facility and all plants will be subjected to inspection by the project lead as part of the approval process. Areas and plants not designated for project use will still be subjected to inspection, since it may still serve as possible sources of inoculum. Plants grown by contractors must be inspected and certified as pest-free at the nursery facility before acceptance; plants will be rejected until all pest or disease infestations are eradicated.
- Use traps and baits (*i.e.*, sticky traps, ant traps, and slug bait) to monitor the presence of threats. Check on a weekly basis.
- Project lead will inspect the nursery and outplanting sites for arthropods, mollusks, pathogens, and alien plant species.
- Project lead is responsible for coordinating the transfer of plants from nursery to the outplanting site. This is to reduce the amount of handling and to prevent the detainment of the plants in less than desirable holding areas, which would increase the chances of contamination and plant stress. This is especially the case for plants obtained from contracted nurseries.
- Sources of transportation (*i.e.* cars, trucks, vans) need to be free of pests, especially ants.
- All *ex situ* outplantings should be periodically monitored post-planting to detect any weed seedlings (or other pests) emerging from the root ball area of the plants.

6. If Plants Are Rejected

- If possible, remove and isolate the infected/infested plants from the uninfected plant inventory. Preferably, remove the infested plants from the facility.
- Immediately treat infected and surrounding plants with the appropriate control method to prevent further infestation.
- Check the surrounding plants and rest of the nursery plant inventory for signs of infection.
- Once the plants are treated and pests are no longer detected, they can be reconsidered for use in reintroduction or augmentation projects.
- Remove and destroy all plants and plant parts infected with a virus. Make sure that no part of the plant (*i.e.*, leaves) is remaining. Infected plant material is a source for potential contamination to the surrounding plants. Be sure to wash your hands after handling the plants and disinfect any tools that were used.

OUTPLANTING

- Clothes, gear, tools, *etc.*, should be clean and free from any foreign soil and plant material.
- Use on-site mulch if needed instead of bringing mulch in from an external source.
- See Hawaii Rare Plant Restoration Group (HRPRG) reintroduction guidelines.

Phytosanitation Checklist

This checklist must be followed by all growers and will be used to ensure compliance prior to the acceptance of any plant material.

Nursery Facility

- ☐ Follow sanitation requirements listed above
- ☐ Walkways covered with coarse gravel or paved with good drainage
- ☐ No plants over or under growing area
- ☐ Benches at least 18" above ground
- ☐ Water hoses stored off ground
- ☐ Adequate storage for media (enclosed on all sides)
- ☐ Approved DOA preparation and storage areas for pesticides
- ☐ Adequate facility for washing and disinfecting pots
- ☐ At minimum, weekly inspections by greenhouse staff

Equipment

- ☐ Use recommended growing media listed below
- ☐ Use sterilized tools and benches, new or disinfected pots and trays (if reused)
- ☐ Clean transportation vehicles to pick up and drop plants at other sites
- ☐ Conduct daily inspections to identify pest problems and initiate early pest control; provide proper equipment and training for staff. (*i.e.,* magnification loop)
- ☐ Adequate chemical application equipment and Personal Protective Equipment
- ☐ Maintain all equipment and protective gear in good working order

Chemical

- ☐ Compliance with State DOA regulation regarding use of all pesticides
- ☐ Completion of State Restricted Use Pesticide Applicator Certification if restricted chemicals are the only means of pest control
- ☐ Apply broad and narrow spectrum fungicides, herbicides, and insecticides for prevention and control as necessary.

- ☐ Conduct routine disinfection treatment (contact DOA for a list of approved chemicals) of all greenhouses, and to the adjacent areas as needed.
- ☐ Maintain an accurate pesticide and fertilizer spray history log.

Phytosanitation

- ☐ Clean benches when rotating crops at least every other month
- ☐ Optimize watering schedule (*i.e.*, not too wet or too dry)to minimize pest and disease problems.
- ☐ Water/irrigate in a manner to minimize splash-over into adjacent pots
- ☐ Remove dying/dead plants and any decomposing leaf or plant matter from benches
- ☐ Space plants on benches to allow for adequate air movement
- ☐ Inspect and clean propagules before planting

Threat Monitoring and Control

The following reference is a general summary provided to help the nursery grower identify threats, signs, and symptoms, and suggest methods for their control. For more information, contact your local agriculture extension agent, Department of Agriculture personnel, or the University of Hawaii Diagnostic Laboratory or Agricultural extension agent.

1. Arthropod Monitoring and Control

- Look for signs and symptoms.
- Identify the target pest.
- Monitor for presence of pests and their levels of abundance.
- Know their life cycle and seasonal fluctuations.
- Monitor on a weekly basis.
- Contact your local agriculture extension agent or DOA agent for proper identification, current control practices, and up-to-date chemicals to use.

a) **Ants**:

- DESCRIPTION: There are many types of ants that affect plants in the nursery as well as in the wild. They have six legs and have a chewing mouthpart. They can range in color and size. They live in colonies and the queen lays thousands of eggs in individual sacs.
- SIGNS AND SYMPTOMS: Ants are usually found on plants that have scale, mealy bug or any other insect that produces honeydew. The ants farm these insects for the honeydew they produce. They can be seen crawling all over the plant and/or pot. "Tunnels" built by ants that are made out of potting media from the pot can be found on the stems protecting insects that produce honeydew.
- CONTROL: There are two distinct types of ants to control. One type is sugar loving and the other prefers an oil-based food. Bait for ants at first sign of presence. If population increases, find and destroy the nest.

b) **Aphids**:

- DESCRIPTION: There are many types of aphids that attack plants; however, all of them are soft-bodied and have piercing sucking mouthparts. Their bodies are pear-shaped and can range in colors from yellow to green to black. Aphids secrete a sweet, sticky substance, which is called honeydew. Ants farm aphids for a constant source of honeydew, which is the ant's source of food. The females bear live young. Once they reproduce, aphids can have many generations a year.
- SIGNS AND SYMPTOMS: When aphids are present on the plant, pale yellow spots are visible on the foliage. Also, leaves may be curled, puckered or stunted. Presence of sticky honeydew is also a good indicator of aphids. Sooty mold may be visible growing on the honeydew. Check under leaves and at growing points for aphid infestation.
- CONTROL: If population numbers increase, spray insecticide as directed on the chemical label. Just a note: aphids are usually attracted to plants over-fertilized with nitrogen.

c) **Beetles**:

- DESCRIPTION: Beetles range in size, shape and color; however all have hard bodies and wings (Ball and Ball 1990). They have chewing mouthparts.
- SIGNS AND SYMPTOMS: Check for chewed up plant parts such as leaves and flowers. If left unattended, the beetle can totally denude the plant.
- CONTROL: Manually pick beetles from the plant by hand. Remove leaf litter or other possible beetle and beetle larvae habitat around the plant.

d) **Black Twig Borer**:
- DESCRIPTION: Adult females are twice a big as the males at about 1/16 inch long and are shiny black in color. The males are reddish-brown in color and can't fly. The entire life cycle can take about a month to complete (Tenbrink and Hara 1994). They have chewing mouthparts.
- SIGNS AND SYMPTOMS: Stems become weakened and breakage often occurs. Look for small round holes. The twig borers will create holes in the branches and create a living area. Die back of the plant is not caused by the borers feeding on the plant. Instead, it is caused by the physical infestation and the introduction of pathogens (Tenbrink and Hara 1994).
- CONTROL: Remove and destroy infested parts. There may be some biological control insects, but more information is needed. Not too much is known about control methods.

e) **(True) Bugs**:
- DESCRIPTION: True bugs range in body shape, size and color. Typically, the body is shield shaped and about 1/6-1/2 in long (Ball and Ball 1990). When smashed, they often exude a distinct odor. They have piercing-sucking mouthparts.
- SIGNS AND SYMPTOMS: The infested plant may have disfigured growth such as discolored spots, stunted growth, or wilted shoot tips (Ball and Ball 1990).
- CONTROL: If infestation is low, hand pick the insects. Clean the area surrounding the plant of leaf litter to decrease suitable habitat.

f) **Cutworms**:
- DESCRIPTION: Cutworms are soft-bodied caterpillars that are dull gray or brown in color, and are 1 to 2 inches in length. They are nocturnal feeders that find refuge in the soil or leaf litter during the day. As adults, they change into moths. The females lay the eggs in the soil, and they can produce an average of 5 generations a year. (Ball and Ball 1990).
- SIGNS AND SYPTOMS: If seedlings are mowed down or chomped down near the soil line, that's a good indicator of cutworm damage. Some cutworms also attack the seedlings from below the soil line, damaging the roots and causing the plants to wilt. (Ball and Ball 1990). Damage look similar to mollusk damage or rodent damage.
- CONTROL: Put up biological, chemical or physical barriers around the seedlings to deter the cutworms. There may be some beneficial biological control.

g) **Leafhoppers**:
- DESCRIPTION: Leafhoppers have wedge-shaped bodies that are 1/8-1/4in long. They have a hunched look to them since their folded wings are slightly protruding from their bodies. (Ball and Ball 1990, Kessing and Mau 1993a). They range in

colors from green, brown or yellow. They are not very active, however, when disturbed, they can jump suddenly or move sideways with agility. They have piercing-sucking mouthparts and can spread virus (Ball and Ball 1990).

- SIGNS AND SYMPTOMS: They feed on all part of the plant (except the roots). As they feed, toxins are released into the plant causing yellowing or discoloration. Leaves will turn yellow and fall off. Leafhoppers excrete honeydew, so ants and sooty mold may be present. (Ball and Ball 1990)
- CONTROL: There may be some beneficial biological control (*e.g.* mymarid wasp) (Kessing and Mau 1993b). Keep area around plants clear of leaf litter and alien plant species.

h) Mealy bugs:

- DESCRIPTION: Mealy bugs have piercing-sucking mouthparts, and can attack either the foliage or the root system, depending on the species. They are mobile throughout their lifecycle. Depending of the species, males are relatively short-lived, living an average of 27 days, while the females can live around 115 days (Martin and Mau 1992). Their bodies are covered with a white waxy substance that gives it a "mealy" look (Tenbrink and Hara 1993).
- SIGNS AND SYMPTOMS: Leaves will look droopy and the areas they feed on will be yellow and discolored. They excrete honeydew, which can cover portions of the plant. Look for sooty mold, which grows on honeydew. If ants are present, that's a good indicator that mealy bugs are there. They can be vectors of pathogens.
- CONTROL: There may be some beneficial biological control (*e.g*., parasitic wasps). Mixing white oil with the chemical will aid in smothering the scale.

i) Scale insects:

- DESCRIPTION: Scales are related to mealy bugs and aphids, and have bodies that range from 1/12 inch to 1/5 inch (Ball and Ball 1990). Most scales are only mobile during the first stage of their lifecycle. Usually, after their first instar, the female scales become immobile attaching themselves to the plant and form a protective coat. This protective coat can vary from cottony white masses to waxy shells. Males, if present, are not able to feed since they don't have mouthparts. The females either lay eggs or bear live young under the protective scale (Mau and Kessing 1992). Several generations can be produced per year. (Ball and Ball 1990)
- SIGNS AND SYMPTOMS: Areas where they are feeding on will turn yellow and may drop. They excrete honeydew can cover portions of the plant. Look for sooty mold, which grows on honeydew. If ants are present, that's a good indicator that scales are there. They can be vectors of pathogens.
- CONTROL: There may be some beneficial biological control (*e.g*., parasitic wasps). Spraying the scale during their mobile stage is the most effective chemical practice. The dead scales are persistent on the plant, so check the scale population prior to spraying (it may just be dead scale shells). Just a note: Over use of nitrogen fertilizer can encourage growth of scale attracted to succulent new growth.

j) Spider mites:

- DESCRIPTION: Spider mites are extremely tiny. Adult females, which are larger than the males, are not any bigger than 1/20 inch (UCDANR 1995). They have

piercing-sucking mouthparts that they use to feed on the underside of leaves and flowers. As they feed, toxins are injected into the plant that result in distorted growth and discoloration of the plant. New generations can be produced as quickly as 2 weeks if the conditions are right (Ball and Ball 1990).

- SIGNS AND SYMPTOMS: Check the underside of leaves and on flowers for webbing and tiny excrement pellets as this will indicate the presence of spider mites. Also, if the foliage begins to turn yellow and develop a dry, sandpapery texture, or become distorted in growth that is a good indicator of spider mites. To check whether the spider mites are still on the plant, use a hand lens and examine the underside of leaves. Tap the branch tip or leaves while holding a white paper underneath to catch the spider mites. (Ball and Ball 1990, UCDANR 1995)
- CONTROL: There may be some beneficial biological control (*e.g.*, parasitic mites and ladybird beetles). Spider mites thrive in hot, dry, dusty conditions. The warmer the conditions, the faster they reproduce. Make sure the plants have adequate water because when plants are water-stressed, they are more susceptible to spider mite damage. Be aware that some chemicals such as carbaryl and pyrethroids can actually increase spider mite production (UCDANR 1995).

k) **Thrips:**

- DESCRIPTION: The adult thrips are winged and are less than 1/25 inch long. They are shiny and usually black or yellow in color and have a rasping mouthpart. Thrips can produce approximately 8 generations per year. They thrive in dry environments so make sure the plants are adequately misted and watered (Ball and Ball 1990).
- SIGNS AND SYMPTOMS: Check the new growing tips or buds for thrips. If the leaves are curled, or if tiny, black excrement on the leaves is visible, that's good indicator that thrips are present. Also, if there is dried tissue on the leaves, or discoloration or disfiguration of the leaves or flowers, that can be another indication of thrips (Ball and Ball 1990 UCDANR 1996).
- CONTROL: There may be some beneficial biological control (*e.g.*, predatory mites). Prune affected flowers and foliage, and dispose of properly. Use sticky traps to monitor. Keep plants adequately watered, and do not let it become water-stressed (Ball and Ball 1990, UCDANR 1996).

l) **Whitefly**:

- DESCRIPTION: Whiteflies are white, tiny moth-like four-winged insects with piercing-sucking mouthparts. The immature whiteflies resemble aphids, however they are legless and not very mobile once they start feeding (Ball and Ball 1990, Flint and Parrella 1995). They produce many generations per year, sometimes one generation in less than three weeks depending on the temperature. They thrive in warmer climates (Flint and Parrella 1995).
- SIGNS AND SYMPTOMS: Check the underside of the leaves for whiteflies. If present, the leaves will prematurely turn yellow and then fall off. The plant growth will also be stunted. Whiteflies produce honeydew, so check for presence of sooty mold or ants.
- CONTROL: There may be some beneficial biological control (*e.g.*, parasitic wasp). Use sticky traps to monitor the whitefly population on a weekly basis in conjunction with a weekly foliage inspection (Flint 1995). Horticultural soaps and other

insecticides can be effective in controlling the population. "Try to time treatments when your monitoring results indicate that most of the population is in the first, second, or third instar stage" (Flint 1995). When spraying, make sure there is good coverage of insecticides to the underside of the leaves.

2. Weed Monitoring and Control

- Any plant (alien or native) in the pot other than the designated plant is considered a weed.
- Monitor on a weekly basis.
- Install weed mat in and around the growing area.
- Have a buffer area around the growing area/nursery of at least 6 feet.
- Enclose growing area to prevent weed seeds from blowing in to pots.
- Pull alien plant species from pots and growing area as they come up. Do not let them go to seed.
- If weed problem gets out of hand, apply herbicide.
- Contact your local agriculture extension agent or DOA agent for proper identification, up-to-date chemicals and current control practices.

3. Mollusk Monitoring and Control

- Look for signs and symptoms.
- Identify the target pests.
- Monitor for pests presence and their levels of abundance.
- Know their life cycle
- Monitor on a daily basis, usually early morning is best.
- Contact your local agriculture extension agent or DOA agent for proper identification, up-to-date chemicals and current control practices.

a) Slug

- DESCRIPTION: Slugs are terrestrial mollusks that do not have shells. They have slimy bodies, are usually 1 to 2 inches (some can even reach 8 inches) long and travel on a foot that leaves a trail of slime behind. The colors range from white, yellow to black. They have a rasping mouthpiece. The eggs are in translucent-white, individual sacs, which form a cluster, and are usually found in dark, cool, moist areas or underground. Slugs can produce about 6 generations per year and take about a year to mature. (Deputy and Murakami 2000).
- SIGNS AND SYMPTOMS: Look for the slime trail, which is usually silver in color. Damage to the plant, such as large ragged holes in leaves, flowers, and stems, is done by the slug. They can quickly defoliate the plant if not controlled. Check the undersides of pots and in drainage hole of the pot to see if they are present. .
- CONTROL: Keep area around plant and in pot clear of leaf litter. Manually dispose of any slugs in growing area. Set up traps to lure slugs and then dispose of them. Set up a physical or chemical barrier to deter slugs. Use baits to kill slugs (Deputy and Murakami 2000).

b) Snails

- DESCRIPTION: Snails are soft-bodied mollusks that are protected in a shell. They can range in color from cream, pink to gray. The markings on the shell vary from species to species. They can be found in moist, dark areas, usually coming out at night to feed with their rasping mouthpiece (Ball and Ball 1990). They produce about

80 eggs at a time, and can lay eggs up to 6 times a year. The eggs are rounded and white in color, and can be found in the upper layer of the soil. The snails mature in two years (Deputy and Murakami 2000).

- SIGNS AND SYMPTOMS: Look for the slime trail, which is usually silver in color. Damage to the plant, such as large ragged holes in leaves, flowers, and stems, is done by the snail. They can quickly defoliate the plant if not controlled. Check the undersides of pots to see if they are present (Ball and Ball 1990).
- CONTROL: Keep area around plant and in pot clear of leaf litter. Manually dispose of any snails in growing area. Set up traps to lure snails and then dispose of them. Set up a physical or chemical barrier to deter snails. Use baits to kill snails (Deputy and Murakami 2000).

4. Pathogen Monitoring and Control

- Look for signs and symptoms.
- Identify the pathogen.
- Know their life cycle.
- Monitor on a daily basis.
- Contact your local agriculture extension agent or DOA agent for proper identification, up-to-date chemicals and current control practices.

a) Bacterial disease

- SIGNS AND SYMPTOMS: Infected plants often have rotted leaves, stems, branches, or tubers, which have a foul odor. When cutting into an infected area, a small amount of whitish or yellowish ooze will seep out. Other symptoms include wilted leaves or stems, or odd shaped galls on the stem or on the roots near the soil line. Symptoms can spread quite quickly by splashing water (such as irrigation or rain) or by infected soil. They can enter a plant either through wounds or through the stomata (Ball and Ball 1990).
- CONTROL: Besides chemical control methods, also remove all infected plants, and wash hands and sterilize tools after handling infected plants. Provide ample spacing between plants to encourage good air circulation. Clean up and remove diseased plant parts and dispose of them by placing in plastic bag or sealed container right away.

b) Fungal diseases

- SIGNS AND SYMPTOMS: Look for rust-colored or powdery-white looking spots on either side of leaves. These spots will eventually make the leaf chlorotic and will eventually kill the leaf tissue. Also, look out for water soaked spots, greasy looking areas, or black streaks or blotches on the leaves or stems (Ball and Ball 1990).
- CONTROL: Besides using fungicide control methods, remove affected areas and dispose of in a plastic bag or a sealed container. Be sure to wash hands and sterilize tools after handling infected plants. Provide ample spacing between plants to encourage good air circulation (Ball and Ball 1990).

c) Viral Diseases

- DESCRIPTION: "Viruses are basically parasites, multiplying inside their hosts or if no host is available, lying inactive but viable in dead plant material for up to 50 years while waiting for a new victim" (Ball and Ball 1990).
- SIGNS AND SYMPTOMS: Be aware of plants that have poor overall growth (like stunted leaves, and flowers). There may be yellowish mottling patterns on the leaves, stems or blossoms that make the plant look sickly (Ball and Ball 1990).
- CONTROL: Viruses are generally spread by insects with piercing-sucking mouthparts such as aphids and leafhoppers. Garden tools and humans are other vectors of viruses. Do not take cuttings from infected plants as the cuttings will also have the virus. Remove and destroy (not in the compost pile) the infected plants, and wash hands and sterilize tools after use (Ball and Ball 1990).

5. Small Mammals and other pest monitoring and control

- Look for signs and symptoms.
- Identify the target pests.
- Monitor for pests presence and their levels of abundance.
- Know their life cycle
- Monitor on a daily basis.
- Contact your local agriculture extension agent or DOA agent for up-to-date chemicals and current control practices.

a) Rats/Mice

- SIGNS AND SYMPTOMS: Look for seedlings and/or seeds dug up, uprooted and eaten, droppings and tracks.
- CONTROL: Traditional mousetrap and bait. Use good sanitation practices by cleaning up all possible food sources, using rodent-proof containers of metal or glass, and removing tall grass, alien plant species and shrubby growth.

b) Birds

- SIGNS AND SYMPTOMS: Young seedlings and/or buds may be nipped off. Look for droppings and feathers.
- CONTROL: Barriers and deterrents like metallic ribbon and owl figures.

c) Toads and Frogs

- SIGNS AND SYMPTOMS: Look for evidence of nestling in pots such as vegetation in pots that are smashed or pushed to the side of the pot. Toads and frogs are potential carrier of nematodes.
- CONTROL: Do not have standing water anywhere that would make it favorable to toads or frogs. Remove or kill any individuals.

Approved Growing Media

Material should be packaged, not purchased in bulk, to lower likelihood of contamination.

1) Peat
2) Bark

3) Bark charcoal
4) Perlite
5) Vermiculite
6) Rock wool
7) Pumice
8) Volcanic cinder - sterilized
9) Coir - low in salt levels
10) Crushed blue rock - sterilized
11) Sphagnun – not to be used for air-layering in wet forest to avoid introduction of new species. Sphagnum may not be dead.

Note: Compost is NOT allowed in the growing media at any time. It can carry pathogens, weed seeds/spores, other pests, and is not a uniform medium.

Coconut Rhinoceros Beetle (CRB) and Little Fire Ant (LFA) Management Procedures (Ver4. Revised 08.02.2021)

BACKGROUND

Green waste has the potential to harbor and spread invasive species around Guam and increases the potential of dispersing invasive species to other islands within Guam's transportation network. The green waste management procedures identified below are an important step in regional biosecurity.

Little Fire Ant

Little Fire Ant (*Wasmannia auropunctata)* (LFA), originally from Central and South America, has spread throughout tropical regions over the last 100 years and was discovered in Guam in 2011. Since its discovery in northern Guam, LFA has been confirmed in at least 28 additional locations all over Guam. LFA disperse slowly on their own but can be spread rapidly by people who inadvertently move them on yard waste, recycled goods or garbage. LFA have multiple queens that mate within or near the parent colony, where fertilized queens spread on foot nearby with a few workers. These new nests remain connected with the parent colony where food gathering and defenses are shared, resulting in large "supercolonies." LFA nest in the ground up to the canopy. These supercolonies are constantly producing new queens and workers, so colonies can remain viable even after the loss of some workers or queens. LFA will prey on insects, invertebrates, small vertebrates, will attack larger wildlife, cause blindness in pets and painful stings to people. Implementing early detection surveys as part of green waste management during projects that involve vegetation clearing or landscaping will reduce and minimize the occurrence and potential ecological, economic, safety and health risks associated with LFA.

Coconut Rhinoceros Beetle

The coconut rhinoceros beetle (CRB) is a pest of palm trees, including: coconut, betel nut, and pandanus. It is also known to attack banana, taro, pineapple, sugar cane and other plants. The adults damage palms by boring into the center of the crown and feeding on the sap and developing leaves, creating V-shaped cuts in the fronds. The boring into the palms is often lethal. Immature stages (eggs, grubs, pupae) are found in dead coconuts and piles of rotting vegetation. Most recent research (Moore *et.al*, 2015) found CRB at all life stages in the crowns of selected palms. Although CRB are established on Guam island-wide, a multi-faceted control effort on Guam and emphasis on preventing CRB from invading neighboring islands and Hawaii is a high priority. Therefore, limiting the breeding sites is critical during green waste management.

GENERAL REQUIREMENTS

The Contractor shall notify the Construction Management Engineer (CME) and installation Biosecurity Program Manager/ Government Biomonitor *at least two weeks prior to* scheduled vegetation removal. No vegetation removal/clearing will be conducted without prior Government approval.

1) The Contractor's Hazard Analysis and Critical Control Point (HACCP) Plan will include CRB and LFA Management Procedures.
2) The Contractor will maintain a clean work site that is subject to review and inspection by the Government Biological Monitor. Vegetation debris left on site that is not mulched or properly managed could facilitate infestations of CRB, LFA, or other species.
3) **No green waste from outside Department of Defense property is allowed to be processed in conjunction with the green waste generated by** construction projects.

SPECIFIC REQUIREMENTS

LFA Procedures:

Step 1. Vegetated areas that will be cleared and mulch stockpile surveys

The following methods shall be applied to this step:

a. The Contractor shall survey (test) green waste stockpiles for LFA at least twice before final disposition within the project footprint. LFA survey options are as follows:
    i. Survey 1: LFA survey shall be conducted prior to vegetation clearing in high risk areas. High risk areas include vegetation adjacent to known LFA infestations. The Government is responsible for notifying the Contractor of these high risk areas. The Contractor shall notify the Government Biomonitor and Biosecurity Program Manager if positive test results are observed prior to proceeding with any vegetation clearing within these areas.
        1. Green waste and solid waste from known LFA infested areas will be processed separately at a Government approved site. Equipment used to handle material will be washed down at a designated temporary HACCP wash down station prior to exiting the known LFA area.
        2. Proceed directly to Step 2.
    ii. Survey 2: LFA survey shall be conducted 30-45 days following processing of green waste to mulch at the designated Green Waste Processing Area (GWPA). (In accordance with Step1, a., iii., a.)
    iii. Survey 3: LFA survey shall be conducted no more than two weeks prior to final disposition of processed green waste, such as: mulch or cured compost (LFA Fact Sheet 7 Little Fire Ants and Mulch, https://littlefireants.com/wp-content/uploads/07-LFA-Fact-Sheet_v7.2_Jul-2017-min.pdf).
        a) The Contractor shall survey around the edge of the stockpile by taking bait lures (chopsticks or 60cc vials (Biolab or similar) and smearing them with a very thin layer of peanut butter on half the stick or inside the vial), and place them around the pile every 10 feet. LFA prefer cool shaded areas, ensure the sticks or vials are covered by old leaves, piece of cardboard, etc. Surveys shall be conducted in the early morning or late afternoon to avoid the higher temperatures of mid-day. Leave the bait lures in place for at least 30 minutes, but no longer than one hour before picking up to examine. If LFA are in the mulch pile they will be present on the bait lure. LFA are very small, less than 3mm or 1/8th inch long, uniformly orange color and are slow in movement. (How to identify LFA, https://littlefireants.com/wp-content/uploads/How-to-Identify-LFA-Field-and-Microscope-Guide_18May20.pdf).
        b) If an LFA survey is suspected to be positive the Contractor shall bring the suspected specimen to the University of Guam (UOG) Extension Service for positive identification.
        c) The Contractor shall notify the Government Biomonitor and Biosecurity Program Manager when turning in a specimen to the UOG Extension Service for identification.
        d) If UOG Extension Service positively identifies the LFA specimen, then the Contractor shall notify Government Biomonitor and Biosecurity Program Manager immediately.
        e) Step 2 below shall be applied within 24 hours of positive identification.
        f) The Contractor shall provide all green waste LFA survey results monthly to Government Biomonitor.

Step 2. Quarantine and treatment of LFA positive stockpiles

The following methods shall be applied to this step:

a. Quarantine green/solid waste stockpile.

   i. The green/solid waste shall be left in place and low-hanging vegetation that is within the 3m isolation buffer around the LFA positive stockpile shall be cut and added to the pile to ensure no further spread occurs to surrounding areas, unless low hanging vegetation and buffer is outside of the project footprint. Cutting vegetation outside of the project footprint is not authorized. Government Biomonitor shall be contacted to address alternative options in the case of conflicting circumstances.
   ii. Allow the greatest amount of sunlight exposure to stockpile (i.e. remove any obstructions, overhead or adjacent to the stockpile for maximum sun exposure).
   iii. Place high visibility rope/flagging around LFA positive stockpile including a 3m isolation buffer with signs that warn personnel on site of LFA presence and treatment.
   iv. Provide GPS location and stockpile size to the Government Biomonitor and Biosecurity Program Manager.
   v. No additional vegetation shall be added to the stockpile that is not within the 3m isolation buffer.
   vi. Provide specific HACCP training to workers managing the quarantine stockpile.
   vii. Immediately apply, according to label instructions, a barrier pesticide around the outside of the isolated green/solid waste pile to prevent spread to areas beyond the pile.

b. Treatment of Stockpile
   i. Treatment of stockpiles are to include procedures outlined in the Hawai'i Ant Lab website (LFA Fact Sheet 7, https://littlefireants.com/wp-content/uploads/07-LFA-Fact-Sheet_v7.2_Jul-2017-min.pdf). Bait applications will be applied over and around the pile at least 4 times at 4-6 week intervals.
   ii. The Contractor shall report all chemical usage on the NAVFAC Online Pesticide Reporting System (NOPRS) and shall follow all EPA labeling requirements/instructions. The Contractor shall be in possession of all permits and/or certifications necessary to conduct the activities stipulated for eradication of LFA.
   iii. Treatment plans shall be submitted to the Government no later than two weeks after positive identification of LFA.
   iv. Once the treatment period is complete, the Contractor shall survey the whole mulch pile again, as described above (In accordance with Step1,a.,iii.,a.) to ensure LFA have been eradicated. Treatment of stockpile (Step 2, b.) will be repeated if a positive test result is observed during this step.
   v. Green waste processing of the stockpile may resume once LFA surveys yield negative results and approval is given by Biosecurity Program Manager and/or Government Biomonitor.

CRB Procedures:

Non-CRB host plants are approved for Methods 1, 2 and 3. For CRB host plants (coconut palms, betel nut, and pandanus) only Methods 2 and 3 are applicable. The Intermediate Method, as described below, will be applied to processed green waste piles and prior to application of Methods 1-3. The Contractor shall determine the appropriate method based on the amount of green waste and submit their processing method to AAFB -EV for approval as part of the Site-Specific Waste Management Plan. The approved

implementation method will also be included in the Hazard Analysis & Critical Control Point (HACCP) Plan. If the method selected is not effective in preventing the establishment of CRB breeding sites (i.e. grubs are found in processed material not protected by Intermediate Method) the Contractor shall work with AAFB -EV to determine a more successful approach and revise their HACCP Plan.

Method 1- Mulch and Spread: **This method is only approved for non-CRB host plant vegetation after the green waste has been processed into mulch.**

The following procedures shall be applied to this method:

a. Mulch the green waste and spread on-site, with a depth of no greater than two inches to avoid creating breeding habitat for CRB.
b. Incorporate the mulch into existing soil as soon as possible to discourage beetle breeding and to aid in site stabilization (to control stormwater runoff).
c. The final spread of mulch shall only be used within the project footprint where no further earth moving activities will disrupt the mulch and soil mixture.

Method 2 - Compost: **This method does not require separating CRB host plants from other vegetation.**

The following procedures shall be applied to this method:

a. Mulch the green waste material and compost.
b. To minimize the risk of fire, stockpile height should not exceed 15 feet.
c. The Contractor shall monitor the compost pile weekly for evidence of CRB infestation (CRB count) and the temperature shall be measured and recorded using a compost thermometer.
d. If the compost pile appears dry, add water until the pile is moist. Optimal composting temperature is between 120-140 degrees F with 50-55% moisture.
e. When temperature of the compost pile exceeds 145 degrees F, the Contractor shall turn the pile using a bulldozer, backhoe, or similar equipment to maintain the optimal compositing conditions.
f. All CRB (grubs and adults) found in pile shall be recorded, killed and removed from netting of the pile.
g. Intermediate Method described below shall be used if compost is infested with grubs until such time that the material can be processed through a grinder/shredder to destroy the grubs and inspected by the Government Biomonitor prior to resuming compost activities.
h. The Contractor shall provide following records monthly to the Government Biomonitor.
    i. Temperature
    ii. Moisture level
    iii. Number of times the pile was turned, and date turned
    iv. Number of CRB observed and life-stage found in pile.

Method 3: Air curtain burners

The following procedures shall be applied to this method:

a. Air curtain burners require the Contracting Officer's approval and coordination with AAFB -EV prior to implementation.
b. This method shall be used sparingly as regulatory agencies are expected to limit usage to emergency situations for the processing of small volumes only.
c. The Contractor is responsible for obtaining all permits and licenses to operate an air curtain burner.

Intermediate Method – Tekken Net: This method shall be used within 30 days when Contractor does not actively apply Methods 1, 2 or 3 to process green waste (mulch).

The following methods shall be applied to this method:

a. Cover mulch green waste piles with a gill/fishnet, called tekken in Chamorro. Tekken net shall be a one-inch mesh measured knot to knot made from 0.25 mm nylon monofilament and laid over piles of green waste.
b. To minimize the risk of fire, stockpile height should not exceed 15 feet.
c. The green waste piles must be completely covered by the net without any holes or gaps greater than one inch to be effective. Green waste piles are attractive to CRB; they will be trapped in the net if they are trying to get into or emerging out from the green waste pile.
d. The tekken net shall be inspected weekly to ensure there are no holes or gaps in the netting and the net should be clear of weeds and other vegetation to allow for CRB observations. The netting should completely cover all processed mulch at the base of the mulch stockpile.
e. All observed CRB caught in the net shall be removed, killed and recorded by the Contractor.
f. The Contractor shall provide weekly records of tekken net maintenance and CRB observations to the Government Biomonitor monthly.

PERFORMANCE STANDARD

All vegetation/green waste material is processed by the Contractor in accordance with procedures outlined above to prevent the spread of LFA and the creation of CRB breeding sites on all projects.

THIS PAGE INTENTIONALLY LEFT BLANK

LOW IMPACT DEVELOPMENT DATA ePROJECTS WON: 1665555

DESIGN STAGE

UFC 3-210-10 (DoD Policy for EISA Section 438)

Footprint: 6,054,840 SF

FC 1-300-09N (Navy LID Policy)

LID Implemented: ■ Yes ☐ No

Applies to both UFC 3-210-10 (DoD Policy for EISA Section 438) and FC 1-300-09N (Navy LID Policy)

Location of LID features: ☐ On Site ☐ Off Site ☐ Both

LID Features: select all that apply

☐ Bioretention	☐ Cisterns	☐ Dry Wells	■ Grass Buffers	■ Grass Swales
☐ Infiltration Trenches	☐ Permeable Pavers	☐ Porous Concrete	☐ Rain Barrels	☐ Rain Gardens
☐ Re-vegetation	☐ Roof Leader Disconnection	☐ Soil Amendments	☐ Tree Boxes	☐ Tree Preservation

☐ Impervious Area Reduction (Square Feet) _____

■ Other Stormwater pretreatment

■ Other Stormwater retention

☐ Other _____

Percent Change in Runoff Volume (Increase or Decrease): 100 % **if increase, indicate technical constraints**

Technical Constraints: select all that apply

☐ Non-potable water demand (for irrigation, toilets, washwater, etc) is too small to warrant water harvesting and reuse systems
☐ Retaining storm water onsite would adversely impact receiving water flows
☐ Site has shallow bedrock, ☐ contaminated soils, ☐ high groundwater, ☐ underground facilities or utilities
☐ Site is too small to infiltrate significant volume
☐ Soil infiltration capacity is limited
☐ State of local requirements restrict the use of green infrastructure / LID
☐ Structural, plumbing, or other modifications to existing buildings to manage storm water infeasible
☐ Other (explain): _____

LID Notes:

Stormwater from the proposed development will be collected and pretreated to meet CNMI requirements (sheet CG 117, 118) then stored in an infiltration basin (sheet CG 123,124) prior to discharge directly to the groundwater aquifer. Duration of storage in the basin is estimated to be less than 12 hours. The ponds are designed to collect and convey 100% of the 25-year event (i.e., 96% probability storm) into the aquifer, and there will be no discharge to surface waters.

NAVFAC LOW IMPACT DEVELOPMENT (LID) Verification Report

DESIGN

eProjects WON: 1665555

Designer of Record: Indicate the LID features listed below that require Contractor post construction analysis.

LID Features: **select all that apply**	**Shown on Sheet:**
☐ Bioretention	
☐ Cisterns	
☐ Dry Wells	
☒ Grass Buffers	CG106 to CG119
☒ Grass Swales	CG106 to CG119
☐ Tree Preservation	
☐ Infiltration Trenches	
☐ Permeable Pavers	
☐ Porous Concrete	
☐ Rain Barrels	
☐ Rain Gardens	
☐ Re-vegetation	
☐ Roof Leader Disconnection	
☐ Tree Box Filters	
☐ Tree Preservation	
☒ Other Stormwater pretreatment	CG117, 118
☒ Other Stormwater retention storage	CG117, 118, 123, 124
☐ Other	

CONSTRUCTION

☐ I certify that the LID features indicated above were constructed in accordance with the plans and specifications and that there have been no deviations.

☐ I certify that as-built drawings have been submitted in accordance with UFGS 01 78 00 Closeout Submittals for the following deviations.

(Explain deviations here):

Contractor (Print Name): _____

Contractor (Signature): _____ Date: _____

SECTION 01 57 19.03 21

SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS
SECRETARY OF THE NAVY (SECNAV) EXPLOSIVE SAFETY RISK ACCEPTANCE WITHIN JOINT REGION MARIANAS
07/25

PART 1 GENERAL

1.1 SUMMARY

This construction contract is exempt from explosive safety requirements in Department of Defense Explosive Safety Regulation (DESR 6055.09) and other corresponding Department of Defense and Department of the Navy Policies.

This specification identifies contract requirements conditional to the exemption:

a. UXO Safety Awareness Training (3Rs Training) for personnel conducting ground disturbing activities

b. Protocol to stop work, evacuate and notify if suspected Munitions and Explosives of Concern (MEC) are encountered.

c. Geographic Information System (GIS) Electronic Submittals documenting

(1) Initial GIS Data Files of Project Limits

(2) Final GIS Data Files of Project Limits and lowest ground disturbance

d. Contractor shall assume 30 days during site preparation and grubbing activities and 30 days during grading and excavation activities associated with delays due to suspect MEC discoveries. This includes stopping and shifting work within 1,000 foot radius, performing notifications and evacuations, obtaining Government MEC QA verification, any necessary EOD responses, and Contracting Officer approvals to resume work. Government response time should be assumed to be 8 hours for suspect MEC discoveries.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

MEC Work Plan; G

Initial GIS Data Files

SD-11 Closeout Submittals

Final GIS Data Files

1.2.1 MEC Work Plan

MEC Work Plan is a concise pre-construction submittal documenting Project Limits, Notification Protocol, 3Rs Training Compliance Plan, and Initial 3Rs Training Log. MEC Work Plan must be Government approved prior to starting ground disturbing activities.

1.2.1.1 Project Limits

Graphic depiction of Project Limits that may be reproduced from contract documents. Notify Contracting Officer of discrepancies in ground disturbing work and contract Project Limits.Graphic depiction of Project Limits that may be reproduced from contract documents. Notify Contracting Officer of discrepancies in ground disturbing work and contract Project Limits.

1.2.1.2 Notification Protocol for Suspected MEC Encounters

Include names, phone and email contacts. Notification protocol is listed in paragraph 3.3.1, unless directed otherwise by Contracting Officer. To prepare the MEC Work Plan, Contracting Officer will provide point of contact information for Government MEC Quality Assurance (QA) Personnel.

1.2.1.3 3Rs Training Compliance Plan

See paragraph 3RS TRAINING REQUIREMENT. Include relevant sections of the Accident Prevention Plan including:

a. Requests and scheduling of Government provided group training by Government MEC QA Personnel

b. SSHO controls to ensure 3Rs Training compliance, including controls for annual re-certification and template for the on-site 3Rs Training Log.

1.2.1.4 Initial 3Rs Training Log

Names of personnel anticipated to require 3Rs Training per paragraph 3RS TRAINING REQUIREMENT, effective/expiration dates and valid Certificates of Completion for all listed personnel.

1.2.2 Initial GIS Data Files

Pre-construction submittal of electronic GIS data file(s) documenting only the Project Limits as indicated in contract. GIS data must conform to "Navy Installation Geospatial Information & Services Specifications for Vector GIS Deliverables," appended to this specification.

Additional to Section 01 33 00 SUBMITTAL PROCEDURES, email data files(s) directly to NAVFAC Marianas MEC Program Manager. Contracting Officer will provide contact information for the MEC Program Manager.

1.2.3 Final GIS Data Files

Provide electronic GIS data file(s) documenting the lowest ground disturbance. Data shall be three-dimensional vector GIS deliverable documenting the extent and depth of ground disturbance. GIS data must conform to "Navy Installation Geospatial Information & Services Specifications for Vector GIS Deliverables," appended to this

specification. Upon request, Contracting Officer will provide an empty Elevation Contour Feature Class in a file or personal geodatabase as a template for vector GIS data file submission.

Additional to Section 01 33 00 SUBMITTAL PROCEDURES, email data files(s) directly to NAVFAC Marianas MEC Program Manager. Contracting Officer will provide contact information for the MEC Program Manager.

1.3 3RS TRAINING REQUIREMENT

Incorporate UXO Safety Awareness Training (3Rs Training) requirements into the Accident Prevention Plan, under oversight responsibility of the Site Safety and Health Officer (SSHO).

3Rs Training Requirement is fulfilled individually by accessing online training at https://www.3Rs.mil, passing the quiz, and receipt of a certificate of completion. Individual online training takes approximately 20 minutes. Alternatively, the Government may provide group 3Rs Training, by Government MEC QA Personnel, at Contractor request and scheduling. Training must be completed annually.

The following personnel are required to take 3Rs Training:

a. Superintendent(s), SSHO, and Quality Control Manager (QCM).

b. All personnel involved in ground disturbing activities. Personnel involved in ground disturbing activities during pre-construction and preparatory phases of work are also subject to this requirement.

c. As designated by SSHO: other personnel that could encounter MEC.

PART 2 PRODUCTS

2.1 GIS DATA COLLECTION

Global Positioning System (GPS) data collection shall be used to produce the final GIS Data File(s) mapping the lowest ground disturbance. Provide professional grade GPS with accuracy level of plus/minus less than 3 feet and differential correction to target accuracies of plus/minus 1-1/2 feet.

Contractor may substitute data from higher accuracy survey equipment in lieu of GPS data collection, where higher accuracy survey equipment is used in concert with excavation operations.

PART 3 EXECUTION

3.1 3RS TRAINING CONTROLS

SSHO shall maintain an updated 3Rs Training Log and non-expired certificates of completion for individuals required to take 3Rs Training. 3Rs Training certificates of completion expire; training must be re-taken annually.

Only the Initial 3Rs Training Log must be submitted as part of the MEC Work Plan for Government approval. Updates for the 3Rs Training Log do not require official resubmission, but must be maintained by the SSHO and be available on-site to Government Representatives on-demand (i.e. new personnel not listed in the initial log, 3Rs Training renewals, etc.).

3.2 UPDATE MEC WORK PLAN

Update and resubmit MEC Work Plan for Government approval upon changes to Project Limits, Notification Protocol (i.e. point of contacts, etc.), or 3Rs Training Compliance Plan. Maintain updated MEC Work Plan, available on-site to Government Representatives on-demand. Official resubmission is not required exclusively for updates to the 3Rs Training Log.

3.3 REQUIREMENTS WHEN SUSPECTED MEC IS ENCOUNTERED

If during any phase of the project work, a suspected MEC item is found, immediately stop-work, evacuate and secure area within 1,000 feet of the suspected MEC item.

3.3.1 Notification Protocol

For suspected MEC encounters immediately notify:

a. Contracting Officer: to confirm evacuation and securing of area within 1,000 feet of the suspected MEC item.

b. Government MEC Quality Assurance (QA) Personnel: to mobilize for verification of suspected MEC item.

3.3.2 Verification of Suspected MEC

Government will verify suspected MEC items, by Government MEC QA Personnel.

3.3.3 Resumption of Work

Contracting Officer or designated representative will direct resumption of work if item is not MEC.

Should item be confirmed MEC, Contracting Officer or designated representative will provide direction to:

a. Resume work outside the MEC item's exclusion zone.

b. Resume work within the area of the MEC following removal of MEC by Government Explosive Ordnance Disposal (EOD).

3.4 UNINTENTIONAL EXPLOSIVE EVENT

If during any phase of the project work there is an unintentional explosive event, the exemption under the SECNAV Explosive Safety Risk Acceptance will cease to apply to this contract. All ground intrusive work will stop until new explosive requirements can be established, approved, and implemented.

-- End of Section --

SECTION 01 58 00

PROJECT IDENTIFICATION
08/19, CHG 5: 08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Preliminary Drawing Indicating Layout And Text Content; G

SD-04 Samples

1.3 QUALITY CONTROL

1.4 PROJECT SIGN

Prior to initiating any work on site, provide one project identification sign at the location designated. Construct the sign in accordance with project sign detail, which can be downloaded at: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables and attached at the end of this section. Maintain sign throughout the life of the project. Upon completion of the project, remove the sign from the site.

1.4.1 Project Identification Signboard (NAVY)

Provide a project identification signboard in accordance with attached Plates 1, 3, and 4. Provide a preliminary drawing indicating layout and text content. Erect a signboard at a conspicuous location on the job site where directed by the Contracting Officer.

a. The field of the sign consists of a 4 by 8 foot sheet of grade B-B medium density overlaid exterior plywood.

b. Lumber is B or better Southern pine, pressure-preservative treated in

accordance with AWPA C1 and AWPA C2. Nails are aluminum or galvanized steel.

c. Give one coat of exterior alkyd primer and two coats of exterior alkyd enamel paint to the entire signboard and supports. Perform the lettering and sign work by a skilled sign painter using paint known in the trade as bulletin colors. The colors, lettering sizes, and lettering styles are as indicated. Where preservative-treated lumber is required, utilize only cured pressure-treated wood which has had the chemicals leached from the surface of the wood prior to painting.

d. Use spray applied automotive quality high gloss acrylic white enamel paint as background for the NAVFAC logo. NAVFAC logo is an applied 2 mil film sticker/decal with either transparent or white background or paint the logo by stencil onto the sign. The weather resistant sticker/decal film is rated for a minimum of 2-year exterior vertical exposure. Mount the self-adhering sticker to the sign with pressure sensitive, permanent acrylic adhesive. Shop cut sticker/decal to rectangular shape and provide pull-off backing sheet on adhesive side of design sticker for shipping.

e. Sign paint colors (manufacturer's numbers/types listed below for color identification only)

(1) Blue = To match dark blue color in the NAVFAC logo.

(2) White = To match Brilliant White color in the NAVFAC logo.

f. NAVFAC logo must retain proportions and design integrity. NAVFAC logos in electronic format may be obtained from the WBDG at the following link: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables.
Use the following to choose color values for the paint to be used:

(1) Dark Blue = equivalent to CMYK values 100, 72, 0, 8.

(2) Light Blue = equivalent to CMYK values 69, 34, 0, 0.

(3) Cyan = equivalent to CMYK values 100, 9, 0, 6.

(4) Yellow = equivalent to CMYK values 0.9,94, 0.

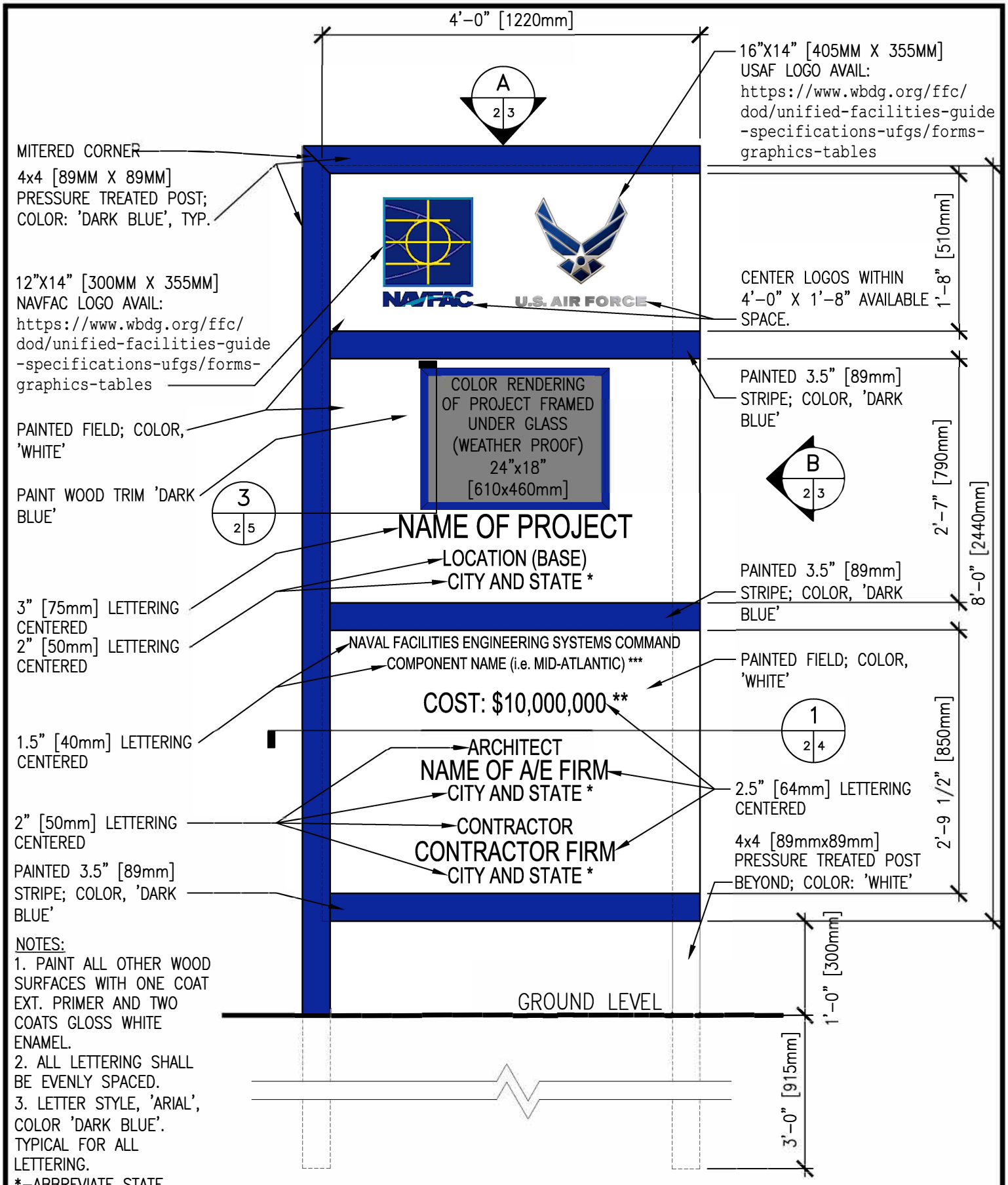
PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --



NOTES:

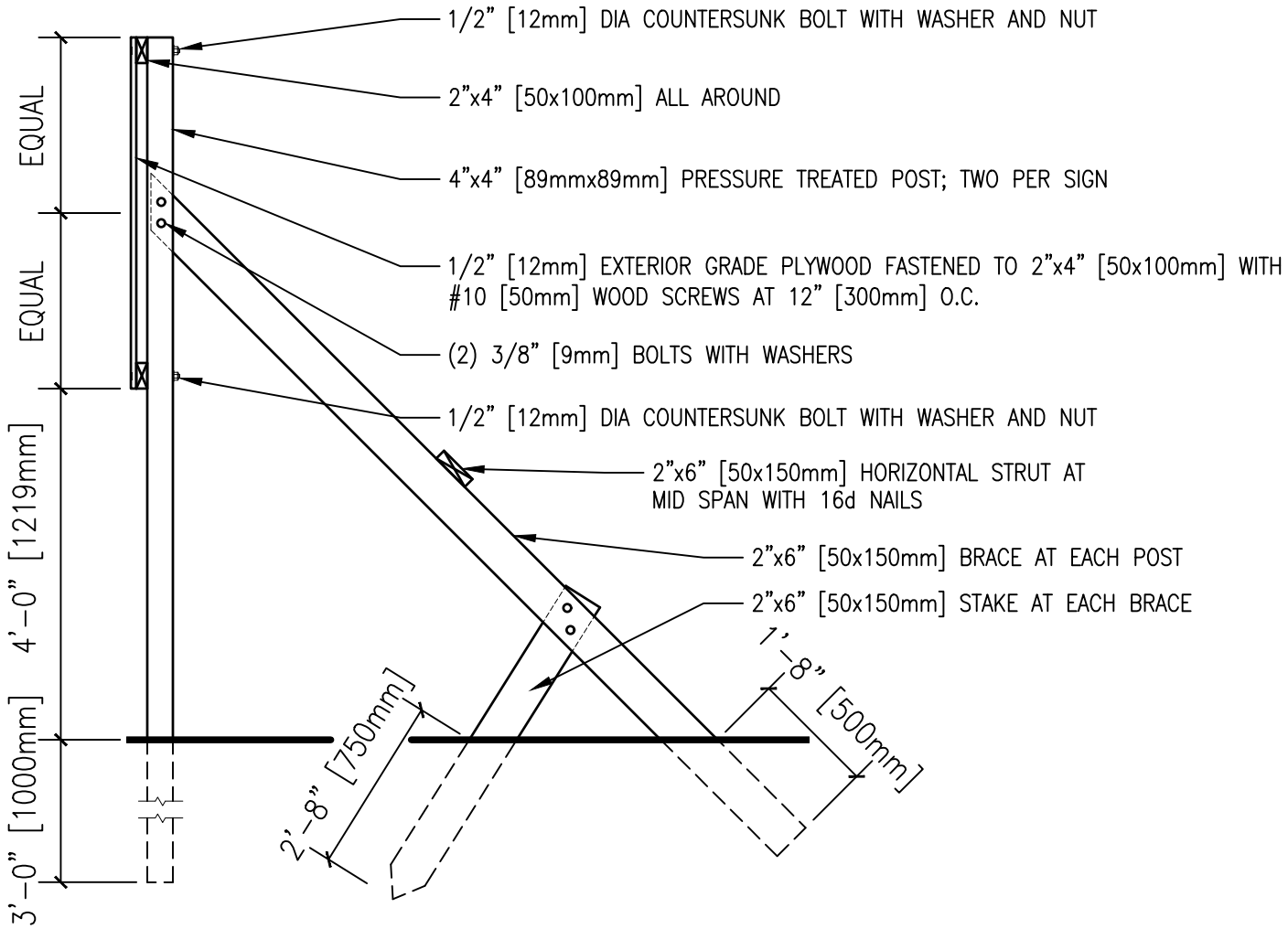
1. PAINT ALL OTHER WOOD SURFACES WITH ONE COAT EXT. PRIMER AND TWO COATS GLOSS WHITE ENAMEL.
2. ALL LETTERING SHALL BE EVENLY SPACED.
3. LETTER STYLE, 'ARIAL', COLOR 'DARK BLUE'. TYPICAL FOR ALL LETTERING.

*–ABBREVIATE STATE
**–CONFIRM USE WITH CONTRACTING OFFICER
***–VERIFY NAME WITH CONTRACTING OFFICER.

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PROJECT IDENTIFICATION SIGNBOARD

SCALE: 3/4" = 1'-0"

PLATE 2USAF



A
6 6

SECTION

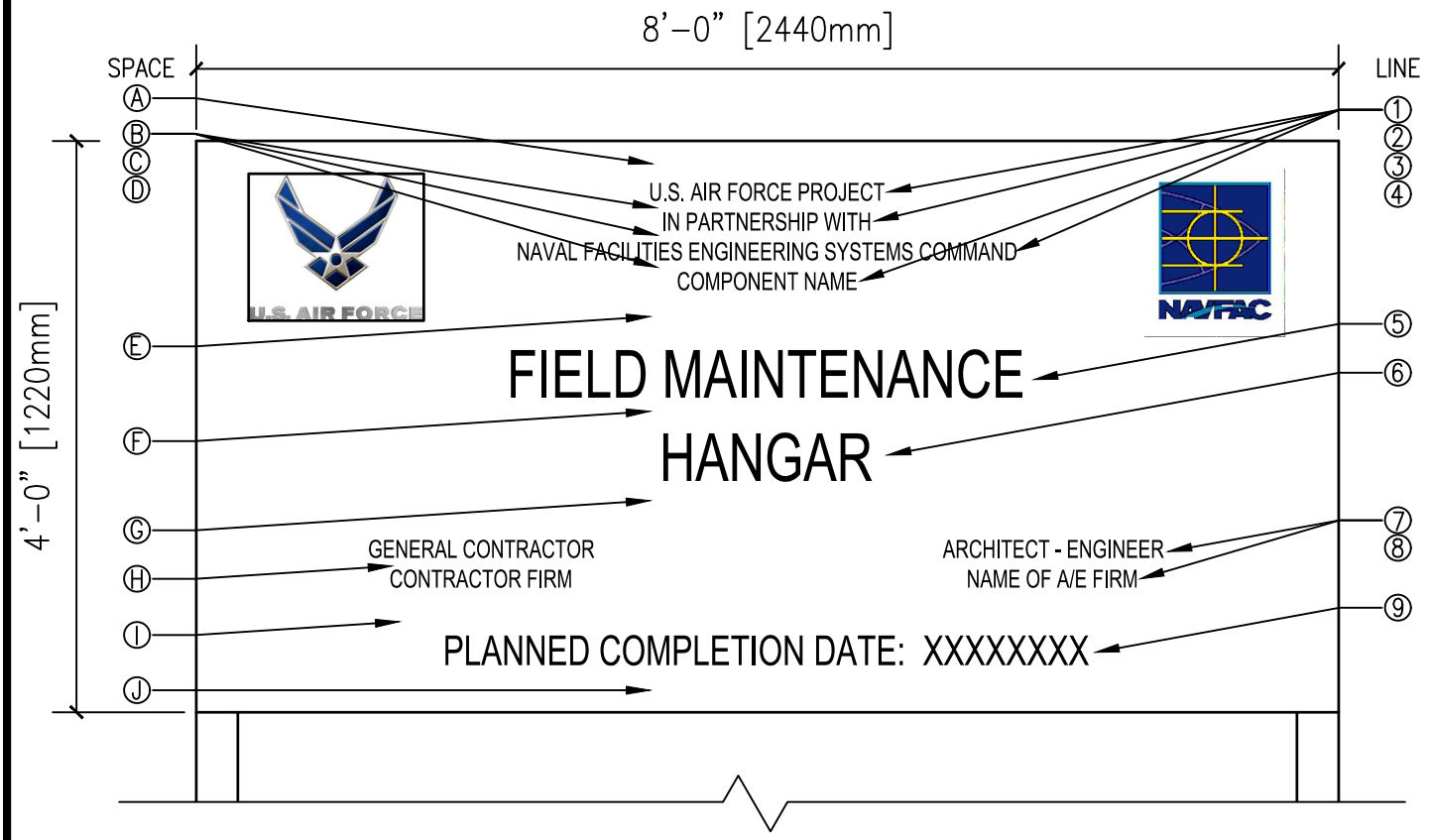
SCALE: 1/2" = 1'-0"

NOTES:

1. THE SIGN MUST BE CONSTRUCTED OF 4'x8' [1200mmx2400mm] 1/2" [12mm] GRADE A-C, EXTERIOR TYPE PLYWOOD MOUNTED ON A FRAME OF TREATED LUMBER.
2. THE HOST MAJCOM WILL PROVIDE SIGN COLORS AND DETAILS TO THE DESIGN MANAGER IN THE REQUIREMENTS AND MANAGEMENT PLAN (RAMP).
3. ALL LETTERING SHALL BE UPPERCASE HELVETICA MEDIUM.
4. PRESERVATIVE TREAT ALL WOOD SURFACES BURIED OR IN CONTACT WITH THE EARTH.
5. ALL FASTENERS SHALL BE GALVANIZED COATED.
6. LUMBER SHALL BE NON STRESS GRADE: $F_t = 8.5^5$ KGS/M^2 (1200PSI)6
   $F_t = 10.5^5$ KGS/M^2 (1500PSI)

7. THE ENTIRE SIGNBOARD AND SUPPORTS SHALL BE GIVEN ONE COAT OF EXTERIOR ALKYD PRIMER AND TWO COATS OF EXTERIOR ALKYD ENAMEL PAINT. THE LETTERING AND SIGN WORK SHALL BE PERFORMED BY A SKILLED SIGN PAINTER USING PAINT KNOWN IN THE TRADE AS BULLETIN COLORS. WHERE PRESERVATIVE-TREATED LUMBER IS REQUIRED, UTILIZE ONLY CURED PRESSURE-TREATED WOOD WHICH HAS HAD THE CHEMICALS LEACHED FROM THE SURFACE OF THE WOOD PRIOR TO PAINTING.

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
PROJECT IDENTIFICATION SIGNBOARD SECTION
U.S. AIR FORCE PROJECTS



A
7 | 7

SIGNBOARD

SCALE: 3/4" = 1'-0"

SPACE	HEIGHT	LINE	DESCRIPTION	LETTER HEIGHT	STROKE
Ⓐ	3.5"	①	U.S. AIR FORCE PROJECT	1.5"	3/16"
Ⓑ	1"	②	IN PARTNERSHIP WITH	1.5"	3/16"
Ⓒ	1"	③	NAVAL FACILITIES ENGINEERING COMMAND	1.5"	3/16"
Ⓓ	1"	④	COMPONENT NAME	1.5"	3/16"
Ⓔ	5"	⑤	PROJECT NAME	4"	1/2"
Ⓕ	3"	⑥	PROJECT NAME CONT'D (IF REQUIRED)	4"	1/2"
Ⓖ	5"	⑦	GENERAL CONTRACTOR/ A–E	1.5"	3/16"
Ⓗ	1"	⑧	GENERAL CONTRACTOR/ A–E	1.5"	3/16"
Ⓘ	4"	⑨	PLANNED COMPLETION DATE:	2.5"	1/4"
Ⓙ	4"				

NOTES:

1. ALL LETTERING SHALL BE UPPERCASE HELVETICA MEDIUM.

2. NAVFAC LOGO AVAILABLE AT:
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables

3. AIR FORCE LOGO AVAILABLE AT:
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
PROJECT IDENTIFICATION SIGNBOARD
U.S. AIR FORCE PROJECTS

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
02/19, CHG 3: 11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Andersen Air Force Base Guam

IHMMP	(2020) Installation Hazardous Materials Management Plan

Naval Facilities Engineering Command Marianas, Joint Region Marianas, Guam

ISWMP	(2013) DoD Integrated Solid Waste Management Plan for DoD Base Guam

1.2 DEFINITIONS

1.2.1 Co-mingle

The practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed.

1.2.2 Construction Waste

Waste generated by construction activities, such as scrap materials, damaged or spoiled materials, temporary and expendable construction materials, and other waste generated by the workforce during construction activities.

1.2.3 Demolition Debris/Waste

Waste generated from demolition activities, including minor incidental demolition waste materials generated as a result of Intentional dismantling of all or portions of a building, to include clearing of building contents that have been destroyed or damaged.

1.2.4 Disposal

Depositing waste in a solid waste disposal facility, usually a managed landfill, regulated in the US under the Resource Conservation and Recovery Act (RCRA).

1.2.5 Diversion

The practice of diverting waste from disposal in a landfill by means of eliminating or minimizing waste, or reuse of materials.

1.2.6 Final Construction Waste Diversion Report

A written assertion by a material recovery facility operator identifying constituent materials diverted from disposal, usually including summary tabulations of materials, weight in short-ton.

1.2.7 Recycling

The series of activities, including collection, separation, and processing, by which products or other materials are diverted from the solid waste stream for use in the form of raw materials in the manufacture of new products sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials, other than fuel.

1.2.8 Reuse

The use of a product or materials again for the same purpose, in its original form or with little enhancement or change.

1.2.9 Salvage

Usable, salable items derived from buildings undergoing demolition or deconstruction, parts from vehicles, machinery, other equipment, or other components.

1.2.10 Source Separation

The practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity.

1.3 PROJECT CONSTRUCTION WASTE (INCLUDES DEMOLITION DEBRIS/WASTE)

Divert a minimum of 60 percent by weight of the project from the landfill. Follow IHMMP, ISWMP, and applicable industry standards in the management of waste. Apply sound environmental principles in the management of waste. (1) Practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction waste and demolition debris/waste from landfills and to facilitate the recycling or reuse of excess construction materials.

1.4 CONSTRUCTION WASTE MANAGEMENT

Implement a Construction Waste Management Program for the project. Take a pro-active, responsible role in the management of construction waste, recycling process, disposal of demolition debris/waste, and require all subcontractors, vendors, and suppliers to participate in the Construction Waste Management Program. Establish a process for clear tracking, and documentation of construction waste and demolition debris/waste.

1.4.1 Implementation of Construction Waste Management Program

Develop and document how the Construction Waste Management Program will be implemented in a construction waste management plan. Submit a Construction Waste Management Plan to the Contracting Officer for approval. Construction waste and demolition debris/waste materials include un-used construction materials not incorporated in the final work, as well as demolition debris/waste materials from demolition activities or

deconstruction activities. In the management of waste, consider the availability of viable markets, the condition of materials, the ability to provide material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates.

1.4.2 Oversight

The Environmental Manager, as specified in Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, is responsible for overseeing and documenting results from executing the Construction Waste Management Plan for the project.

1.4.3 Special Programs

Implement any special programs involving rebates or similar incentives related to recycling of construction waste and demolition debris/waste materialsconstruction waste and demolition debris/waste materials. Ensure firms and facilities used for recycling, reuse, and disposal are permitted for the intended use to the extent required by federal, state, and local regulations.

1.4.4 Special Instructions

Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the projects. Designation of single source separating or commingling will be clearly marked on the containers.

1.4.5 Waste Streams

Delineate waste streams and characterization, including estimated material types and quantities of waste, in the Construction Waste Management Plan. Manage all waste streams associated with the project. Typical waste streams are listed below. Include additional waste steams not listed:

a. Land Clearing Debris
b. Asphalt
c. Masonry and CMU
d. Concrete
e. Metals (includes, but is not limited to, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, bronze)
f. Wood (nails and staples allowed)
g. Glass
h. Paper
i. Plastics (PET, HDPE, PVC, LDPE, PP, PS, Other)
j. Gypsum
k. Non-hazardous paint and paint cans
l. Carpet
m. Ceiling Tiles
n. Insulation
o. Beverage Containers

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance

with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Waste Management Plan

SD-06 Test Reports

Sampling and Analytical Report for Surplus Soil; G

SD-07 Certificates

Disposal Documentation or Acceptance of Surplus Soil; G

SD-11 Closeout Submittals

Final Construction Waste Diversion Report; S

1.6 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Construction Waste M anagement Plan and to develop a mutual understanding relative to the management of the Construction Waste Management Program and how waste diversion requirements will be met.

The requirements of this meeting may be fulfilled during the coordination and mutual Understanding meeting outlined in Section 01 45 00 QUALITY CONTROL. At a minimum, discuss and document waste management goals at following meetings:

a. Pre-bid meeting.

b. Preconstruction meeting.

c. Regular Quality Control meetings.

d. Work safety meeting (if applicable).

1.7 CONSTRUCTION WASTE MANAGEMENT PLAN

Submit Construction Waste Management Plan within 15 days after notice to proceed. Revise and resubmit Construction Waste Management Plan, as necessary, in order for construction to begin. Execute demolition or deconstruction activities in accordance with Section 02 41 00 DEMOLITION AND DECONSTRUCTION. Manage demolition debris/waste or deconstruction materials in accordance with the approved construction waste management plan.

An approved Construction Waste Management Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Ensure all subcontractors receive a copy of the approved Construction Waste Management Plan. The plan demonstrates how to meet the project waste diversion requirement. Also, include the following in the plan:

a. Identify the names of individuals responsible for waste management and waste management tracking, along with roles and responsibilities on

the project.

b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.

c. Description of the regular meetings to be held to address waste management.

d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of materials.

e. Name of landfill to be used.

f. Identification of local and regional re-use programs, including non-profit organizations such as schools, local housing agencies, and organization that accept used materials such as material exchange networks and resale stores. Include the name, location, phone number for each re-use facility identified, and provide a copy of the permit or license for each facility.

g. List of specific materials, by type and quantity, that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, address, and phone number.

h. Identification of materials that cannot be recycled or reused with an explanation or justification, to be approved by the Contracting Officer.

i. Description of the means by which materials identified in item (g) above will be protected from contamination.

j. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).

k. Copy of training plan for subcontractors and other services to prevent contamination by co-mingling materials identified for diversion and waste materials.

1.8 RECORDS (DOCUMENTATION)

1.8.1 General

Maintain records to document the types and quantities of waste generated and diverted though re-use, recycling and sale to third parties; through disposal to a landfill facility. Provide explanations for materials not recycled, reused or sold. Collect and retain manifests, weight tickets, sales receipts, and invoices specifically identifying diverted project waste materials or disposed materials.

1.8.2 Accumulated

Maintain a running record of materials generated and diverted from landfill disposal, including accumulated diversion rates for the project. Make records available to the Contracting Officer during construction or

incidental demolition activities. Provide a copy of the diversion records to the Contracting Officer upon completion of the construction, incidental demolitions or minor deconstruction activities.

1.9 FINAL CONSTRUCTION WASTE DIVERSION REPORT

A Final Construction Waste Diversion Report is required at the end of the project. Provide Final Construction Waste Diversion Report 60 days prior to the Beneficial Occupancy Date (BOD). The final Construction Waste Diversion Report must be included in the Sustainability eNotebook in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

1.10 COLLECTION

Collect, store, protect, and handle reusable and recyclable materials at the site in a manner which prevents contamination, and provides protection from the elements to preserve their usefulness and monetary value. Provide receptacles and storage areas designated specifically for recyclable and reusable materials and label them clearly and appropriately to prevent contamination from other waste materials. Keep receptacles or storage areas neat and clean.

Train subcontractors and other service providers to either separate waste streams or use the co-mingling method as described in the Construction Waste Management Plan. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. Separate materials by one of the following methods described herein:

1.10.1 Source Separation Method

Separate waste products and materials that are recyclable from trash and sort as described below into appropriately marked separate containers and then transport to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the category types as defined in the C onstruction Waste Management Plan.

1.10.2 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.11 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures as described in the waste management plan. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the following:

1.11.1 Reuse

Give first consideration to reusing construction and demolition materials as a disposition strategy. Recover for reuse materials, products, and components as described in the approved Construction Waste Management P

lan. Coordinate with the Contracting Officer to identify onsite reuse opportunities or material sales or donation available through Government resale or donation programs. Sale of recovered materials is not allowed on the Installation. Consider the use of surplus industrial supply broker services, who match entities with reusable or repurpose industrial materials with entities with need of such materials.

1.11.2 Recycle

Recycle non-hazardous construction and demolition/debris materials that are not suitable for reuse. Track rejection of contaminated recyclable materials by the recycling facility. Rejected recyclables materials will not be counted as a percentage of diversion calculation. Recycle all fluorescent lamps, HID lamps, mercury (Hg) -containing thermostats and ampoules, and PCBs-containing ballasts and electrical components as directed by the Contracting Officer. Do not crush lamps on site as this creates a hazardous waste stream with additional handling requirements.

1.11.3 Compost

Consider composting on site if a reasonable amount of compostable materials will be available and a utilization of compostable material can be determined and appropriately planned for. Compostable materials include plant materials, sawdust and certain food scraps. Composting as a strategy must be explicitly addressed in the Construction Waste Management Plan submitted for approval to ensure it is feasible.

1.11.4 Waste

Dispose by landfill only those waste materials with no practical use, economic benefit, or recycling opportunity.

1.12 CLEAN SURPLUS SOIL

There must not be offsite reuse of excess materials for unrestricted land use (e.g. schools, daycare, residential properies) unless material is deemed cleaned through testing and demonstration of meeting regulatory screening standards.

Perform sampling and analysis for surplus soil in accordance with the requirements indicated in the table below, applicable Federal and Guam regulations, and requirements from the recipients of the surplus soil.

Contaminated soil specified in Section 02 61 13, EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL must be segregated from the clean surplus soil and have separated stockpile for reuse onsite or waste characterization based on the type of contamination (e.g., contaminants, excavated locations).

Determine the levels of the soil contaminants and compare the results to the Tropical Pacific Tier 1 Soil Environmental Screening Levels (TPESL) for unrestricted and restricted land use.

Use a multi-incremental sampling technique with minimum 75 increments per each sample or stockpile decision unit. The stockpile size must be less than 400 cubic yards.

The laboratory performing the analysis must be certified by the DoD Environmental Laboratory Accreditation Program (DoD ELAP) or National

Environmental Laboratory Accreditation Program (NELAP). Use of non-certified laboratories must be pre-approved by the Contracting Officer.

A Sampling and Analytical Report for Surplus Soil must be submitted to the Contracting Officer. The report must include the following, but are not limited to:

a. Origin of the surplus soil

b. Photographs and location maps for the origin of surplus soil

c. Detailed sampling procedures

d. Soil analytical results and comparison to Tier 1 TPESL

e. Laboratory analytical report, in an appendix of the soil report.

f. Surplus soil reuse or disposal plan

g. Locations where the surplus soil will be reused or disposed of

Do not haul any surplus soil off site until test results have been received and approved by the Contracting Officer. Provide the Disposal Documentation or Acceptance of Surplus Soil including soil quantities to the Contracting Officer. The receiving entity must have the appropriate Guam EPA Clearing, Grubbing and Grading Permit for the activity.

Surplus Soil Testing Requirement	Minimum Number of Samples
Toxicity Characteristic Leaching Procedure (TCLP) 8 Metals	1 sample per 400 cubic yards surplus soil
23 Target Analytes List (TAL) Metals (Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, Zn)	1 sample per 400 cubic yards surplus soil
PCBs (Total Aroclor)(polychlorinated biphenyls)	1 sample per 400 cubic yards surplus soil
BTEX(benzene, toluene, ethylbenzene & xylene)	1 sample per 400 cubic yards surplus soil
PAH(polycyclic aromatic hydrocarbons)	1 sample per 400 cubic yards surplus soil
TPH, gasoline(total petroleum hydrocarbons as gasoline)	1 sample per 400 cubic yards surplus soil
TPH, middle distillates	1 sample per 400 cubic yards surplus soil
TPH, residual fuels	1 sample per 400 cubic yards surplus soil
PFAS (per-and polyfluoroalkyl substances)	1 sample per 400 cubic yards surplus soil
Explosive (Method 8330B)	1 sample per 400 cubic yards surplus soil
Total Pesticides (Aldrin, Chlordane, Dieldrin, Endosulfan, Endrin, Heptachlor, Heptachlor Epoxide, Dichlorodiphenyldichoroethane (DDD), Dichlorodiphenyldichoroethylene (DDE), Dichlorodiphenyltrichoroethane (DDT))	1 sample per 400 cubic yards surplus soil

Surplus Soil Testing Requirement	Minimum Number of Samples
HVOCs(Halogenated Volatile Organic Compounds)	1 sample per 400 cubic yards surplus soil

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 78 00

CLOSEOUT SUBMITTALS
05/19, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2024) Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2017) Cleaning Products for Industrial and Institutional Use

U.S. DEPARTMENT OF DEFENSE (DOD)

FC 1-300-09N	(2024) Navy and Marine Corps Design
UFC 1-300-08	(2023) Criteria for Transfer and Acceptance of DoD Real Property

1.2 DEFINITIONS

1.2.1 As-Built Drawings

As-built drawings are the marked-up drawings, maintained by the Contractor on-site, that depict actual conditions and deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to submitted Requests for Information (RFI's); direction from the Contracting Officer; design that is the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site. These files serve as the basis for the creation of the record drawings.

1.2.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings. Record drawings must include a complete set of all drawings for the project.

1.3 SOURCE DRAWING FILES

After award and upon request by the Contractor completing the Limited Authrization for Use of Electronic Data form provided at the end of this section, the electronic drawings, in source format, will be made available to the Contractor for Record Drawing preparation.

1.3.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CAD drawing files are not construction documents. Differences may exist between the CAD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CAD files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Warranty Management Plan

Warranty Tags

Final Cleaning

Spare Parts Data

SD-08 Manufacturer's Instructions

Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

SD-11 Closeout Submittals

As-Built Drawings; G

Record Drawings; G

As-Built Record of Equipment and Materials

Certification of EPA Designated Items; G

Certification Of USDA Designated Items; G

Interim DD FORM 1354; G

Checklist for DD FORM 1354; G

High Performance and Sustainable Building (HPSB) Checklist; G

1.5 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

a. Indicate manufacturer's name, part number, and stock level required for test and balance, pre-commissioning, maintenance and repair activities. List those items that may be standard to the normal maintenance of the system.

1.6 WARRANTY MANAGEMENT

1.6.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction. At least 30 calendar days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan narrative must contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Submit warranty information, made available during the construction phase, to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period must begin on the date of project acceptance and continue for the full product warranty period. Conduct a joint 4 month and 9 month warranty inspection, measured from time of acceptance; with the Contractor, Contracting Officer and the Customer Representative. The warranty management plan must include, but is not limited to, the following:

a. Roles and responsibilities of personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. For each warranty, the name, address, telephone number, and e-mail of each of the guarantor's representatives nearest to the project location.

c. A list and status of delivery of Certificates of Warranty for extended

warranty items, including roofs, HVAC balancing, pumps, motors, transformers, and for commissioned systems, such as fire protection and alarm systems, sprinkler systems, and lightning protection systems.

d. As-Built Record of Equipment and Materials list for each warranted equipment, item, feature of construction or system indicating:

(1) Name of item.
(2) Model and serial numbers.
(3) Location where installed.
(4) Name and phone numbers of manufacturers or suppliers.
(5) Names, addresses and telephone numbers of sources of spare parts.
(6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have warranties longer than one year must be indicated with separate warranty expiration dates.
(7) Cross-reference to warranty certificates as applicable.
(8) Starting point and duration of warranty period.
(9) Summary of maintenance procedures required to continue the warranty in force.
(10) Cross-reference to specific pertinent Operation and Maintenance manuals.
(11) Organization, names and phone numbers of persons to call for warranty service.
(12) Typical response time and repair time expected for various warranted equipment.

e. The plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

f. Procedure and status of tagging of equipment covered by warranties longer than one year.

g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty or safety reasons.

1.6.2 Performance Bond

The Performance Bond must remain effective throughout the construction and warranty period .

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.6.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. At this meeting, establish and review communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact must be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.6.4 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	

Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

PART 2 PRODUCTS

2.1 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9 Estimate of Percentage of Recovered Material Content for EPA Designated Items and FAR 52-223-17 Affirmative Procurement of EPA designated items in Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

a. The product does not meet appropriate performance standards;

b. The product is not available within a reasonable time frame;

c. The product is not available competitively (from two or more sources);

d. The product is only available at an unreasonable price (compared with a comparable non-recycled content product)."

Record each product used in the project that has a requirement or option of containing recycled content in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, exemptions (a, b, c, or d, as indicated), and comments. Recycled content values may be determined by weight or volume percent, but must be consistent throughout.

2.2 CERTIFICATION OF USDA DESIGNATED ITEMS

Submit the Certification of USDA Designated Items as required by FAR 52-223-1 Bio-based Product Certifications and FAR 52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current USDA standards for biobased materials content. The following exemptions may apply to the non-procurement of biobased content materials:

a. The product does not meet appropriate performance standards;

b. The product is not available within a reasonable time frame;

c. The product is not available competitively (from two or more sources);

d. The product is only available at an unreasonable price (compared with a comparable bio-based content product)."

Record each product used in the project that has a requirement or option of containing biobased content in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, total value of biobased content, exemptions (a, b, c, or d, as indicated), and comments. Biobased content values may be determined by weight or volume percent, but must be consistent throughout.

PART 3 EXECUTION

3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Maintain the as-builts throughout construction as red-lined hard copies on site and red-lined PDF files. Submit As-Built Drawings 30 days prior to Beneficial Occupancy Date (BOD).

3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

a. Use base colors of red, green, and blue. Color code for changes as follows:

   (1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

   (2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

   (3) Additions (Green) - Added items, lettering in notes and leaders.

b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.

c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.

d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.

e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.

f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.

g. For deletions, cross out all features, data and captions that relate to that revision.

h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.

i. Indicate one of the following when attaching a print or sketch to a markup print:

1) Add an entire drawing to contract drawings

2) Change the contract drawing to show changes on the drawing.

3) Provided for reference only to further detail the initial design.

j. Incorporate all shop and fabrication drawings into the markup drawings.

3.1.2 As-Built Drawings Content

Show on the as-built drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Layout and schematic drawings of electrical circuits and piping.

d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

e. Changes in details of design or additional information obtained from working drawings specified to be prepared or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment, and foundations.

f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

g. Changes or Revisions which result from the final inspection.

h. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup

drawings.

i. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

j. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

k. Changes in location of equipment and architectural features.

l. Modifications and compliance with FC 1-300-09N procedures.

m. Actual location of anchors, construction and control joints, etc., in concrete.

n. Unusual or uncharted obstructions that are encountered in the contract work area during construction.

o. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

3.2 RECORD DRAWINGS

Prepare and provide Record Drawings and Source Documents in accordance with FC 1-300-09N. Record drawings must include a complete set of all drawings for the project. Provide four copies of Record Drawings and Documents on separate CDs or DVDs 30 calendar days after BOD.

3.2.1 Fire Protection Systems Record Drawings

a. Prepare record drawings after the Government has approved the satisfactory completion of formal inspection and acceptance test.

b. Qualified technician certified in the applicable program of National Institute for Certification in Engineering Technologies (NICET) Level III for the specific trade must prepare and/or supervise the preparation of drawings. The NICET technician must provide certification credentials on drawings.

c. Prepare drawings in electronic drawing files compatible with AutoCAD® computer software. Scale drawings to fit on uniform 22 inch by 34 inch size sheets having borders, title block and information fields exact to that of the Contract Drawings. Drawings shall have same Project title and project location as specified in the Contract Drawings.

d. Drawings must show the final conditions, number, sizes and locations for piping, conduit, wires, equipment, components, devices, appliances and device addresses. Label each system, system component and parts with manufacturer's name, model number, serial number, manufactured date, applicable federal, military, industry and technical society publication references, etc.

e. Provide drawing description and drawing designation in the title block. Drawing designation will be in the form of "FP-R-#", where "#" is a unique sequential integer.

f. Drawings must bear the signature approval of the Registered Fire Protection Engineer specified in Section 01 45 00 QUALITY CONTROL.

g. Upon compilation of complete set of fire protection system record drawings, request from the Contracting Officer a unique "NAVFAC Drawing Number" for each drawing. Provide each drawing with unique "NAVFAC Drawing Number" prior to submission. Submit record drawings in AutoCAD® and Adobe®PDF formats.

3.3 OPERATION AND MAINTENANCE MANUALS

Provide project operation and maintenance manuals as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide four electronic copies of the Operation and Maintenance Manual files and one hard copy of the Operation and Maintenance Manuals. Submit to the Contracting Officer for approval within 30 calendar days of the Beneficial Occupancy Date (BOD). Update and resubmit files for final approval at BOD.

3.4 CLEANUP

Provide final cleaning in accordance with ASTM E1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment and comply with the Indoor Air Quality (IAQ) Management Plan. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, and 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.5 REAL PROPERTY RECORD

Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. Contact the Contracting Officer for any project specific information necessary to complete the DD FORM 1354.

3.5.1 Interim DD FORM 1354

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft DD FORM 1354 attached to this section, and submit an accounting of all installed property with Interim DD FORM 1354. Include any additional assets, improvements, and alterations from the Draft DD FORM 1354.

3.5.2 Completed DD FORM 1354

Attach the Real Property receiving Component's completed High Performance and Sustainable Building (HPSB) Checklist for each applicable building to the completed DD 1354, in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. For convenience, a blank fillable PDF DD FORM 1354 may be obtained at the following link: www.esd.whs.mil/Portals/54/Documents/DD/forms/dd/dd1354.pdf

Submit the completed Checklist for DD FORM 1354 of Installed Building

Equipment items. Attach this list to the updated DD FORM 1354.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY

NAVFAC Pacific
258 Makalapa DR, STE 100
Pearl Harbor, Hawaii 96860-3134

LIMITED AUTHORIZATION FOR USE OF ELECTRONIC DATA

Contractor Information

Primary: Name (Print)	Signature	Phone #
Additional: Name (Print)	Signature	Phone #
Additional: Name (Print)	Signature	Phone #

(Hereinafter "Contractor") is authorized to use the attached electronic data for the sole and exclusive purpose of

_____

_____

(Insert use: e.g. – assisting in the preparation of Contract related submittals for Contract No. 1234)

The Contractor shall not use the electronic data for any other purpose, including any other commercial, business or for-profit activity. The Contractor shall not assign, loan, sell, copy or otherwise transfer the electronic data to any other party without the Government's prior written consent. The Government makes no representation or warranty as to the suitability of the data for the Contractor's preparation of drawings and/or specifications as part of their contract submittal, including but not limited to, any expressed or implied warranty of merchantability or fitness for a particular purpose. The Contractor is under no obligation to use the electronic data and assumes full and complete responsibility for their use in preparing drawings and/or specifications for the above-referenced purpose. However, should they decide to use the electronic data, the Contractor acknowledges and agrees to indemnify, defend and hold the Government and their consultants harmless from and against any and all claims arising out of the use of the data. The Contractor also agrees to submit back to the Government the affected data where modified in relation to the above-referenced purpose for incorporation into the Government database.

The Contractor's use of the attached electronic data constitutes acknowledgment and agreement to the terms noted herein this limited authorization.

For Government Approval/Acknowledgment

Name (Print)	Signature	Phone #
Title	Date	

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA
05/23, CHG 1: 05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE GUIDELINE 1.4	(2019) Preparing Systems Manuals for Facilities

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2024) Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings
ASTM E2166	(2016; R 2023) Standard Practice for Organizing and Managing Building Data

U.S. DEPARTMENT OF DEFENSE (DOD)

FC 1-300-09N	(2024) Navy and Marine Corps Design

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

Facility Data Workbook; G

Training Plan; G

Training Outline; G

Training Content; G

Operation And Maintenance Manual, Progress Submittal; G

Operation And Maintenance Manual, Prefinal Submittal; G

Operation And Maintenance Manual, Final Submittal; G

SD-11 Closeout Submittals

Training Video Recording; G

Validation of Training Completion; G

Training Plan; G

Record Drawings And Utility Systems; G

1.3 MEETINGS

To assure that Operation and Maintenance Manual and Facility Data Workbook requirements are being met through the duration of the project, organize the following meetings and discuss the subsequent topics:

1.3.1 Pre-Construction Meeting

At a minimum, discuss the following:

a. The requirement for Operation and Maintenance Manuals and Facility Data deliverables under this contract including coordination meetings

b. Processes and method of gathering Facility Data information during construction

c. Primary roles and responsibilities associated with the development and delivery of the Operation and Maintenance Manuals and Facility Data deliverables, and

d. Identify and agree upon a date and attendance list for the meetings described below:

1.3.2 Operation and Maintenance Manual and Facility Data Workbook Coordination Meeting

Facilitate a meeting after the Pre-Construction Meeting prior to the submission of the Operation and Maintenance Manual Progress Submittal. Meeting attendance must include the Contractor's Operation and Maintenance Manual and Facility Data Workbook Preparer, Designer of Record (DOR), Quality Control Manager, the Government's Design Manager (DM), Contracting Officer's Representative, and Government's facility data reviewer. Include any Mechanical, Electrical, and Fire Protection Sub-Contractors.

The purpose of this meeting is to reach a mutual understanding of the scope of work concerning the contract requirements for Operation and Maintenance Manual and coordinate the efforts necessary by both the Government and Contractor to ensure an accurate collection, preparation and timely Government review of Operation and Maintenance Manual.

1.3.3 Submittal Coordination Meeting

Facilitate a meeting following submission and Government review of each design or progress submittal of the Operation and Maintenance Manual and Facility Data Workbook.

a. Include personnel from the Coordination meeting and any additional personnel identified.

b. The purpose of this meeting is to demonstrate ongoing compliance with the requirements identified in this specification. Discuss Government review comments and unresolved items preventing completion and

Government approval of the Operation and Maintenance Manuals and Facility Data Workbook (FDW).

c. The applicable deliverables, along with Government remarks associated with review of these submittals serve as the primary guide and agenda for this meeting.

1.3.4 Facility Turnover Meeting

Include Operation and Maintenance Manual in NAVFAC Red Zone (NRZ) facility turnover meetings as specified in Section 01 30 00, ADMINISTRATIVE REQUIREMENTS.

1.4 FACILITY DATA WORKBOOK

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide Facility Data Workbook as a list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

1.5 OPERATION AND MAINTENANCE MANUAL MEDIA

Assemble Operation and Maintenance Manual into an electronically bookmarked file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete bookmarked operation and maintenance directory.

1.5.1 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

a. Building Number

b. Project Title

c. Activity and Location

d. Construction Contract Number

e. Prepared For: (Contracting Agency)

f. Prepared By: (Name, title, phone number and email address)

g. Include the disk content on the disk label

h. Date

i. Virus scanning program used

1.5.2 O&M Manual Tabbed Hard Copy

Provide a hard copy of the O&M manual upon completion of the project. Provide tabs for each section and subsection for ease of navigation by the user.

1.6 O&M MANUAL CONTENT

Organize the bookmarked Operation and Maintenance Manual into the following Parts in accordance with ASHRAE GUIDELINE 1.4, and as modified and detailed below. Word template for O&M Manual is available at: www.wbdg.org/dod/ufgs/ufgs-01-78-23.

1.6.1 Part 1: Executive Summary

Provide a summary of the information found in the O&M manual including the purpose of the manual and a description of the manual's organization.

1.6.2 Part 2: Facility Design and Construction

1.6.2.1 General Facility and Systems Description

Provide an overview of the intent for design and use of the facility. Provide a PDF of the Record Drawings prepared in accordance with FC 1-300-09N and 01 78 00 CLOSEOUT SUBMITTALS and bookmarked using the sheet title and sheet number. Include uncluttered 11 by 17 inches floor plans with room numbers, type or function of space, and overall facility dimensions on the floor plans. Do not include items such as construction instructions, references, or frame numbers.

Detail the overall dimensions of the facility, number of floors, foundation type, expected number of occupants, and facility Category Code list and generally describe all the facility systems and any special building features (for example, HVAC Controls, Sprinkler Systems, Cranes, Elevators, and Generators). Include photographs marked up and labeled to show key operating components and the overall facility appearance.

1.6.2.2 Basis of Design

Provide a copy of the contract Basis of Design.

1.6.2.3 Contract Documents, RFP, Amendments, and Modifications

Provide the contract construction documents complete, to include specifications, drawings, Request for Proposal, amendments, and modifications.

1.6.2.4 Room Inventory of Real Property and Finishes

Provide a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. Include, as applicable, the following information for each piece of equipment installed: description of item, all dimensions, location by room number, model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Real property includes, but is not limited to, floor coverings, wall surfaces, ceiling surfaces, windows, roofing, HVAC filters, plumbing fixtures, and lighting fixtures. Submit the final list 30 days after transfer of the completed facility.

Include spatial data defining actual net square footage and data of each room. Also include the room finish schedule including room names and numbers. Include schedules in the construction drawings in the room inventory. Add a column to each schedule to record what was provided by

the contractor during construction. Provide a PDF of room inventory. Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

1.6.3 Part 3: Facilities, Systems, and Assemblies Information

1.6.3.1 Organization

Bookmark information in this section using the current version of ASTM E2166 Uniformat II, UFGS numbers, and document type as outlined in the example below. Bookmark/tab each item to the third level for easy navigation of the manual.

Example as shown in Table below:

PARTS AND SUBPART NUMBERING
3.1 B20 EXTERIOR CLOSURE (System)
3.1.1 B2030 EXTERIOR DOORS (Subsystem)
3.1.1.1 B2030110 GLAZED DOORS (Component)
3.1.1.1.1 Applicable specifications List in UFGS Format
3.1.1.1.2 Manufacturer's Operations and Maintenance Data
3.1.1.1.3 Approved Submittal
3.1.1.1.4 Coordination/Shop Drawings
3.1.1.1.5 Sequence of Operation for Operating Equipment
3.1.1.1.6 Testing Equipment Information and Performance Data
3.1.1.1.7 Routine Maintenance Requirements
3.1.1.1.8 Repair Procedures
3.1.1.1.9 Emergency Procedures & Locations of Applicable Controls
3.1.1.1.10 Warranties
3.1.1.1.11 Record Drawings and Utility Systems

PARTS AND SUBPART NUMBERING
3.1.1.1.12 Contractor / Supplies Listing and Contact Information

1.6.3.2 Related Specifications

Reference each specification related to the subsystem in this section, and locate the actual specification section in Part 2 of the O&M Manual. List specifications in table format as shown in the below example.

UFGS Number	Specification Title	Page Spec Begins in Part 2

1.6.3.3 Manufacturer's Operations and Maintenance Data

Provide a copy of all manufacturer specifications and cutsheets. Provide text-searchable, high-quality document files from the manufacturer's online or electronic documentation. Color documents are preferred. Provide documents specific to the product(s) installed under this Contract. Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Provide Uniformat II Level 3 identification for D20, D30, D40 installed equipment. When possible, do not submit document files containing multiple product catalogs from the same manufacturer, or product data from multiple manufacturers in the same files. Provide documents directly from the manufacturer whenever possible. Do not provide scanned copies of hardcopy documents. Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master part catalog.

1.6.3.4 Approved Submittals and Certificates

Provide a copy of all submittals documented with the required approval as applicable for each UFGS specification listed in the table outlined in applicable specifications. Include copies of SD-07 Certificates

submittals documented with the required approval, SD-08 Manufacturer's Instructions submittals documented with the required approval, and SD-10 Operation and Maintenance Data submittals documents with the required approval.

1.6.3.5 Approved Coordination/Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work. Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

1.6.4 Sequence of Operation for Operating Equipment

Provide record one-line diagrams for each floor, delineating mechanical equipment location within the building. Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.6.4.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard. Specify if any certifications or licenses are required to operate the equipment.

1.6.4.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

1.6.4.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.6.4.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

1.6.4.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.6.4.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as

lubrication, adjustment, inspection, and recording gauge readings.

1.6.4.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.6.4.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

1.6.4.9 Additional Requirements for Equipment Control Systems

Provide Data Package 5 and the following for all control systems:

a. Provide a narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Submit complete controls equipment schedules, full as-built sequence of operations, wiring and logic diagrams, Input/Output Tables, equipment schedules, copies of checkout tests and calibrations performed by the Contractor (not Cx tests), and all associates information.

c. Full points list. Provide a listing of rooms with the following information for each room:

(1) Floor

(2) Room number

(3) Room name

(4) Air handler unit ID

(5) Reference drawing number

(6) Air terminal unit tag ID

(7) Heating or cooling valve tag ID

(8) Minimum cfm

(9) Maximum cfm

d. Full print out of all schedules and set points after testing and acceptance of the system.

e. Full as-built print out of software program.

f. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.6.4.10 Testing Equipment Information and Performance Data

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.6.5 Routine Maintenance Requirements

1.6.5.1 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including requirements by type of activity. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

a. Define the anticipated time required to perform each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6.5.2 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities. Provide procedural instructions for Oil Sampling for all equipment.

c. A Lubrication Schedule showing service interval frequency.

1.6.6 Repair Procedures

Provide instructions and a list of tools required to repair or restore the

product or equipment to proper condition or operating standards. Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials. Specify if any certifications or licenses are required to repair the equipment.

1.6.6.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.6.6.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.6.6.3 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required specialty tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

1.6.6.4 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

1.6.6.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Identify if replacement of a subassembly, attachment or accessory requires the entire assembly to be replaced. Include warranty information for primary components of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.6.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.6.7 Record Drawings and Utility Systems

The record drawings are the final compilation of actual conditions reflected in the as-built drawings. Provide record drawings as outlined in 01 78 00 CLOSEOUT SUBMITTALS.

Using Record Source Drawings, show and document details of the actual installation of the utility systems, annotate and highlight the Operation and Maintenance information. Provide the following drawings at a large enough scale to differentiate designated isolation units from surrounding valves and switches.

1.6.6.8 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.6.6.9 Contractor / Supplier Listing and Contact Information

Provide a list that includes the name, address, telephone number, email and website of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.6.7 Part 4: Facility Operations

1.6.7.1 Completed Facility Operating Plan

Provide a plan that documents that procedures for the operation of systems and assemblies in the facility. The systems that should be included in the Operating Plan include, but are not limited to:

a. Electrical systems and equipment

b. Mechanical systems and equipment

c. Fire Protection systems and equipment

d. Control Systems and equipment

e. Architectural and Structural systems, fixtures, structures, and equipment

f. Vertical transportation such as elevators and escalators

1.6.7.2 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

1.6.7.3 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting

and blank test forms. Provide final set points.

1.6.7.4 Approved Field Test Reports and Manufacturer's Field Reports

Compile and provide approved Field Test Reports (SD-06) and Manufacturer's Field Reports (SD-09) submittals.

1.6.7.5 Maintenance Plans, Procedures, Checklists, Records, and Spare Parts Inventory

1.6.7.5.1 Maintenance Schedules

Include recommended maintenance schedules for systems and equipment.

1.6.7.5.2 Ongoing Commissioning Operational and Maintenance Record Keeping

Include ongoing commissioning and optimization procedures and documentation to monitor and improve the performance of facility systems.

1.6.7.5.3 Janitorial and Cleaning Plans and Procedures

Include a copy of facility cleaning and janitorial plan with procedures and intended chemicals and equipment.

Provide environmentally friendly cleaning recommendations in accordance with ASTM E1971.

1.6.7.6 Utility Record Drawings

1.6.7.6.1 Utility Schematic Diagrams

Provide a one-line schematic diagram for each utility system such as power, water, wastewater, and gas/fuel. Schematic diagram must show from the point where the utility line is connected to the mainline up to the 5 foot connection point to the facility. Indicate location or area designation for route of transmission or distribution lines; locations of duct banks, manholes/handholes or poles; isolation units such as valves and switches; and utility facilities such as pump stations, lift stations, and substations.

1.6.7.6.2 Enlarged Connection and Cutoff Plans

Provide enlarged floor plans and provide information between the 5 foot utilities connection point and where utilities connect to facility distribution. Enlarge floor plans/elevations of the rooms where the utility enters the building and indicate on these plans the locations of the main interiors and exterior connection and cutoff points for the utilities. Also enlarge floor plans/elevations of the rooms where equipment is located. Include enough information to enable someone unfamiliar with the facility to locate the connection and cutoff points. Indicate designations such as room number, panel number, circuit breaker, or valve number of each utility and equipment connection and cutoff point, and what that connection and cutoff point controls.

1.6.7.6.2.1 Description of Utility Metering and Monitoring Systems

Provide in narrative format a description of the utility metering and monitoring systems. Include locations, function, and related systems.

1.6.7.6.2.2 Procedures for Tracking Utility Use and Reporting

Procedures for usage reporting and tracking in support of establishing and monitoring utility budgets and costs, and in developing annual energy reports.

1.6.7.6.2.3 One-Line Diagrams and Meter Location of System

Provide one-line diagrams and design drawings that highlight meter locations on the site.

1.6.7.6.3 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.6.8 Part 5: Training

Provide a copy of training plans used for each type of equipment along with training materials used, arranged in specification sequence. Provide a copy of training records, sign-in sheets, and agendas. Include training and documentation on the updating and continued use of the O&M Manual.

1.6.9 Part 6: Cx Project Report and TAB Report

Provide the final Cx Plan and complete Cx reports with evaluation and testing forms and records for each building system. Include relevant commissioned system assemblies test reports including installers checklists of assemblies. Provide all Cx Progress Reports, issues and resolutions logs with resolution or status of each item, and a list of any open items and seasonal or additional testing required.

1.6.10 Part 7: Regulatory Requirements

Provide information describing regulatory and policies compliance requirements or provide a reference to where it is stored.

1.6.11 Part 8: Permits

Provide information requiring frequently asked questions and associated answers or provide a reference to where it is stored.

1.6.12 Part 9: Operations and Maintenance Manual Approval

Provide a signed document stating that the project O&M Manual has been reviewed and confirming agreement with the approach it presents. Include contact information for the signer for coordination of any future changes.

1.6.13 Part 10: Risk Category V

For equipment required to be seismically certified according to Section 26 05 48 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT, documentation demonstrating compliance with certification requirements must be maintained in a file identified as "Equipment Seismic Certification Documentation" within the O&M Manual. This file must clearly state: "Replacement or modification of seismically certified components must be approved by a qualified professional engineer according to original

certification criteria".

1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. O&M Data Packages are one of the components of the O&M Manual. The information required in each type of data package follows:

1.7.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.7.2 Data Package 1

a. Safety precautions and hazards

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Extended warranty information

f. Contractor information

g. Spare parts and supply list

1.7.3 Data Package 2

a. Safety precautions and hazards

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan, schedule, and procedures

f. Cleaning recommendations

g. Maintenance and repair procedures

h. Removal and replacement instructions

i. Spare parts and supply list

j. Parts identification

k. Warranty information

l. Extended warranty information

m. Contractor information

1.7.4 Data Package 3

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Operating log

h. Lubrication data

i. Preventive maintenance plan, schedule, and procedures

j. Cleaning recommendations

k. Troubleshooting guides and diagnostic techniques

l. Wiring diagrams and control diagrams

m. Maintenance and repair procedures

n. Removal and replacement instructions

o. Spare parts and supply list

p. Product submittal data

q. O&M submittal data

r. Parts identification

s. Warranty information

t. Extended warranty information

u. Testing equipment and special tool information

v. Testing and performance data

w. Contractor information

x. Field test reports

1.7.5 Data Package 4

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Operating log

i. Lubrication data

j. Preventive maintenance plan, schedule, and procedures

k. Cleaning recommendations

l. Troubleshooting guides and diagnostic techniques

m. Wiring diagrams and control diagrams

n. Repair procedures

o. Removal and replacement instructions

p. Spare parts and supply list

q. Repair work-hours

r. Product submittal data

s. O&M submittal data

t. Parts identification

u. Warranty information

v. Extended warranty information

w. Personnel training requirements

x. Testing equipment and special tool information

y. Testing and performance data

z. Contractor information

aa. Field test reports

1.7.6 Data Package 5

a. Safety precautions and hazards

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan, schedule, and procedures

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

q. Warranty information

r. Extended warranty information

s. Testing and performance data

t. Contractor information

u. Field test reports

v. Additional requirements for HVAC control systems

1.7.7 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the Facilities Management Specialist, building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS. Training must include classroom or field lectures based on the system operating requirements.

The location of classroom training requires approval by the Contracting Officer.

3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the Quality Control Manager (QC) prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and QC. Include within the plan the following elements:

a. Equipment included in training

b. Intended audience

c. Location of training

d. Dates of training

e. Objectives

f. Outline of the information to be presented and subjects covered including description

g. Start and finish times and duration of training on each subject

h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)

i. Instructor names and instructor qualifications for each subject

j. List of texts and other materials to be furnished by the Contractor that are required to support training

k. Description of proposed software to be used for video recording of training sessions.

3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The QC is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

b. Relevant health and safety issues.

c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.

d. Design intent.

e. Use of O&M Manual Files.

f. Review of control drawings and schematics.

g. Interactions with other systems.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

3.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

3.1.5 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

3.1.7 Quality Control Coordination

Coordinate this training with the QCin accordance with Section 01 45 00 QUALITY CONTROL.

3.2 SUBMITTAL SCHEDULING

3.2.1 Operation and Maintenance Manual, Progress Submittal

Submit the Progress submittal when construction is approximately 50 percent complete, to the Contracting Officer for approval. Provide Operation and Maintenance Manual Files (Bookmarked PDF). Include the

elements and portions of system construction completed up to this point. The purpose of this submittal is to verify progress is in accordance with contract requirements as discussed during the Operation and Maintenance Manual Coordination Meeting.

3.2.2 Operation and Maintenance Manual, Prefinal Submittal

Submit the 100 percent submittal of the Operation and Maintenance Prefinal Submittal to the Contracting Officer for approval a minimum of 90 calendar days prior to the Beneficial Occupancy Date (BOD). This submittal must provide a complete, working document that can be used to operate and maintain the facility. Any portion of the submittal that is incomplete or inaccurate requires the entire submittal to be returned for correction. Any discrepancies discovered during the Government's review of Operation and Maintenance Progress submittal must be corrected prior to the Prefinal submission. The Prefinal Submittal must include Operation and Maintenance Manual Files (Bookmarked PDF).

3.2.3 Operation and Maintenance Manual, Final Submittal

Submit completed Operation and Maintenance Manual Files (Bookmarked PDF). The Final submittal is due at BOD. Any discrepancies discovered during the Government's review of the Prefinal submittal, including the Field Verification, must be corrected prior to the Final submission.

-- End of Section --

SECTION 01 78 23.33

OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS
08/18, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA J4 Handbook	(Part IV) Federal Supply Class Assignments (Numeric and Alphabetic Listing) (http://www.dla.mil/)

1.2 CONTRACTOR RESPONSIBILITY

The Contractor is responsible for providing the technical publications specified herein for all of the components, assemblies, sub-assemblies, attachments, and accessories, required to be supplied in accordance with submittal requirements of each specification section, regardless of whether the item was manufactured and assembled in-house or obtained from other sources. The System Supplier is responsible to the Contractor for providing the technical publications specified herein for all of the components, assemblies, sub-assemblies, attachments, and accessories that the System Supplier provided.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

System Instructions; G

PART 2 PRODUCTS

2.1 DEVELOPMENT OF SUBMITTALS

2.1.1 Operation and Maintenance System Instructions (OMSI) Submittal Requirements

OMSI submittals are required in order that complete documentation can be assembled to provide the Government "Activity" with the necessary information and orientation to adequately operate and maintain the new structures/facilities of this project. Submit the OMSI documents and information specified for the equipment listed under the OMSI submittal paragraphs in each technical section. Provide copies of each Electronic Operation and Maintenance Support Information (e-OMSI) submittal to the Contracting Officer no later than 120-days prior to contract completion. In addition to requirements of this section, see Section 01 78 23

OPERATION AND MAINTENANCE DATA for additional requirements on assembly of operation and maintenance data. OMSI submittals are to be submitted separate from and in addition to Contractor's product approval submittals.

2.1.2 Assembly

Provide submittals in separate folders consistent with the Contractor's standard practice. For hard copy manufacturer's manuals or data for the components, assemblies, subassemblies, and other operating parts which are provided must be assembled into a loose-leaf notebook-type folder, indexed by major assembly and component in sequential order. Manuals must be complete in all respects for all equipment, controls, and accessories provided. In addition, provide an electronic copy of the manuals in Adobe Acrobat 11.0 or later (CD-ROM or DVD-ROM). Utilize Bookmarks to display indexing, and assembly and component requirements.

2.2 IDENTIFICATION

On each folder identify and mark as follows:

a. Inscribe on the cover, the words, "FUEL SYSTEM OPERATION AND MAINTENANCE MANUAL", the name and location of the building, and the contract number.

b. Equipment manufacturer and/or Contractor's address and telephone number; names, address and telephone numbers of each subcontractor installing equipment; and local representative for each item of equipment.

c. Volume number and title of the folder.

d. The manual must have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. Sub-divide manuals or provide separate manuals for each of the following categories.

(1) Operating Instructions
(2) Maintenance, Service, and Repair Instructions
(3) Parts Manual

PART 3 EXECUTION

3.1 OPERATING INSTRUCTIONS

The operator's instructions must include specific instructions and illustrations of the equipment operation required or recommended by the manufacturer as follows:

3.1.1 Safety

Include manufacturer's safety precautions to be observed while operating under all conditions for which the equipment was designed. Clearly list all major hazards to personnel and equipment safety that are peculiar to systems and equipment described in the manual.

3.1.2 Operator Prestart

Include instructions for prestart checks, lubrication, and service requirements necessary for setting up or preparing each system for use,

warm up procedures, and verification of normal operation. Include control diagrams with data to explain detailed operation and control of each item of the equipment.

3.1.3 Starting and Shutdown Procedures and Controls

Include a control sequence describing start up operation and provide shutdown procedures and post-shutdown requirements.

3.1.4 Normal Operating Instructions

Instructions must be sufficient to enable the mechanic to adjust, stop and start, and operate the equipment properly. Special startup precautions must be noted, as well as other items requiring action before the equipment may be put into service. Include detailed drawings indicating procedure and valve numbers and status as to normally open/closed.

3.1.5 Emergency Operating Procedures

Include action to be taken in the event of a malfunction of the unit, either to permit a short period of continued operation or to prevent further damage to the unit and to the system in which it is installed.

3.1.6 Operator Service Requirements

Include instructions for operator service requirements during operation of the equipment.

3.2 OPERATION INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor must be thoroughly familiar with all parts of the installation and must be trained in operating theory as well as practical operation and maintenance work. Instruction must be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. A minimum of 1 man-day (8-hours) of instruction must be furnished for each system specified in other sections. When more than 4 man-days of instruction are specified, approximately half of the time must be used for classroom instruction. All other time must be used for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction must be provided to acquaint the operating personnel with the changes or modifications. Government representatives must be allowed to video tape all classroom and field instructions.

3.3 MAINTENANCE, SERVICE AND REPAIR INSTRUCTIONS

The shop or maintenance manual must include manufacturer's instructions to maintain the equipment in a safe and serviceable condition. The maintenance or shop manual must contain all necessary instructions, illustrations, charges and diagrams covering, as a minimum, the items listed below.

3.3.1 Lubrication Instructions

a. Include a table showing recommended lubricants for specific

temperature ranges and applications.

b. Include chart(s) with schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities. Provide a lubrication schedule showing service interval frequency.

3.3.2 Table of Preventative Maintenance Instructions

Include frequency in time, miles or hours covering routine servicing, lubrication, and adjustments.

3.3.3 Preventative Maintenance Inspection

Points and checklist should be clearly spelled out as part of operator-type inspection in this section. Include chart with schematic diagram and/or a separate inspection checklist indicating what should be examined for wear or possible malfunction and what should be reported for repair.

3.3.4 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to enable prompt isolation of the cause of a malfunction with corrective maintenance instructions. Instructions must clearly indicate why the check out is performed and what conditions are to be sought.

3.3.5 Removal and Replacement Instructions

Provide step-by-step procedures for removal, replacement, disassembly and assembly of all components, assemblies, sub-assemblies, accessories, and attachments normally subjected to wear, damage, malfunction, and frequent replacement. These instructions should provide for a judicious combination of text and illustrations.

3.3.6 Maintenance and Repair Procedure

Provide instructions for tolerances, dimensions, settings, and adjustments normally required for performing routine maintenance servicing. Instructions must provide the necessary information to bring equipment up to the required serviceable standard when it becomes unserviceable. Include instructions for examining equipment for needed repairs and adjustment, and any tests or inspections required to determine whether or not parts must be replaced.

3.4 PARTS MANUAL

3.4.1 Contents

The parts manual must provide positive identification and coverage for all of the parts of components, assemblies, sub-assemblies, and accessories of the end item normally subject to wear, malfunctioning, damage, or loss. Include any special hardware requirements (e.g., high-strength bolts and nuts). The parts manual may cover more than one model or series or equipments, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice. Identification of the parts must be such that all parts may be ordered and centrally stocked by the government without further identification to the make, model, and serial

number of the equipment being provided.

3.4.2 Illustrations, Drawings, and/or Exploded Views

Provide clear and legible illustrations, drawings, and/or views to enable easy identification of all individual parts, components, assemblies, sub-assemblies, and accessories of the end item. Show part numbers and description on illustrations or list separately. When the illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number which will cross-reference the illustrated part to listed part. Parts shown in the listings must be grouped by components, assemblies, and sub-assemblies with individual parts identified to the assembly.

3.4.3 End Item Manufacturer's Part Numbers

Include parts for which the end item manufacturer has proprietary rights or has exercised design control, and for which the end item manufacturer is the logical supplier. The end item manufacturer must also assign numbers to purchased production parts, if such parts are altered to meet the prime manufacturer's design configuration. (Repainting, marking, or other insignificant operations are not adequate cause for use of exclusively assigned numbers).

3.4.4 Components Assemblies/Parts

Include those components assemblies/parts purchased by the end item manufacturer for which the end item manufacturer does not have control, and must be identified by the actual manufacturer's name and part numbers. Detail parts in the manufacturer's assembly, as well as attaching parts, for which the manufacturer does not have design control must also be identified by the applicable actual manufacturer's parts numbers. This paragraph does not restrict the end item manufacturer from assigning part numbers as long as the actual manufacturer's part number and the Federal Supply Code for Manufacturer (DLA J4 Handbook) or manufacturer is shown.

3.4.5 Appendices

End item manufacturer may add an appendix for cross-reference to implement components assemblies/parts requirements when implementation in manual form varies drastically with the style, format, and method of Contractor's standard commercial practice. Subject cross-referenced in an appendix will appear in the following format:

End Item Manufacturer's Alpha Numeric Seq.	Actual Manufacturer's Name and/or FCSM* from DLA J4 Handbook	Actual Manufacturer Part No.
100001	John Doe & Co. 000000	2000002
*Federal Supply Code for Manufacturers Cataloging Handbook, Name to Code		

3.5 VALIDATION

Each submittal must be validated by the Contractor or Manufacturer as being accurate and applicable to the systems and equipment provided.

3.6 SPECIFIC EQUIPMENT SUBMITTALS

The technical sections of this specification identify the specific equipment or systems for which OMSI submittals are required. This paragraph' and its subparagraph contain a general list of various types of equipment and systems together with the OMSI information required for each type. The applicable OMSI information contained in this paragraph must be submitted for each specific piece of equipment or system listed under the "OMSI Submittals" paragraph in the technical sections. Operating instructions; maintenance, service, and repair instructions; and parts manuals must conform to the requirements of their -respective paragraph herein. Provide validation in accordance with paragraph VALIDATION for all submittals.

3.6.1 Pressure Gages

a. Manufacturer's descriptive literature, general.

b. Parts manuals and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

3.6.2 Hydrant Outlet Pits, Isolation Valve Pits, High Point Vent and Low Point Drain Pits

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

e. Name, address and telephone number of the nearest manufacturer's representative.

3.6.3 Piping and Fittings

a. Certificates of Compliance.

b. Batch run numbers.

c. Manufacturer's descriptive literature, general.

d. Name address and telephone number of manufacturer.

3.6.4 Manual Valves

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specified conditions.

g. Where specified to have limit switches, control wiring diagrams showing all terminations of conductors (and all control devices) labeled to permit identification in the field; part numbers of all control devices; normally open or normally closed; voltage of all control components.

h. Name, address and telephone number of the nearest manufacturer's representative.

3.6.5 Gaskets and Isolating Gasket Kits

a. Manufacturer's descriptive literature, general.

b. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

c. Name, address and telephone number of the nearest manufacturer's representative.

3.6.6 Strainers

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

e. Name, address and telephone number of the nearest manufacturer's representative.

3.6.7 Protective Coatings

a. Manufacturer's descriptive literature, general.

b. Maintenance, service and repair instructions.

c. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

d. Name, address and telephone number of the nearest manufacturer's representative.

e. Product standards compliance and the materials system data sheet.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 78 24.00 20

FACILITY DATA WORKBOOK (FDW)
05/23, CHG 1: 11/23

PART 1 GENERAL

1.1 DEFINITIONS AND ABBREVIATIONS

1.1.1 eOMSI

Electronic Operation and Maintenance Support Information

1.1.2 Facility Data Workbook (FDW)

A Microsoft Excel file containing required facility information populated by the Contractor.

1.1.3 Systems

The words "system", "systems", and "equipment", when used in this document refer to as-built systems and equipment.

1.1.4 KTR

An abbreviation for "Contractor."

1.2 OPERATION AND MAINTENANCE MANUAL AND FACILITY DATA WORKBOOK MEETINGS

1.2.1 Pre-Construction Meeting

Meeting requirements are identified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.3 SUBMITTAL SCHEDULING

1.3.1 Facility Data Workbook (FDW), Progress Submittal

Submit the Progress submittal when construction is approximately 50 percent complete, to the Contracting Officer for approval. Provide Facility Data Workbook (Excel). Include the elements and portions of system construction completed up to this point.

The purpose of this submittal is to verify progress is in accordance with contract requirements as discussed during the Operation and Maintenance Manual and Facility Data Workbook Meetings. Field verify a portion of the eOMSI information in accordance with paragraph FIELD VERIFICATION.

1.3.2 Facility Data Workbook (FDW), Prefinal Submittal

Submit the 100 percent submittal of the FDW Prefinal Submittal to the Contracting Officer for approval within 60 calendar days of the Beneficial Occupancy Date (BOD). This submittal must provide a complete, working document that can be used to operate and maintain the facility. Any portion of the submittal that is incomplete or inaccurate requires the entire submittal to be returned for correction. Any discrepancies discovered during the Government's review of FDW Progress submittal must be corrected prior to the Prefinal submission.

1.3.3 Facility Data Workbook (FDW), Final Submittal

Submit completed Facility Data Workbook (Excel). The Final submittal is due at BOD. Any discrepancies discovered during the Government's review of the Prefinal eOMSI submittal, including the Field Verification, must be corrected prior to the Final eOMSI submission.

1.4 UNITS OF MEASURE

Provide FDW utilizing the units of measure used in the Government generated contract documents.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

Facility Data Workbook (FDW), Progress Submittal; G

Facility Data Workbook (FDW), Prefinal Submittal; G

Facility Data Workbook (FDW), Final Submittal; G

PART 2 PRODUCTS

2.1 eOMSI FACILITY DATA WORKBOOK

An initial, pre-edited draft of the Model & Facility Data Matrix tab within the Facility Data Workbook is attached to this Section. The Government will provide this Facility Data Workbook electronically to the Contractor upon award. Add, delete, and update Mastersystems, Systems, and Subsystems that may have changed during construction, or any items that may have been omitted or missed during design, at no additional cost to the Government. Complete the KTR Facility Data File tab based on the selection of Mastersystems, Systems, and Subsystems installed. The following tabs are included in the eOMSI Facility Data File Workbook and serve the purpose stated:

a. Instructions Tab: Instructions for completing Model & Facility Data Matrix Tab and KTR Facility Data File Tab. If a discrepancy exists between what is required in this Section and the Workbook, the instructions within the workbook take precedence.

b. Model & Facility Data Matrix Tab: - The Matrix lists Required Facility Asset Fields for each SYSTEM and SUBSYSTEM. The Designer of Record selects SYSTEMS and SUBSYSTEMS that are within the project scope, which the Contractor needs to include and populate in KTR Facility Data File tab. The "Required Facility Asset Field Position Numbers," one through thirty-five, are pre-populated, and are not editable.

c. Required Facility Asset Fields Tab: Defines the 35 Required Facility Asset Field Position Numbers used in Model and Facility Data Matrix and KTR Facility Data File tabs.

d. KTR Sample Facility Data File Tab: Sample KTR eOMSI facility data file. This tab provides an example of the mandatory fields of equipment installed by the Contractor, and populated in the KTR eOMSI Facility Data File Tab, along with their descriptions.

e. KTR Facility Data File Tab: Required eOMSI facility data file deliverable provided to the Government. Provide a separate and unique new row for each facility component or piece of equipment installed. Coordinate with the Government's Contracting Officer's Representative and NAVFAC PW FMD for specific facility component naming convention.

PART 3 EXECUTION

3.1 FIELD VERIFICATION

Field verify Facility Data Workbook information with Contractor and Government personnel. Include the following personnel in this meeting: Contractor's Facility Data Workbook Preparer and Quality Control Manager, and the Government's Contracting Officer's Representative and NAVFAC PW FMD. Request, and provide, an eOMSI Field Verification Meeting no sooner than 14 calendar days after submission of the Progress FDW submittal, and another, no sooner than 14 calendar days after submission of the Prefinal FDW submittal. During this meeting, the Government and Contractor will verify that the Facility Data Workbook is complete and accurate.

Field verify that at least 5 Subsystems under each of the Mastersystems are accurate, for a total of 25 Subsystems. For each of these items, verify that the required facility asset field, as defined in the "Model & Facility Data Matrix" tab, contains the specified data and it is accurate (i.e., item description, manufacturer, model no., serial no.). 100 percent accuracy of eOMSI information is required for successful field verification. If data discrepancies are discovered amongst the 25 Subsystems verified, resubmit an updated eOMSI FDW, and request a make-up field verification meeting. At the make-up field verification meeting 25 new Subsystems and their associated required facility asset fields will be field verified; the 25 new Subsystems must be 100 percent accurate. Any discrepancies discovered must be corrected prior to next eOMSI Facility Data Workbook Submittal.

(1) D10 - CONVEYING
(2) D20 - PLUMBING
(3) D30 - HVAC
(4) D40 - FIRE PROTECTION
(5) D50 - ELECTRICAL

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

					Modeling Requirements			
					DESIGN MODEL			RECORD MODEL
CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	DISCIPLINE	LOD	GRADE	GRADE
A10	**A10 - FOUNDATIONS**	**MASTERSYSTEM**	*	No	*	*	*	*
A1010	**STANDARD FOUNDATIONS**	**SYSTEM**	*	No	*	*	*	*
A1010110	A1010110 - STRIP FOOTINGS	SUBSYSTEM	LF	Yes	STRUCTURAL	300	A	A+
A1010210	A1010210 - SPREAD FOOTINGS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
A1010250	A1010250 - PILE CAPS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
A1020	**A1020 - SPECIAL FOUNDATIONS**	**SYSTEM**	*	Yes	*	*	*	*
A102005	A102005 - RAFT FOUNDATIONS	SUBSYSTEM	CY	No	STRUCTURAL	300	A	A+
A1020110	A1020110 - CIP CONCRETE PILES	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
A1020120	A1020120 - PRECAST CONCRETE PILES	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
A1020130	A1020130 - STEEL PIPE PILES	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
A1020140	A1020140 - STEEL H PILES	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
A1020160	A1020160 - TREATED WOOD PILES	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
A1020210	A1020210 - GRADE BEAMS	SUBSYSTEM	LF	Yes	STRUCTURAL	300	A	A+
A1030	**A1030 - SLAB ON GRADE**	**SYSTEM**	*	No	*	*	*	*
A1030120	A1030120 - PLAIN/REINFORCED	SUBSYSTEM	SF	Yes	STRUCTURAL	300	A	A+
A20	**A20 - BASEMENT CONSTRUCTION**	**MASTERSYSTEM**	*	No	*	*	*	*
A2010	**A2010 - BASEMENT EXCAVATION**	**SYSTEM**	*	No	*	*	*	*
A2020	**A2020 - BASEMENT WALLS**	**SYSTEM**	*	No	*	*	*	*
A2020110	A2020110 - CIP CONCRETE	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
A2020140	A2020140 - CONCRETE BLOCK	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
A2020150	A2020150 - WOOD	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
B10	**B10 - SUPERSTRUCTURE**	**MASTERSYSTEM**	*	No	*	*	*	*
B1010	**B1010 - FLOOR CONSTRUCTION**	**SYSTEM**	*	No	*	*	*	*
B1010220	B1010220 - CIP CONCRETE BEAM AND SLAB	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1010238	B1010238 - PRECAST CONCRETE BEAM AND PLANK	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1010244	B1010244 - LIGHT GAUGE STEEL FLOOR SYSTEM	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1010250	B1010250 - COMPOSITE DECK, STEEL BAR JOISTS	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1010254	B1010254 - COMP DECK, STRUCTURAL STEEL BEAM	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1010264	B1010264 - WOOD BEAM, JOIST, AND DECK	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1010998	B1010998 - EXTERIOR STAIRS	SUBSYSTEM	FLIGHT	No	STRUCTURAL	300	A	A+
B1020	**B1020 - ROOF CONSTRUCTION**	**SYSTEM**	*	No	*	*	*	*
B1020102	B1020102 - WOOD DECK AND RAFTER	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1020108	B1020108 - STEEL DECK, BEAMS AND BAR JOIST	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1020122	B1020122 - CIP CONCRETE ROOF CONSTRUCTION	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1020137	B1020137 - AWNING/CANOPY	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1020901	B1020901 - CIP CONCRETE BEAM AND SLAB	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1020902	B1020902 - PRECAST CONCRETE BEAM AND PLANK	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B1030	**B1030 - ROOF CONSTRUCTION**	**SYSTEM**	*	No	*	*	*	*
B103001	B103001 - METAL STRUCTURAL FRAME	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
B20	**B20 - EXTERIOR ENCLOSURE**	**MASTERSYSTEM**	*	No	*	*	*	*
B2010	**B2010 - EXTERIOR WALLS**	**SYSTEM**	*	No	*	*	*	*
B2010101	B2010101 - CIP CONCRETE	SUBSYSTEM	SF	Yes	STRUCTURAL	300	A	A+
B2010104	B2010104 - PRECAST CONCRETE PANEL (RIBBED)	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B2010106	B2010106 - PRECAST CONCRETE PANEL (TILT UP)	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B2010109	B2010109 - CONCRETE BLOCK	SUBSYSTEM	SF	Yes	STRUCTURAL	300	A	A+
B2010125	B2010125 - SOLID BRICK - SINGLE WYTHE	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B2010126	B2010126 - SOLID BRICK - DOUBLE WYTHE	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B2010128	B2010128 - STONE VENEER W/STUD BACKUP	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2010130	B2010130 - BRICK VENEER W/STUD BACKUP	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2010132	B2010132 - MASONRY COMPOSITE	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
B2010134	B2010134 - MASONRY CAVITY	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2010140	B2010140 - GLASS BLOCK	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2010146	B2010146 - METAL SIDING PANEL	SUBSYSTEM	SF	Yes	ARCHITECTURAL	300	A	A+
B2010148	B2010148 - WOOD CLADDING W/STUD BACKUP	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2010151	B2010151 - STUCCO WALL	SUBSYSTEM	SF	Yes	ARCHITECTURAL	300	A	A+
B2010152	B2010152 - E.I.F.S.	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2020	**B2020 - EXTERIOR GLAZED OPENINGS**	**SYSTEM**	*	Yes	*	*	*	*
B2020102	B2020102 - WOOD WINDOWS	SUBSYSTEM	EA	Yes	ARCHITECTURAL	300	A	A+
B2020104	B2020104 - STEEL WINDOWS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
B2020106	B2020106 - ALUMINUM WINDOWS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
B2020210	B2020210 - TUBULAR ALUMINUM FRAMING	SUBSYSTEM	SF	Yes	ARCHITECTURAL	300	A	A+
B2020220	B2020220 - CURTAIN WALL PANELS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2030	**B2030 - EXTERIOR DOORS**	**SYSTEM**	*	No	*	*	*	*
B2030110	B2030110 - GLAZED DOORS	SUBSYSTEM	EA	Yes	ARCHITECTURAL	300	A	A+
B2030210	B2030210 - WOOD DOORS	SUBSYSTEM	EA	Yes	ARCHITECTURAL	300	A	A+
B2030220	B2030220 - STEEL DOORS	SUBSYSTEM	EA	Yes	ARCHITECTURAL	300	A	A+
B2030230	B2030230 - ALUMINUM DOORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
B2030410	B2030410 - OVERHEAD DOORS	SUBSYSTEM	EA	Yes	ARCHITECTURAL	300	A	A+
B2030901	B2030901 - HANGAR DOORS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B2030902	B2030902 - BLAST RESISTANT DOORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
B30	**B30 - ROOFING**	**MASTERSYSTEM**	*	No	*	*	*	*
B3010	**B3010 - ROOF COVERING**	**SYSTEM**	*	No	*	*	*	*
B3010105	B3010105 - BUILT-UP	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
B3010120	B3010120 - SINGLE PLY MEMBRANE	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
B3010130	B3010130 - PREFORMED METAL	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
B3010135	B3010135 - FORMED METAL	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
B3010140	B3010140 - SHINGLE TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
B3010320	B3010320 - ROOF DECK INSULATION	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
B3010610	B3010610 - GUTTERS	SUBSYSTEM	LF	No	ARCHITECTURAL	200	A	A+
B3010620	B3010620 - DOWNSPOUTS	SUBSYSTEM	LF	No	ARCHITECTURAL	200	A	A+
B3020	**B3020 - ROOF OPENING**	**SYSTEM**	*	No	*	*	*	*
B3020110	B3020110 - SKYLIGHTS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
B3020210	B3020210 - HATCHES	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C10	**C10 - INTERIOR CONSTRUCTION**	**MASTERSYSTEM**	*	No	*	*	*	*
C1010	**C1010 - PARTITIONS**	**SYSTEM**	*	No	*	*	*	*
C1010102	C1010102 - CONCRETE BLOCK	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
C1010120	C1010120 - TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
C1010126	C1010126 - DRYWALL W/STUD FRAMING	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
C1010140	C1010140 - PLASTER W/STUD FRAMING	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+
C1010710	C1010710 - INTERIOR WINDOWS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020	**C1020 - INTERIOR DOORS**	**SYSTEM**	*	No	*	*	*	*
C1020102	C1020102 - SPECIAL DOORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020111	C1020111 - FIRE DOOR, SWINGING	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020112	C1020112 - FIRE DOOR, SLIDING	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020113	C1020113 - FIRE DOOR, ROLLING SERVICE/ROLL-UP	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020114	C1020114 - METAL DOOR	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020120	C1020120 - WOOD DOOR/WOOD FRAME	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020122	C1020122 - WOOD DOOR/METAL FRAME	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020124	C1020124 - WOOD FIRE DOORS/METAL FRAMES	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1020301	C1020301 - BLAST RESISTANT DOOR	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1030	**C1030 - FITTINGS**	**SYSTEM**	*	No	*	*	*	*
C1030110	C1030110 - TOILET PARTITIONS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1030310	C1030310 - LOCKERS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
C1030830	C1030830 - CABINETS	SUBSYSTEM	LF	No	ARCHITECTURAL	300	A	A+
C1030831	C1030831 - COUNTERTOP	SUBSYSTEM	LF	No	ARCHITECTURAL	300	A	A+
C20	**C20 - STAIRS**	**MASTERSYSTEM**	*	No	*	*	*	*
C2010	**C2010 - STAIR CONSTRUCTION**	**SYSTEM**	*	No	*	*	*	*
C2010110	C2010110 - STAIRS	SUBSYSTEM	FLIGHT	No	ARCHITECTURAL	300	A	A+
C2020	**C2020 - STAIR FINISHES**	**SYSTEM**	*	No	*	*	*	*
C30	**C30 - INTERIOR FINISHES**	**MASTERSYSTEM**	*	No	*	*	*	*
C3010	**C3010 - WALL FINISHES**	**SYSTEM**	*	No	*	*	*	*
C3010230	C3010230 - WALL COVERING	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3010380	C3010380 - WALL TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020	**C3020 - FLOORING**	**SYSTEM**	*	No	*	*	*	*
C3020901	C3020901 - CARPET	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020902	C3020902 - CARPET TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020903	C3020903 - COMPOSITION SHEET	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020904	C3020904 - CONCRETE TOPPING	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020905	C3020905 - WOOD	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020906	C3020906 - TERRAZZO	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020907	C3020907 - VINYL TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020908	C3020908 - CORK TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020909	C3020909 - RUBBER SHEET	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020910	C3020910 - PORCELAIN TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020911	C3020911 - QUARRY TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020912	C3020912 - PAINT	SUBSYSTEM	SF	Yes	ARCHITECTURAL	100	B	B+
C3020913	C3020913 - MARBLE TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020914	C3020914 - CERAMIC TILE	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3020915	C3020915 - ACCESS FLOORING	SUBSYSTEM	SF	No	ARCHITECTURAL	100	B	B+
C3030	**C3030 - CEILING FINISHES**	**SYSTEM**	*	No	*	*	*	*
C3030105	C3030105 - PLASTER	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
C3030110	C3030110 - DRYWALL	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
C3030210	C3030210 - ACOUSTICAL	SUBSYSTEM	SF	No	ARCHITECTURAL	200	A	A+
C3040	**C3040 - INTERIOR FINISH ASSEMBLIES**	**SYSTEM**	*	No	*	*	*	*
D10	**D10 - CONVEYING**	**MASTERSYSTEM**	*	No	*	*	*	*
D1010	**D1010 - ELEVATORS AND LIFTS**	**SYSTEM**	*	No	*	*	*	*
D1010110	D1010110 - HYDRAULIC ELEVATORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1010140	D1010140 - TRACTION GEARED ELEVATORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1010150	D1010150 - TRACTION GEARLESS ELEVATORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1010160	D1010160 - CABLE DRUM ELEVATOR	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1010200	D1010200 -	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1010250	D1010250 - ACCESSIBILITY LIFTS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1010300	D1010300 - MATERIAL LIFTS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1010901	D1010901 - LIFTS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1020	**D1020 - ESCALATORS AND MOVING WALKS**	**SYSTEM**	*	No	*	*	*	*
D1020110	D1020110 - ESCALATORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1020210	D1020210 - MOVING WALKS	SUBSYSTEM	LF	No	ARCHITECTURAL	300	A	A+
D1090	**D1090 - OTHER CONVEYING SYSTEMS**	**SYSTEM**	*	No	*	*	*	*
D1090901	D1090901 - CONVEYORS	SUBSYSTEM	LF	No	ARCHITECTURAL	300	A	A+
D1090902	D1090902 - CRANES AND HOISTS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+
D1090903	D1090903 - PNEUMATIC TUBE SYSTEM	SUBSYSTEM	LF	No	ARCHITECTURAL	300	A	A+
D20	**D20 - PLUMBING**	**MASTERSYSTEM**	*	No	*	*	*	*
D2010	**D2010 - PLUMBING FIXTURES**	**SYSTEM**	*	No	*	*	*	*
D2010110	D2010110 - TOILET	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010210	D2010210 - URINAL	SUBSYSTEM	EA	No	PLUMBING	300	A	A+

Required Facility Asset Fields

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
AssetNum	Change Date	Description	Long Description	MASTERSYSTEM	SYSTEM	SUBSYSTEM	Building Number	Site ID	Work Center	Asset Type	Asset Quantity	Inventory Category	Purchase Price	Budgeted Cost	Replacement Cost	Meter Group	Belongs to (Parent)	Contract Number	Task/Delivery Order Number	Drawing Reference ID	Warranty Expiration Date	Status Date	Installation Date	Asset Status	Classstructureid	Job Plan Code	Equipment Tag Number	Additional Location Information	Manufacturer	Model	Serial #	Asset Comment	PM Plan	PM Program

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

					Modeling Requirements			
					DESIGN MODEL			RECORD MODEL
CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	DISCIPLINE	LOD	GRADE	GRADE
D2010310	D2010310 - LAVATORY	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010410	D2010410 - SINK	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010430	D2010430 - LABORATORY SINK	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010510	D2010510 - BATHTUB	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010610	D2010610 - GROUP WASH FOUNTAIN	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010710	D2010710 - SHOWER	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010810	D2010810 - DRINKING FOUNTAIN	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010820	D2010820 - WATER COOLER	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010901	D2010901 - EMERGENCY SHOWER	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010902	D2010902 - EMERGENCY EYE WASH	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2010903	D2010903 - BIDET	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020	**D2020 - DOMESTIC WATER DISTRIBUTION**	**SYSTEM**	•	No	•	•	A	A+
D2020210	D2020210 - WATER HEATERS, RESIDENTIAL, ELEC	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020220	D2020220 - WATER HEATERS, RESIDENTIAL, GAS	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020230	D2020230 - WATER HEATERS, RESIDENTIAL, OIL	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020240	D2020240 - WATER HEATERS, COMMERCIAL, ELEC	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020250	D2020250 - WATER HEATERS, COMMERCIAL, GAS	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020260	D2020260 - WATER HEATERS, COMMERCIAL, OIL	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020901	D2020901 - BOOSTER PUMP	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020902	D2020902 - STORAGE TANK	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020903	D2020903 - BACKFLOW PREVENTER	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020904	D2020904 - HEAT TRANSFER PACKAGE	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2020905	D2020905 - PIPING/FITTINGS	SUBSYSTEM	LF	No	PLUMBING	300	A	A+
D2020906	D2020906 - CIRCULATING PUMP	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2030	**D2030 - SANITARY WASTE**	**SYSTEM**	•	No	•	•	•	•
D2030901	D2030901 - SANITARY WASTE SEPARATOR	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2030902	D2030902 - WASTE/VENT PIPING	SUBSYSTEM	LF	No	PLUMBING	300	A	A+
D2030905	D2030905 - SUMP PUMP	SUBSYSTEM	EA	No	PLUMBING	300	A	A+
D2040	**D2040 - RAIN WATER DRAINAGE**	**SYSTEM**	•	No	•	•	•	•
D2040210	D2040210 - ROOF DRAINS	SUBSYSTEM	LF	No	PLUMBING	300	A	A+
D2090	**D2090 - OTHER PLUMBING SYSTEMS**	**SYSTEM**	•	No	•	•	•	•
D30	**D30 - HVAC**	**MASTERSYSTEM**	•	No	•	•	•	•
D3010	**D3010 - ENERGY SUPPLY**	**SYSTEM**	•	No	•	•	•	•
D3020	**D3020 - HEAT GENERATING SYSTEMS**	**SYSTEM**	•	No	•	•	•	•
D3020126	D3020126 - BOILER, ELECTRIC, HOT WATER	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020128	D3020128 - BOILER, ELECTRIC, STEAM	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020130	D3020130 - BOILER CAST IRON HOT WATER GAS	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020134	D3020134 - BOILER, CAST IRON, STEAM, GAS	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020136	D3020136 - BOILER, CAST IRON HT WTR GAS/OIL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020138	D3020138 - BOILER, CAST IRON, STEAM GAS/OIL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020311	D3020311 - BOILER FUEL OIL PUMP	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020901	D3020901 - BOILER, CAST IRON, HT WTR, OIL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020902	D3020902 - BOILER, CAST IRON, STEAM, OIL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020903	D3020903 - BOILER, SOLID FUEL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020904	D3020904 - BOILER FEEDWATER TANK	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020905	D3020905 - FURNACE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3020906	D3020906 - EXPANSION TANK	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030	**D3030 - COOLING GENERATING SYSTEMS**	**SYSTEM**	•	No	•	•	•	•
D3030120	D3030120 - CHILLER, SCROLL, AIR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030125	D3030125 - CHILLER, SCROLL, WATER COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030130	D3030130 - CHILLER, RECIP, WATER COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030135	D3030135 - CHILLER, RECIP, AIR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030140	D3030140 - CHILLER, CENTRIFUGAL, WTR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030145	D3030145 - CHILLER, GAS ABSO, WTR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030150	D3030150 - CHILLER, STEAM ABSO, WTR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030160	D3030160 - CHILLER, SCREW, AIR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030165	D3030165 - CHILLER, SCREW, WATER COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030221	D3030221 - CONDENSING UNIT, AIR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030222	D3030222 - CONDENSING UNIT, WATER COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030223	D3030223 - SPLIT DUCTLESS HEAT PUMP , OUTDOOR UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030223	D3030223 - SPLIT DUCTLESS UNIT, OUTDOOR UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030224	D3030224 - SPLIT SYSTEM HEAT PUMP , OUTDOOR UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030225	D3030225 - SPLIT DUCTLESS HEAT PUMP , OUTDOOR UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030310	D3030310 - COOLING TOWER, GALVANIZED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030320	D3030320 - COOLING TOWER, FIBERGLASS	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030330	D3030330 - COOLING TOWER, STAINLESS STEEL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030901	D3030901 - CONDENSER, DX, AIR COOLED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030902	D3030902 - CONDENSER, DX, EVAPORATIVE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3030903	D3030903 - PACKAGED DX REFRIGERANT SYSTEM	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040	**D3040 - DISTRIBUTION SYSTEMS**	**SYSTEM**	•	No	•	•	A	A+
D3040106	D3040106 - AIR HANDLING UNIT, FIELD FAB	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040110	D3040110 - AIR HANDLING UNIT, CENTRAL STA	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040114	D3040114 - AIR HANDLING UNIT, ROOFTOP	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040118	D3040118 - FAN COIL A/C, CAB MNT, TWO PIPE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040122	D3040122 - FAN COIL A/C, CAB MNT, FOUR PIPE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040124	D3040124 - FAN COIL A/C, DUCT MOUNT, 2 PIPE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040128	D3040128 - FAN COIL A/C, DUCT MOUNT, 4 PIPE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040132	D3040132 - VAV TERMINAL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040136	D3040136 - VAV TERMINAL, FAN POWERED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040220	D3040220 - FAN SYSTEM, CENTRIFUGAL IN-LINE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040230	D3040230 - FAN SYSTEM, UTILITY SET	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040240	D3040240 - FAN SYSTEM, ROOF EXHAUST	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040250	D3040250 - COMM/IND VACUUM DUST COLLECTION	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040260	D3040260 - KITCHEN EXHAUST/MAKE-UP AIR	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040312	D3040312 - CONDENSATE RETURN PUMP	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040313	D3040313 - CONDENSATE RETURN PUMP, DUPLEX	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040330	D3040330 - CIRCULATING PUMP, END SUCTION	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040340	D3040340 - CIRCULATING PUMP, DOUBLE SUCTION	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040610	D3040610 - HEAT EXCHANGER, PLATE TYPE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040620	D3040620 - HEAT EXCHANGER, SHELL TUBE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040901	D3040901 - DEHUMIDIFIER	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040902	D3040902 - HUMIDIFIER	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040903	D3040903 - FAN COIL A/C, DX	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040904	D3040904 - SPLIT DUCTLESS SYSTEM, INDOOR UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3040905	D3040905 - SPLIT SYSTEM HEAT PUMP, INDOOR UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050	**D3050 - TERMINAL & PACKAGE UNITS**	**SYSTEM**	•	No	•	•	•	•
D3050120	D3050120 - UNIT HEATERS, GAS	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050130	D3050130 - UNIT HEATERS, HYDRONIC	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050170	D3050170 - SPLIT SYSTEMS AIR COOLED CONDENSE UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050175	D3050175 - ROOFTOP A/C	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050176	D3050176 - ROOFTOP AIR CONDITIONER, ELECTRIC HEAT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050178	D3050178 - ROOFTOP AIR CONDITIONER, HOT WATER HEAT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050179	D3050179 - ROOFTOP AIR CONDITIONER, STEAM HEAT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050185	D3050185 - COMPUTER ROOM COOLING UNITS	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050201	D3050201 - PKG A/C, AIR COOLED, ELEC HEAT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050203	D3050203 - PKG A/C, AIR COOLED, HW HEAT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050210	D3050210 - PKG A/C, WATER COOLED, ELEC HEAT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050220	D3050220 - PKG A/C, WATER COOLED, HW HEAT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050230	D3050230 - HEAT PUMP, WTR SOURCE, CENT STA	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050235	D3050235 - HEAT PUMP, WATER SOURCE, CONSOLE	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050240	D3050240 - HEAT PUMP, DUCT MNT, HORIZONTAL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050245	D3050245 - HEAT PUMP, AIR/AIR, ROOF TOP	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050255	D3050255 - THRU-WALL A/C UNIT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050260	D3050260 - THRU-WALL HEAT PUMP	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050330	D3050330 - PACKAGE TERMINAL AIR CONDITIONER (PTAC)	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050340	D3050340 - PACKAGE TERMINAL HEAT PUMP (PTHP)	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050530	D3050530 - BASEBOARD HEATING	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050901	D3050901 - UNIT HEATERS, ELECTRIC	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050902	D3050902 - UNIT HEATER, INFRARED	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050904	D3050904 - SMOKE VENTS	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3050905	D3050905 - HYDRONIC HEATING - FIN TUBE	SUBSYSTEM	LF	No	MECHANICAL	300	A	A+
D3060	**D3060 - CONTROLS & INSTRUMENTATION**	**SYSTEM**	•	No	•	•	•	•
D3060901	D3060901 - HVAC CONTROLS, ELECTRIC, DIGITAL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3060902	D3060902 - HVAC CONTROLS, PNUEMATIC	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3060903	D3060903 - AIR COMPRESSOR	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3060904	D3060904 - AIR DRYER	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3060905	D3060905 - DIRECT DIGITAL CONTROL (DDC) SYSTEM	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3090	**D3090 - OTHER HVAC SYSTEMS & EQUIPMENT**	**SYSTEM**	•	No	•	•	•	•
D3090220	D3090220 - ENERGY RECOVERY WHEEL	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3090310	D3090310 - FUME HOOD EXHAUST SYSTEM	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3090320	D3090320 - GARAGE EXHAUST SYSTEMS	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3090901	D3090901 - INDUSTRIAL EXHAUST SYSTEM	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3090902	D3090902 - CHEMICAL FEEDWATER	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
D3090903	D3090903 - AIR CURTAIN	SUBSYSTEM	LF	No	MECHANICAL	300	A	A+
D40	**D40 - FIRE PROTECTION**	**MASTERSYSTEM**	•	No	•	•	•	•
D4010	**D4010 - SPRINKLERS**	**SYSTEM**	•	No	•	•	•	•
D4010310	D4010310 - DRY PIPE SYSTEMS	SUBSYSTEM	SF	No	FIRE	300	A	A+
D4010350	D4010350 - PREACTION SYSTEMS	SUBSYSTEM	SF	No	FIRE	300	A	A+
D4010370	D4010370 - DELUGE SYSTEMS	SUBSYSTEM	SF	No	FIRE	300	A	A+
D4010390	D4010390 - FIRECYCLE SYSTEMS	SUBSYSTEM	SF	No	FIRE	300	A	A+
D4010410	D4010410 - WET PIPE SYSTEMS	SUBSYSTEM	SF	No	FIRE	300	A	A+
D4010905	D4010905 - FIRE PUMP, ELECTRIC MOTOR DRIVEN	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4010906	D4010906 - FIRE PUMP, ENGINE DRIVEN	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4010907	D4010907 - JOCKEY PUMP	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4010908	D4010908 - AIR COMPRESSOR	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4020	**D4020 - STANDPIPES**	**SYSTEM**	•	No	•	•	•	•
D4020310	D4020310 - RISER	SUBSYSTEM	FLOOR	No	FIRE	300	A	A+
D4030	**D4030 - FIRE PROTECTION SPECIALTIES**	**SYSTEM**	•	No	•	•	•	•
D4090	**D4090 - OTHER FIRE PROTECTION SYSTEMS**	**SYSTEM**	•	No	•	•	•	•
D4090901	D4090901 - CARBON DIOXIDE EXTINGUISHING SYS	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4090902	D4090902 - HOOD FIRE PROTECTION	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4090903	D4090903 - BACKFLOW PREVENTER	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4090904	D4090904 - FIRE PUMPS	SUBSYSTEM	EA	No	FIRE	300	A	A+
D4090920	D4090920 - CLEAN AGENT EXTINGUISHING SYSTEM	SUBSYSTEM	SF	No	FIRE	300	A	A+
D50	**D50 - ELECTRICAL**	**MASTERSYSTEM**	•	No	•	•	•	•
D5010	D5010 - ELECTRICAL SERVICE & DISTRIBUTION	SYSTEM	•	No	•	•	•	•

Required Facility Asset Fields

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
AssetNum	Change Date	Description	Long Description	MASTERSYSTEM	SYSTEM	SUBSYSTEM	Building Number	Site ID	Work Center	Asset Type	Asset Quantity	Inventory Category	Purchase Price	Budgeted Cost	Replacement Cost	Meter Group	Belongs to (Parent)	Contract Number	Task/Delivery Order Number	Drawing Reference ID	Warranty Expiration Date	Status Date	Installation Date	Asset Status	Classstructureid	Job Plan Code	Equipment Tag Number	Additional Location Information	Manufacturer	Model	Serial #	Asset Comment	PM Plan	PM Program

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	Modeling Requirements: DESIGN MODEL DISCIPLINE	DESIGN MODEL LOD	DESIGN MODEL GRADE	RECORD MODEL GRADE	Required Facility Asset Fields: 1 AssetNum	2 Change Date	3 Description	4 Long Description	5 MASTERSYSTEM	6 SYSTEM	7 SUBSYSTEM	8 Building Number	9 Site ID	10 Work Center	11 Asset Type	12 Asset Quantity	13 Inventory Category	14 Purchase Price	15 Budgeted Cost	16 Replacement Cost	17 Meter Group	18 Belongs to (Parent)	19 Contract Number	20 Task/Delivery Order Number	21 Drawing Reference ID	22 Warranty Expiration Date	23 Status Date	24 Installation Date	25 Asset Status	26 Classstructureid	27 Job Plan Code	28 Equipment Tag Number	29 Additional Location Information	30 Manufacturer	31 Model	32 Serial #	33 Asset Comment	34 PM Plan	35 PM Program
D5010120	D5010120 - ELECTRICAL SERVICE	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5010240	D5010240 - SWITCHGEAR	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5010901	D5010901 - TRANSFER SWITCH	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5010902	D5010902 - TRANSFORMER	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5010903	D5010903 - MOTOR CONTROL CENTER	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5010905	D5010905 - CAPACITOR BANK	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5010906	D5010906 - PANELBOARDS	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5020	**D5020 - LIGHTING & BRANCH WIRING**	**SYSTEM**	*	No	*	*	*	*																																				
D5020120	D5020120 - ELECTRICAL DISTRIBUTION	SUBSYSTEM	SF	No	ELECTRICAL	200	A	A+																																				
D5020248	D5020248 - INTERIOR LIGHTING, FLUORECENT	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5020250	D5020250 - INTERIOR LIGHTING, INCANDESCENT	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5020252	D5020252 - INTERIOR LIGHTING, HIGH INT	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5020901	D5020901 - EXIT LIGHTING	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5020902	D5020902 - EXPLOSION PROOF LIGHTING	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5020903	D5020903 - EXTERIOR LIGHTING	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5030	**D5030 - COMMUNICATION AND SECURITY**	**SYSTEM**	*	No	*	*	*	*																																				
D5030910	D5030910 - COMMUNICATION/ALARM SYSTEMS	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5030911	D5030911 -	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5030930	D5030930 - MASTER BOX	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5090	**D5090 - OTHER ELECTRICAL SYSTEMS**	**SYSTEM**	*	No	*	*	*	*																																				
D5090210	D5090210 - GENERATORS	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5090901	D5090901 - EMERGENCY LIGHTING	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
D5090902	D5090902 - LIGHTNING PROTECTION (ARRESTERS)	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5090903	D5090903 - GROUNDING SYSTEM	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+																																				
D5090904	D5090904 - UNINTERUPTIBLE POWER SUPPLY	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+																																				
E10	**E10 - EQUIPMENT**	**MASTERSYSTEM**	*	No	*	*	*	*																																				
E1010	**E1010 - COMMERCIAL EQUIPMENT**	**SYSTEM**	*	No	*	*	*	*																																				
E1010220	E1010220 - CONDENSING UNIT, AIR COOLED	SUBSYSTEM	EA	No	ARCHITECTURAL	200	A	A+																																				
E1010901	E1010901 - CONDENSER, DX, AIR COOLED	SUBSYSTEM	EA	No	ARCHITECTURAL	200	A	A+																																				
E1010910	E1010910 - REFRIGERATOR/FREEZER WALK-IN BOX	SUBSYSTEM	EA	No	ARCHITECTURAL	200	A	A+																																				
E1020	**E1020 - INSTITUTIONAL EQUIPMENT**	**SYSTEM**	*	No	*	*	*	*																																				
E1030	**E1030 - VEHICULAR EQUIPMENT**	**SYSTEM**	*	No	*	*	*	*																																				
E1030110	E1030110 - VEHICULAR SERVICE EQUIPMENT	SUBSYSTEM	EA	No	ARCHITECTURAL	200	A	A+																																				
E1030111	E1030111 - AIR COMPRESSOR	SUBSYSTEM	EA	No	ARCHITECTURAL	200	A	A+																																				
E1030112	E1030112 - AIR DRYER	SUBSYSTEM	EA	No	ARCHITECTURAL	200	A	A+																																				
E1030310	E1030310 - LOADING DOCK EQUIPMENT	SUBSYSTEM	EA	No	ARCHITECTURAL	200	A	A+																																				
E1040	**E1040 - INDUSTRIAL PROCESS EQUIPMENT**	**SYSTEM**	*	No	*	*	*	*																																				
E1059	E1059 - OTHER EQUIPMENT	SYSTEM	*	No	*	*	*	*																																				
E20	**E20 - FURNISHINGS**	**MASTERSYSTEM**	*	No	*	*	*	*																																				
E2010	**E2010 - FIXED FURNISHINGS**	**SYSTEM**	*	No	*	*	*	*																																				
E2020	**E2020 - MOVEABLE FURNISHINGS**	**SYSTEM**	*	No	*	*	*	*																																				
E202002	E202002 - MODULAR PREFABRICATED FURNITURE	SUBSYSTEM	EA	No	INTERIORS	200	C	-																																				
F10	**F10 - SPECIAL CONSTRUCTION**	**MASTERSYSTEM**	*	No	*	*	*	*																																				
F1010	**F1010 - SPECIAL STRUCTURES**	**SYSTEM**	*	No	*	*	*	*																																				
F101001	F101001 - PRE-ENGINEERED STRUCTURES	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F101001.01	F101001.01 - K-SPAN BUILT STRUCTURES	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F101003	F101003 - AIR SUPPORTED STRUCTURES	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+																																				
F101099.01	F101099.01 - PAINT BOOTH	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+																																				
F101099.02	F101099.02 - PORTABLE OFFICE UNITS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+																																				
F1020	**F1020 - INTEGRATED CONSTRUCTION**	**SYSTEM**	*	No	*	*	*	*																																				
F102001	F102001 - SPECIAL PURPOSE ROOMS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F102002	F102002 - INTEGRATED ASSEMBLIES	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F1030	**F1030 - SPECIAL CONSTRUCTION SYSTEMS**	**SYSTEM**	*	No	*	*	*	*																																				
F103001	F103001 - VAULTS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F103002	F103002 - SOUND VIBRATION AND SEISMIC CONSTRUCTION	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F103003	F103003 - RADIATION PROTECTION	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F1040	**F1040 - SPECIAL FACILITIES**	**SYSTEM**	*	No	*	*	*	*																																				
F104001	F104001 - INTERIOR SWIMMING POOLS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F104002	F104002 - LIQUID AND GAS STORAGE TANKS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+																																				
F104003	F104003 - KENNELS AND ANIMAL SHELTERS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F104004	F104004 - SITE CONSTRUCTED INCINERATORS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+																																				
F104005	F104005 - ICE RINKS	SUBSYSTEM	SF	No	ARCHITECTURAL	300	A	A+																																				
F1050	**F1050 - SPECIAL CONTROLS AND INSTRUMENTATION**	**SYSTEM**	*	No	*	*	*	*																																				
F105001	F105001 - RECORDING INSTRUMENTATION	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+																																				
F105002	F105002 - BUILDING AUTOMATION SYSTEMS	SUBSYSTEM	EA	No	ARCHITECTURAL	300	A	A+																																				
F20	**F20 - SELECTIVE BUILDING DEMOLITION**	**MASTERSYSTEM**	*	No	*	*	*	*																																				
F2010	**F2010 - BUILDING ELEMENTS DEMOLITION**	**SYSTEM**	*	No	*	*	*	*																																				
F201001	F201001 - SUBSTRUCTURE AND SUPERSTRUCTURE	SUBSYSTEM	LS	No	STRUCTURAL	200	C	C+																																				
F201002	F201002 - EXTERIOR ENCLOSURE	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F201003	F201003 - ROOFING	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F201004	F201004 - INTERIOR CONSTRUCTION AND FINISHES	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F201005	F201005 - CONVEYING SYSTEMS	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F201006	F201006 - MECHANICAL SYSTEMS	SUBSYSTEM	LS	No	MECHANICAL	200	C	C+																																				
F201007	F201007 - ELECTRICAL SYSTEMS	SUBSYSTEM	LS	No	ELECTRICAL	200	C	C+																																				
F201008	F201008 - EQUIPMENT AND FURNISHINGS	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F2020	**F2020 - DEMOLITION COMPONENTS & SUPERSTRUCTURE**	**SYSTEM**	*	No	*	*	*	*																																				
F202001	F202001 - SUBSTRUCTURE AND SUPERSTUCUTRE	SUBSYSTEM	LS	No	STRUCTURAL	200	C	C+																																				
F202002	F202002 - EXTERIOR ENCLOSURE	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F202003	F202003 - ROOFING	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F202004	F202004 - INTERIOR CONSTRUCTION AND FINISHES	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F202005	F202005 - CONVEYING SYSTEMS	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F202006	F202006 - MECHANICAL SYSTEMS	SUBSYSTEM	LS	No	MECHANICAL	200	C	C+																																				
F202007	F202007 - ELECTRICAL SYSTEMS	SUBSYSTEM	LS	No	ELECTRICAL	200	C	C+																																				
F202008	F202008 - EQUIPMENT AND FURNISHINGS	SUBSYSTEM	LS	No	ARCHITECTURAL	200	C	C+																																				
F30	**F30 - BUILDING SERVICES**	**MASTERSYSTEM**	*	No	*	*	*	*																																				
F3010	**F3010 - JANITORIAL SERVICES**	**SYSTEM**	*	No	*	*	*	*																																				
F301010	F301010 - JANITORIAL SERVICES	SUBSYSTEM	SF	No	N/A	-	-	-																																				
G20	**G20 - SITE IMPROVEMENTS**	**MASTERSYSTEM**	*	No	*	*	*	*																																				
G2010	**G2010 - PAVEMENTS**	**SYSTEM**	*	No	*	*	*	*																																				
G201002.01	G201002.01 - CURBS AND GUTTERS	SUBSYSTEM	CY	No	CIVIL	300	A	A+																																				
G201002.02	G201002.02 - DRAINS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201003.01	G201003.01 - FLEXIBLE ASPHALT PAVEMENTS	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G201003.02	G201003.02 - RIGID CONCRETE PAVEMENTS	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G201004	G201004 - MARKINGS AND SIGNAGE	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201005	G201005 - GUARDRAILS AND BARRIERS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201005.01	G201005.01 - VEHICLE CRASH BARRIER	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201005.02	G201005.02 - VEHICLE CRASH BEAM	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201005.03	G201005.03 - VEHICLE RETRACTABLE BOLLARDS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201005.04	G201005.04 - VEHICLE TRAFFIC ARM	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201005.05	G201005.05 - VEHICLE TRAFFIC SPIKES	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G201099.01	G201099.01 - COMPOSITE	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G201099.02	G201099.02 - PAVERS	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G201099.03	G201099.03 - UNIMPROVED/GRAVEL	SUBSYSTEM	CY	No	CIVIL	300	A	A+																																				
G2020	**G2020 - B PARKING LOT /PARKING AREA PAVEMENT**	**SYSTEM**	*	No	*	*	*	*																																				
G202001	G202001 - PARKING LOT BASES AND SUBBASES	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G202005.01	G202005.01 - GUARD RAIL AND POSTS	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G202005.02	G202005.02 - WHEEL STOPS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G2020061	G2020061 - ASHPALT RESURFACING	SUBSYSTEM	EA	No	CIVIL	100	B	B+																																				
G2020062	G2020062 - CONCRETE RESURFACING	SUBSYSTEM	EA	No	CIVIL	100	B	B+																																				
G202007	G202007 - PARKING METERS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G2030	**G2030 - PEDESTRIAN PAVING**	**SYSTEM**	*	No	*	*	*	*																																				
G203003.01	G203003.01 - ASPHALT PEDESTRIAN PAVING	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G203003.02	G203003.02 - CONCRETE PEDESTRIAN PAVING	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G203003.03	G203003.03 - PAVERS PEDESTRIAN PAVING	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G2040	**G2040 - SITE IMPROVEMENTS & AMMENITIES**	**SYSTEM**	*	No	*	*	*	*																																				
G204001.01	G204001.01 - FENCES AND GATES	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G204001.02	G204001.02 - FENCES - CHAIN LINK	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G204001.03	G204001.03 - FENCES - MISCELLANEOUS METAL	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G204002	G204002 - RETAINING WALLS	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G204005	G204005 - SIGNAGE	SUBSYSTEM	EA	No	CIVIL	200	B	B+																																				
G204006.01	G204006.01 - FOUNTAINS, POOLS AND WATERCOURSES	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204006.02	G204006.02 - FOUNTAINS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204008.01	G204008.01 - TERRACE AND PERIMETER WALLS	SUBSYSTEM	CY	No	CIVIL	300	A	A+																																				
G204008.02	G204008.02 - STONE WALL	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G204008.03	G204008.03 - FREE STANDING BRICK WALL	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G204009	G204009 - FLAG POLES	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204099	G204099 - TRUCK SCALES	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204099.01	G204099.01 - SITE FURNISHINGS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204099.02	G204099.02 - SITE SEATING	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204099.03	G204099.03 - HANDRAIL - PIPE RAILINGS	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G204099.04	G204099.04 - CIGARETTE RECEPTACLE	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204099.05	G204099.05 - GUARD RAILS AND POSTS	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G204099.06	G204099.06 - TRASH CANS	SUBSYSTEM	EA	No	CIVIL	200	B	B+																																				
G204099.07	G204099.07 - MAILBOXES	SUBSYSTEM	EA	No	CIVIL	200	B	B+																																				
G204099.08	G204099.08 - TURNSTILES	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G204099.09	G204099.09 - OUTDOOR COVERING	SUBSYSTEM	SF	No	CIVIL	300	A	A+																																				
G2050	**G2050 - LANDSCAPING**	**SYSTEM**	*	No	*	*	*	*																																				
G205004	G205004 - LAWNS AND GRASSES	SUBSYSTEM	SF	No	LANDSCAPE	200	B	B+																																				
G205005	G205005 - EXTERIOR PLANTS	SUBSYSTEM	EA	No	LANDSCAPE	200	B	B+																																				
G205006	G205006 - PLANTERS	SUBSYSTEM	EA	No	LANDSCAPE	200	B	B+																																				
G205007.01	G205007.01 - IRRIGATION PIPING	SUBSYSTEM	SF	No	LANDSCAPE	200	B	B+																																				
G205007.02	G205007.02 - IRRIGATION BACKFLOW PREVENTION	SUBSYSTEM	EA	No	LANDSCAPE	200	B	B+																																				
G205007.03	G205007.03 - IRRIGATION CONTROLS	SUBSYSTEM	EA	No	LANDSCAPE	200	B	B+																																				
G205099	G205099 - LANDSCAPING	SUBSYSTEM	SF	No	LANDSCAPE	200	B	B+																																				
G2060	**G2060 - A ROAD/STREET PAVEMENT**	**SYSTEM**	*	No	*	*	*	*																																				
G206001	G206001 - ROAD BASES AND SUBBASES	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G2099	G2099 - OTHER SITE IMPROVEMENTS	SYSTEM	*	No	*	*	*	*																																				
G90	**G90 - OTHER SITE CONSTRUCTION**	**MASTERSYSTEM**	*	No	*	*	*	*																																				
G9010	**G9010 - SERVICE AND PEDESTRIAN TUNNELS**	**SYSTEM**	*	No	*	*	*	*																																				
G901001.01	G901001.01 - SERVICE TUNNELS	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G901001.04	G901001.04 - INITIAL TUNNEL SUPPORT SYSTEMS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G901001.05	G901001.05 - BORING OR JACKING CONDUITS	SUBSYSTEM	EA	No	CIVIL	300	A	A+																																				
G901001.06	G901001.06 - MICROTUNNELING	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G901001.07	G901001.07 - TRENCH BOXES	SUBSYSTEM	CY	No	CIVIL	300	A	A+																																				
G901001.08	G901001.08 - PEDESTRIAN TUNNELS	SUBSYSTEM	LF	No	CIVIL	300	A	A+																																				
G9090	**G9090 - OTHER SITE SYSTEMS & EQUIPMENT**	**SYSTEM**	*	No	*	*	*	*																																				

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

					Modeling Requirements			
					DESIGN MODEL			RECORD MODEL
CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	DISCIPLINE	LOD	GRADE	GRADE
G909001.01	G909001.01 - VEHICULAR BRIDGES	SUBSYSTEM	EA	No	CIVIL	300	A	A+
G909001.02	G909001.02 - PREFABRICATED BRIDGES	SUBSYSTEM	EA	No	CIVIL	300	A	A+
G909002	G909002 - RAILROAD TRACKS AND BEDS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
G909002.01	G909002.01 - RAILROAD TRACK	SUBSYSTEM	LF	No	CIVIL	300	A	A+
G909002.02	G909002.02 - RAILROAD GRADE CROSSINGS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
G909002.03	G909002.03 - RAILROAD TRAIN SCALES	SUBSYSTEM	EA	No	CIVIL	300	A	A+
G909003	G909003 - SNOW MELTING SYSTEMS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
H10	**H10 - WATERFRONT STRUCTURES**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H1010	H1010 - SUBSTRUCTURE	SYSTEM	•	No	•	•	•	•
H101004	H101004 - RELIEVING PLATFORMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
H1020	**H1020 - SUPERSTRUCTURE**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H1030	**H1030 - DECK COMPONENTS**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H103009	H103009 - GUARD POSTS AND RAILINGS	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
H103010	H103010 - PAINT STRIPING	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
H1040	**H1040 - FENDER SYSTEMS**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H104003	H104003 - CORNER FENDER SYSTEM	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
H1050	**H1050 - MOORING HARDWARE**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H1060	**H1060 - APPURTENANCES**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H1099	**H1099 - OTHER WATERFRONT STRUCTURES**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H20	**H20 - GRAVING DRYDOCKS**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H2010	H2010 - DOCK BASIC STRUCTURE	SYSTEM	•	No	•	•	•	•
H201001	H201001 - DOCK BASIC STRUCTURE	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
H201002	H201002 - DOCK FITTINGS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
H201003	H201003 - DOCK MECHANICAL EQUIPMENT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
H201004	H201004 - DOCK SERVICES	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
H201005	H201005 - FIRE PROTECTION	SUBSYSTEM	EA	No	FIRE	300	A	A+
H2020	**H2020 - PUMP HOUSE**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H202001	H202001 - PUMP HOUSE BASIC STRUCTURES	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
H202002	H202002 - PUMP HOUSE ELECTRIC EQUIPMENT	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+
H202003	H202003 - PUMP HOUSE MISC. SYSTEMS/EQUIPMENT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
H2030	**H2030 - CAISSON**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H203001	H203001 - CAISSON EXTERIOR STRUCTURE	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
H203002	H203002 - CAISSON INTERIOR STRUCTURE -	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
H203003	H203003 - CAISSON INTERIOR STRUCTURE -	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
H203004	H203004 - CAISSON MECHANICAL EQUIPMENT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
H203005	H203005 - CAISSON ELECTRICAL EQUIPMENT	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+
H203006	H203006 - MISC. CAISSON SYSTEMS/EQUIPMENT	SUBSYSTEM	EA	No	MECHANICAL	300	A	A+
H30	**H30 - COASTAL PROTECTION**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H3010	H3010 - WAVE PROTECTION	SYSTEM	•	No	•	•	•	•
H301001	H301001 - WAVE PROTECTION ARMORS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
H301002	H301002 - BREAKWATERS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
H3020	**H3020 - SLOPE PROTECTION**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H30200	H302003- COMBINED FILL REVETMENTS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
H302001	H302001 - ROCK REVETMENTS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
H302002	H302007 - GRANULAR FILL REVETMENTS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
H40	**H40 - NAVIGATION DREDGING AND RECLAMATION**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H4010	**H4010 - DREDGING**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H401010	H401010 - DREDGING COMPONENTS	SUBSYSTEM	EA	No	CIVIL,	200	C	C+
H4020	**H4020 - DREDGING DISPOSAL**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H402001	H402001 - OCEAN DISPOSAL	SUBSYSTEM	EA	No	CIVIL,	200	C	C+
H402002	H402002 - NEW CONFINED DISPOSAL FACILITIES	SUBSYSTEM	EA	No	CIVIL,	200	C	C+
H402003	H402003 - EXISTING CONFINED DISPOSAL FACILITIES	SUBSYSTEM	EA	No	CIVIL,	200	C	C+
H4030	**H4030 - RECLAMATION**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H403001	H403001 - RECLAMATION COMPONENTS	SUBSYSTEM	EA	No	CIVIL,	200	C	C+
H60	**H60 - WATERFRONT DEMOLITION**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H6010	H6010 - PARTIAL OR TOTAL IN-WATER/OVER-WATER DEMOLITION	SYSTEM	•	No	•	•	•	•
H601001	H601001 - COMPLETE WATERFRONT DEMOLITION	SUBSYSTEM	EA	No	STRUCTURAL,	200	C	C+
H601002	H601002 - DEMOLITION OF COMPONENTS	SUBSYSTEM	EA	No	STRUCTURAL,	200	C	C+
H601003	H601003 - RELOCATION OF WATERFRONT UTILITIES	SUBSYSTEM	EA	No	STRUCTURAL,	200	C	C+
H6020	**H6020 - NON IN-WATER OR OVER-WATER DEMOLITION**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H602001	H602001 - COMPLETE WATERFRONT DEMOLITION	SUBSYSTEM	EA	No	STRUCTURAL,	200	C	C+
H602002	H602002 - DEMOLITION OF COMPONENTS	SUBSYSTEM	EA	No	STRUCTURAL,	200	C	C+
H602003	H602003 - RELOCATION OF WATERFRONT AND UTILITIES	SUBSYSTEM	EA	No	STRUCTURAL,	200	C	C+
H6030	**H6030 - HAZARDOUS COMPONENTS**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H603001	H603001 - REMOVAL OF HAZARDOUS COMPONENTS	SUBSYSTEM	EA	No	CIVIL	200	C	C+
H603002	H603002 - ENCAPSULATION OF HAZARDOUS COMPONENTS	SUBSYSTEM	EA	No	CIVIL	200	C	C+
H70	**H70 - WATERFRONT ANTI-TERRORIST FORCE PROTECTION**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H7010	H7010 - WATERSIDE ANTITERRORISM/FORCE PROTECTION	SYSTEM	•	No	•	•	•	•
H701001	H701001 - WATERSIDE AT/FP COMPONENTS	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
H7020	**H7020 - LANDSIDE ANTITERRORISM/FORCE PROTECTION**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
H702001	H702001 - LANDSIDE AT/FP COMPONENTS	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
I10	**I10 - AIRFIELD SITE IMPROVEMENTS**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I1010	I1010 - AIRFIELD PAVEMENTS	SYSTEM	•	No	•	•	•	•
I101004	I101004 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101005	I101005 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101006	I101006 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101007	I101007 - RUNWAY BASES AND SUBBASES (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101008	I101008 - RUNWAY MARKING	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101009	I101009 - RUNWAY RESURFACING ASPHALT (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101010	I101010 - RUNWAY RESURFACING CONCRETE (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101011	I101011 - RUNWAY SURFACE ASPHALT (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101012	I101012 - RUNWAY SURFACE CONCRETE (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I101013	I101013 - RUNWAY OVERRUNS	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I1020	**I1020 - AIRFIELD PAVEMENT-TAXIWAY (BRANCH)**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I102001	I102001 - TAXIWAY SURFACE ASPHALT (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I102002	I102002 - TAXIWAY SURFACE CONCRETE (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I102003	I102003 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I102004	I102004 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I102005	I102005 - TAXIWAY BASES AND SUBBASES (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I102006	I102006 - TAXIWAY MARKING	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I102007	I102007 - TAXIWAY RESURFACING ASPHALT (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I102008	I102008 - TAXIWAYRESURFACING CONCRETE (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I1030	**I1030 - AIRFIELD PAVEMENT-PARKING APRON (BRANCH)**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I103001	I103001 - PARKING APRON SURFACE ASPHALT (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I103002	I103002 - PARKING APRON CONCRETE (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I103003	I103003 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I103004	I103004 - PARKING APRON MARKING	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I103005	I103005 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I103006	I103006 -	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I1040	**I1040 - AIRFIELD PAVEMENT-**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I1050	**I1050 - AIRFIELD PAVEMENT-HELIPAD (BRANCH)**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I105001	I105001 - HELIPAD SURFACE ASPHALT (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I105002	I105002 - HELIPAD CONCRETE (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I105003	I105003 - HELIPAD BASES AND SUBBASES (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I105004	I105004 - HELIPAD MARKING	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I105005	I105005 - HELIPAD RESURFACING ASPHALT (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I105006	I105006 - HELIPAD RESURFACING CONCRETE (SECTION)	SUBSYSTEM	SF	No	CIVIL,	300	A	A+
I20	**I20 - AIRFIELD ELECTRICAL UTILITIES**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I2010	I2010 - AIRFIELD LIGHTING	SYSTEM	•	No	•	•	•	•
I201001	I201001 - AIRFIELD LIGHTING COMPONENTS	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+
I2020	**I2020 - AIRFIELD LIGHTING VAULTS**	**SYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I202001	I202001 - AIRFIELD LIGHTING VAULT COMPONENTS	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+
I2099	I2099 - OTHER AIRFIELD SITE IMPROVEMENTS	SYSTEM	•	No	•	•	•	•
I30	**I30 - AIRFIELD SPECIAL CONSTRUCTION**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I3010	I3010 - AIRFIELD SPECIALTY SYSTEMS	SYSTEM	•	No	•	•	•	•
I301001	I301001 - AIRFIELD SPECIALTY SYSTEM COMPONENTS	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
I40	**I40 - AIRCRAFT ENGINE TEST CELLS**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
I4010	I4010 - PRIMARY INTAKE	SYSTEM	•	No	•	•	•	•
I40100	I40100 - FIRE SYSTEM	SYSTEM	•	No	•	•	•	•
I40110	I40110 - DYNAMOMETER	SYSTEM	•	No	•	•	•	•
I40120	I40120 - TIE-DOWNS	SYSTEM	•	No	•	•	•	•
I40130	I40130 - CONTROL ROOM	SYSTEM	•	No	•	•	•	•
I40140	I40140 - JET BLAST DEFLECTOR	SYSTEM	•	No	•	•	•	•
I4020	I4020 - SECONDARY INTAKE	SYSTEM	•	No	•	•	•	•
I4030	I4030 - EXHAUST STACK	SYSTEM	•	No	•	•	•	•
I4040	I4040 - AUGMENTER	SYSTEM	•	No	•	•	•	•
I4050	I4050 - RUN ROOM	SYSTEM	•	No	•	•	•	•
I4060	I4060 - FLOOR	SYSTEM	•	No	•	•	•	•
I4070	I4070 - DOORS AND WINDOWS	SYSTEM	•	No	•	•	•	•
I4080	I4080 - FUEL SYSTEM/PRESERVATION OIL	SYSTEM	•	No	•	•	•	•
I4090	I4090 - START SYSTEM	SYSTEM	•	No	•	•	•	•
I4090100	I4090100 - AIR START	SUBSYSTEM	EA	No	SPECIALTY	300	A	A+
I4090110	I4090110 - HYDRAULIC START	SUBSYSTEM	EA	No	SPECIALTY	300	A	A+
I4090120	I4090120 - ELECTRIC START	SUBSYSTEM	EA	No	SPECIALTY	300	A	A+
I4099	I4099 - OTHER AIRCRAFT ENGINE TEST CELLS	SYSTEM	•	No	•	•	•	•
J10	**J10 - Electric Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
J1010	J1010 - Production	SYSTEM	•	No	•	•	•	•
J1010110	J1010110 - UG Structures	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010120	J1010120 - Support Structures	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010130	J1010130 - Switch Stations	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010140	J1010140 - Sub Stations	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010150	J1010150 - Circuits	SUBSYSTEM	LF	No	ELECTRICAL,	300	A	A+
J1010155	J1010155 - Plant Electrical	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010160	J1010160 - Power Generation	SUBSYSTEM	KW	No	ELECTRICAL,	300	A	A+
J1010170	J1010170 - Plant Controls	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010175	J1010175 - Cooling System	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010180	J1010180 - Fuel System	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010185	J1010185 - Compressed Air	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1010190	J1010190 - Power Conversion	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1020	J1020 - Transmission	SYSTEM	•	No	•	•	•	•
J1020110	J1020110 - UG Structures	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1020120	J1020120 - Support Structures	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1020130	J1020130 - Switch Stations	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1020140	J1020140 - Sub Stations	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1020150	J1020150 - Circuits	SUBSYSTEM	LF	No	ELECTRICAL,	300	A	A+
J1030	J1030 - Distribution	SYSTEM	•	No	•	•	•	•

Required Facility Asset Fields

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
AssetNum	Change Date	Description	Long Description	MASTERSYSTEM	SYSTEM	SUBSYSTEM	Building Number	Site ID	Work Center	Asset Type	Asset Quantity	Inventory Category	Purchase Price	Budgeted Cost	Replacement Cost	Meter Group	Belongs to (Parent)	Contract Number	Task/Delivery Order Number	Drawing Reference ID	Warranty Expiration Date	Status Date	Installation Date	Asset Status	Classstructureid	Job Plan Code	Equipment Tag Number	Additional Location Information	Manufacturer	Model	Serial #	Asset Comment	PM Plan	PM Program

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

					Modeling Requirements			
					DESIGN MODEL			RECORD MODEL
CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	DISCIPLINE	LOD	GRADE	GRADE
J1030110	J1030110 - UG Structures	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1030120	J1030120 - Support Structures	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1030130	J1030130 - Switch Stations	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1030140	J1030140 - Sub Stations	SUBSYSTEM	EA	No	ELECTRICAL,	300	A	A+
J1030150	J1030150 - Circuits	SUBSYSTEM	LF	No	ELECTRICAL,	300	A	A+
K10	**K10 - Potable Water Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
K1010	K1010 - Production	SYSTEM	•	No	•	•	•	•
K1010110	K1010110 - Wells	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010120	K1010120 - Raw Water Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010130	K1010130 - Raw Water Pumping	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010140	K1010140 - Finished Water Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010150	K1010150 - Preliminary Treatment	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010160	K1010160 - Coagulation Flocculation	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010170	K1010170 - Sedimentation	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010180	K1010180 - Adsorption	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010190	K1010190 - Filtration	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010200	K1010200 - Chemical Treatment	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010210	K1010210 - Finished Water Pumping	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010220	K1010220 - Disinfection	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010230	K1010230 - Solids Handling	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010250	K1010250 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010260	K1010260 - Plant Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010280	K1010280 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010290	K1010290 - Plant Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1010300	K1010300 - Raw Water Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1020	K1020 - Distribution	SYSTEM	•	No	•	•	•	•
K1020100	K1020100 - Service Areas	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1020110	K1020110 - Pump Stations	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K1020120	K1020120 - Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K20	**K20 - Non-Potable Water Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
K2010	K2010 - Production	SYSTEM	•	No	•	•	•	•
K2010110	K2010110 - Wells	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2010120	K2010120 - Water Supply Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2010130	K2010130 - Pump Stations	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2010140	K2010140 - Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2010150	K2010150 - Plant Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2010160	K2010160 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2010180	K2010180 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2020	K2020 - Distribution	SYSTEM	•	No	•	•	•	•
K2020100	K2020100 - Service Areas	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2020110	K2020110 - Pump Stations	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K2020120	K2020120 - Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K30	**K30 - Fire Protection Water Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
K3010	K3010 - Production	SYSTEM	•	No	•	•	•	•
K3010110	K3010110 - Wells	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3010120	K3010120 - Water Supply Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3010130	K3010130 - Pump Stations	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3010140	K3010140 - Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3010150	K3010150 - Plant Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3010160	K3010160 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3010180	K3010180 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3020	K3020 - Distribution	SYSTEM	•	No	•	•	•	•
K3020100	K3020100 - Service Areas	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3020110	K3020110 - Pump Stations	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K3020120	K3020120 - Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K40	**K40 - Salt Water Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
K4010	K4010 - Production	SYSTEM	•	No	•	•	•	•
K4010110	K4010110 - Wells	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4010120	K4010120 - Water Supply Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4010130	K4010130 - Pump Stations	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4010140	K4010140 - Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4010150	K4010150 - Plant Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4010160	K4010160 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4010180	K4010180 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4020	K4020 - Distribution	SYSTEM	•	No	•	•	•	•
K4020100	K4020100 - Service Areas	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4020110	K4020110 - Pump Stations	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
K4020120	K4020120 - Storage	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L10	**L10 - Steam Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
L1010	L1010 - Production	SYSTEM	•	No	•	•	•	•
L1010100	L1010100 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010110	L1010110 - Plant Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010120	L1010120 - Plant Steam	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010135	L1010135 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010140	L1010140 - Make-up Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010150	L1010150 - Boiler Feedwater	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010160	L1010160 - Boilers	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010170	L1010170 - Chemical Feed	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010180	L1010180 - Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010190	L1010190 - Condensate and Blowdown	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010200	L1010200 - Fuel System	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010220	L1010220 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1010230	L1010230 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1020	L1020 - Distribution	SYSTEM	•	No	•	•	•	•
L1020100	L1020100 - Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1020140	L1020140 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1020150	L1020150 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1030	L1030 - Return	SYSTEM	•	No	•	•	•	•
L1030100	L1030100 - Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1030110	L1030110 - Pump Station	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1030120	L1030120 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L1030130	L1030130 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L20	**L20 - High Temp Hot Water Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
L2010	L2010 - Production	SYSTEM	•	No	•	•	•	•
L2010100	L2010100 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010110	L2010110 - Plant Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010120	L2010120 - Plant High Temp Hot Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010135	L2010135 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010140	L2010140 - Make-up Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010150	L2010150 - Boiler Feedwater	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010160	L2010160 - Boilers	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010170	L2010170 - Chemical Feed	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010180	L2010180 - Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010190	L2010190 - Condensate and Blowdown	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2010200	L2010200 - Fuel System	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2020	L2020 - Distribution	SYSTEM	•	No	•	•	•	•
L2020100	L2020100 - Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2020110	L2020110 - Pump Station	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2020140	L2020140 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2020150	L2020150 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2030	L2030 - Return	SYSTEM	•	No	•	•	•	•
L2030100	L2030100 - Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2030110	L2030110 - Pump Station	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2030120	L2030120 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L2030130	L2030130 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L30	**L30 - Domestic Hot Water Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
L3010	L3010 - Production	SYSTEM	•	No	•	•	•	•
L3010100	L3010100 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010110	L3010110 - Plant Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010120	L3010120 - Plant Domestic Hot Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010135	L3010135 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010140	L3010140 - Make-up Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010150	L3010150 - Boiler Feedwater	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010160	L3010160 - Boilers	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010170	L3010170 - Chemical Feed	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010180	L3010180 - Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010190	L3010190 - Condensate and Blowdown	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3010200	L3010200 - Fuel System	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3020	L3020 - Distribution	SYSTEM	•	No	•	•	•	•
L3020100	L3020100 - Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3020110	L3020110 - Pump Station	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3020140	L3020140 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3020150	L3020150 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3030	L3030 - Return	SYSTEM	•	No	•	•	•	•
L3030100	L3030100 - Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3030110	L3030110 - Pump Station	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3030120	L3030120 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L3030130	L3030130 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L40	**L40 - Chilled Water Utilities**	**MASTERSYSTEM**	**•**	**No**	**•**	**•**	**•**	**•**
L4010	L4010 - Production	SYSTEM	•	No	•	•	•	•
L4010100	L4010100 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010110	L4010110 - Plant Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010120	L4010120 - Plant Chilled Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010135	L4010135 - Plant Controls	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010140	L4010140 - Make-up Water	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010150	L4010150 - Chiller Feedwater	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010160	L4010160 - Chiller	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010170	L4010170 - Chemical Feed	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010180	L4010180 - Compressed Air	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010190	L4010190 - Condenser	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4010200	L4010200 - Fuel System	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4020	L4020 - Distribution	SYSTEM	•	No	•	•	•	•
L4020100	L4020100 - Service Area	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4020110	L4020110 - Pump Station	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4020140	L4020140 - UG Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+
L4020150	L4020150 - Support Structures	SUBSYSTEM	EA	No	CIVIL,	300	A	A+

Required Facility Asset Fields

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
AssetNum	Change Date	Description	Long Description	MASTERSYSTEM	SYSTEM	SUBSYSTEM	Building Number	Site ID	Work Center	Asset Type	Asset Quantity	Inventory Category	Purchase Price	Budgeted Cost	Replacement Cost	Meter Group	Belongs to (Parent)	Contract Number	Task/Delivery Order Number	Drawing Reference ID	Warranty Expiration Date	Status Date	Installation Date	Asset Status	Classstructureid	Job Plan Code	Equipment Tag Number	Additional Location Information	Manufacturer	Model	Serial #	Asset Comment	PM Plan	PM Program

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	Modeling Requirements: DESIGN MODEL DISCIPLINE	DESIGN MODEL LOD	DESIGN MODEL GRADE	RECORD MODEL GRADE
L4030	**L4030 - Return**	**SYSTEM**	*	No	*	*	*	*
L4030100	L4030100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
L4030110	L4030110 - Pump Station	SUBSYSTEM	EA	No	CIVIL	300	A	A+
L4030120	L4030120 - UG Structures	SUBSYSTEM	EA	No	CIVIL	300	A	A+
L4030130	L4030130 - Support Structures	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M10	**M10 - Sanitary Sewer Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
M1010	M1010 - Production	SYSTEM	*	No	*	*	*	*
M1010100	M1010100 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010110	M1010110 - Equalization	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010120	M1010120 - Preliminary Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010130	M1010130 - Primary Clarification	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010140	M1010140 - Holding Tanks	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010150	M1010150 - Biological Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010160	M1010160 - Chemical Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010170	M1010170 - Secondary Clarification	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010180	M1010180 - Filtration	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010190	M1010190 - Disinfection	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010200	M1010200 - Sludge Dewatering	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010210	M1010210 - Sludge Disposal	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010220	M1010220 - Sludge Digestion	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010240	M1010240 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010250	M1010250 - Plant Water	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010270	M1010270 - Plant Controls	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1010280	M1010280 - Plant Compressed Air	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1020	**M1020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
M1020100	M1020100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1020110	M1020110 - Storage	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M1020120	M1020120 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M20	**M20 - Industrial Wastewater Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
M2010	**M2010 - Production**	**SYSTEM**	*	No	*	*	*	*
M2010100	M2010100 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010110	M2010110 - Equalization	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010120	M2010120 - Preliminary Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010130	M2010130 - Primary Clarification	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010140	M2010140 - Holding Tanks	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010150	M2010150 - Biological Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010160	M2010160 - Chemical Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010170	M2010170 - Secondary Clarification	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010180	M2010180 - Filtration	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010190	M2010190 - Disinfection	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010200	M2010200 - Sludge Dewatering	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010210	M2010210 - Sludge Disposal	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010220	M2010220 - Sludge Digestion	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010240	M2010240 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010250	M2010250 - Plant Water	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010270	M2010270 - Plant Controls	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2010280	M2010280 - Plant Compressed Air	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2020	**M2020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
M2020100	M2020100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M2020120	M2020120 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M30	**M30 - City Wastewater Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
M3010	**M3010 - Production**	**SYSTEM**	*	No	*	*	*	*
M3010100	M3010100 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010110	M3010110 - Equalization	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010120	M3010120 - Preliminary Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010130	M3010130 - Primary Clarification	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010140	M3010140 - Holding Tanks	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010150	M3010150 - Biological Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010160	M3010160 - Chemical Treatment	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010170	M3010170 - Secondary Clarification	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010180	M3010180 - Filtration	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010190	M3010190 - Disinfection	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010200	M3010200 - Sludge Dewatering	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010210	M3010210 - Sludge Disposal	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010220	M3010220 - Sludge Digestion	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010240	M3010240 - Plant Electrical	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010250	M3010250 - Plant Water	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010270	M3010270 - Plant Controls	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3010280	M3010280 - Plant Compressed Air	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3020	**M3020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
M3020100	M3020100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3020110	M3020110 - Storage	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M3020120	M3020120 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M40	**M40 - Storm Water Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
M4010	**M4010 - Production**	**SYSTEM**	*	No	*	*	*	*
M4010100	M4010100 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M4010110	M4010110 - Storage	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M4010120	M4010120 - Plant Controls	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M4020	**M4020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
M4020100	M4020100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M4020110	M4020110 - Storage	SUBSYSTEM	EA	No	CIVIL	300	A	A+
M4020120	M4020120 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N10	**N10 - Natural Gas Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
N1010	N1010 - Production	SYSTEM	*	No	*	*	*	*
N1010100	N1010100 - Plant Electric	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N1010110	N1010110 - Plant Water	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N1010130	N1010130 - Compressed Air	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N1010140	N1010140 - Compressed Gas	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N1010150	N1010150 - Plant Controls	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N1020	**N1020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
N1020100	N1020100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N1020110	N1020110 - Storage	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N1020120	N1020120 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N20	**N20 - Propane Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
N2010	**N2010 - Production**	**SYSTEM**	*	No	*	*	*	*
N2010100	N2010100 - Plant Electric	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N2010110	N2010110 - Plant Water	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N2010130	N2010130 - Compressed Air	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N2010140	N2010140 - Compressed Gas	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N2010150	N2010150 - Plant Controls	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N2020	**N2020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
N2020100	N2020100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N2020110	N2020110 - Storage	SUBSYSTEM	EA	No	CIVIL	300	A	A+
N2020120	N2020120 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P10	**P10 - Compressed Air Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
P1010	P1010 - Production	SYSTEM	*	No	*	*	*	*
P1010100	P1010100 - Plant Electric	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P1010110	P1010110 - Plant Water	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P1010130	P1010130 - Compressed Air	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P1010140	P1010140 - Compressed Gas	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P1010150	P1010150 - Plant Controls	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P1020	**P1020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
P1020100	P1020100 - Service Area	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P1020110	P1020110 - Storage	SUBSYSTEM	EA	No	CIVIL	300	A	A+
P1020120	P1020120 - Pump Stations	SUBSYSTEM	EA	No	CIVIL	300	A	A+
Q10	**Q10 - Multiple Commodity Utilities**	**MASTERSYSTEM**	*	No	*	*	*	*
Q1020	**Q1020 - Distribution**	**SYSTEM**	*	No	*	*	*	*
Q1020100	Q1020100 - Surface Structures	SUBSYSTEM	EA	No	CIVIL	300	A	A+
Q1020110	Q1020110 - UG Structures	SUBSYSTEM	EA	No	CIVIL	300	A	A+
Q1020120	Q1020120 - Support Structures	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R11	**R11 - LIQUID FUELS STORAGE IN BULK**	**MASTERSYSTEM**	*	No	*	*	*	*
R1110	**R1110 - SHIP FUEL STORAGE**	**SYSTEM**	*	No	*	*	*	*
R111099	R111099 - SHIP FUEL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1120	**R1120 - AVIATION GASOLINE STORAGE**	**SYSTEM**	*	No	*	*	*	*
R112099	R112099 - AVIATION GASOLINE STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1130	**R1130 - DIESEL FUEL STORAGE**	**SYSTEM**	*	No	*	*	*	*
R113099	R113099 - DIESEL FUEL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1140	**R1140 - MOTOR GASOLINE STORAGE**	**SYSTEM**	*	No	*	*	*	*
R114099	R114099 - MOTOR GASOLINE STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1150	**R1150 - JET ENGINE FUEL STORAGE**	**SYSTEM**	*	No	*	*	*	*
R115099	R115099 - JET ENGINE FUEL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1160	**R1160 - LIQUEFIED PETROLEUM FUEL GAS STORAGE**	**SYSTEM**	*	No	*	*	*	*
R116099	R116099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1170	**R1170 - VAPOR COLLECTION / RECOVERY SYSTEM**	**SYSTEM**	*	No	*	*	*	*
R117099	R117099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1182	**R1182 - CONTAMINATED FUEL STORAGE**	**SYSTEM**	*	No	*	*	*	*
R118299	R118299 - CONTAMINATED FUEL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1184	**R1184 - BULK (DEPOT) HEATING FUEL STORAGE**	**SYSTEM**	*	No	*	*	*	*
R118499	R118499 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1199	R1199 - BOTTLED LIQUID FUEL STORAGE SYS	SYSTEM	*	No	*	*	*	*
R12	**R12 - LIQUID STORAGE OTHER THAN WATER, FUEL, AND PO**	**MASTERSYSTEM**	*	No	*	*	*	*
R1215	**R1215 - ROAD OIL STORAGE**	**SYSTEM**	*	No	*	*	*	*
R121599	R121599 - ROAD OIL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1225	**R1225 - LUBRICANT STORAGE**	**SYSTEM**	*	No	*	*	*	*
R122599	R122599 - LUBRICANT STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1235	**R1235 - BALLAST AND SLUDGE STORAGE**	**SYSTEM**	*	No	*	*	*	*
R123599	R123599 - BALLAST AND SLUDGE STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1240	**R1240 - ORGANIC OIL STORAGE**	**SYSTEM**	*	No	*	*	*	*
R124099	R124099 - ORGANIC OIL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1245	**R1245 - MISCELLANEOUS LIQUID STORAGE**	**SYSTEM**	*	No	*	*	*	*
R124599	R124599 - MISCELLANEOUS LIQUID STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1250	**R1250 - INDUSTRIAL / POL WASTE STORAGE FACILITY**	**SYSTEM**	*	No	*	*	*	*
R125099	R125099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R1299	**R1299 -**	**SYSTEM**	*	No	*	*	*	*
R21	**R21 - AVIATION FUEL FACILITIES**	**MASTERSYSTEM**	*	Yes	*	*	*	*
R2110	R2110 - AIRCRAFT DIRECT FUELING STATION	SYSTEM	*	Yes	*	*	*	*

Required Facility Asset Fields

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
AssetNum	Change Date	Description	Long Description	MASTERSYSTEM	SYSTEM	SUBSYSTEM	Building Number	Site ID	Work Center	Asset Type	Asset Quantity	Inventory Category	Purchase Price	Budgeted Cost	Replacement Cost	Meter Group	Belongs to (Parent)	Contract Number	Task/Delivery Order Number	Drawing Reference ID	Warranty Expiration Date	Status Date	Installation Date	Asset Status	Classstructureid	Job Plan Code	Equipment Tag Number	Additional Location Information	Manufacturer	Model	Serial #	Asset Comment	PM Plan	PM Program

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

					Modeling Requirements			
					DESIGN MODEL			RECORD MODEL
CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	DISCIPLINE	LOD	GRADE	GRADE
R211099	R211099 -	SUBSYSTEM	EA	Yes	CIVIL	300	A	A+
R2120	R2120 - AIRCRAFT TRUCK FUELING FACILITY	SYSTEM	*	No	*	*	*	*
R212099	R212099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2130	R2130 - AIRCRAFT DEFUELING FACILITY	SYSTEM	*	No	*	*	*	*
R213099	R213099 - AIRCRAFT DEFUELING FACILITY COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2150	R2150 - AIRCRAFT READY FUELS STORAGE	SYSTEM	*	No	*	*	*	*
R215099	R215099 - AIRCRAFT READY FUELS STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2199	R2199 - OTHER AVIATION FUEL FACILITIES	SYSTEM	*	No	*	*	*	*
R22	R22 - MARINE FUEL FACILITIES	MASTERSYSTEM	*	No	*	*	*	*
R2210	R2210 - MARINE FUELING FACILITY	SYSTEM	*	No	*	*	*	*
R221099	R221099 - MARINE FUELING FACILITY COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2220	R2220 - SMALL CRAFT FUELING STATION	SYSTEM	*	No	*	*	*	*
R222099	R222099 - SMALL CRAFT FUELING STATION COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2230	R2230 - SMALL CRAFT READY FUEL STORAGE	SYSTEM	*	No	*	*	*	*
R223099	R223099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2299	R2299 - OTHER MARINE FUEL FACILITIES	SYSTEM	*	No	*	*	*	*
R23	R23 - GROUND BASED VEHICLE AND EQUIPMENT FUEL FAC	MASTERSYSTEM	*	No	*	*	*	*
R2310	R2310 - FILLING STATION	SYSTEM	*	No	*	*	*	*
R231099	R231099 - FILLING STATION COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2315	R2315 - FILLING STATION BUILDING	SYSTEM	*	No	*	*	*	*
R231599	R231599 - FILLING STATION BUILDING COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2316	R2316 - OVERHEAD COVER, AIRFIELD	SYSTEM	*	No	*	*	*	*
R231699	R231699 - OVERHEAD COVER, AIRFIELD COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2317	R2317 - OVERHEAD COVER, MISCELLANEOUS	SYSTEM	*	No	*	*	*	*
R231799	R231799 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2320	R2320 - FILLING STATION SHELTER	SYSTEM	*	No	*	*	*	*
R232099	R232099 - FILLING STATION SHELTER COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2323	R2323 - VEHICLE AND EQUIPMENT READY FUEL STORAGE	SYSTEM	*	No	*	*	*	*
R232399	R232399 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2340	R2340 - ETHANOL READY FUEL STORAGE	SYSTEM	*	No	*	*	*	*
R234099	R234099 - ETHANOL READY FUEL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2350	R2350 - BIODIESEL READY FUEL STORAGE	SYSTEM	*	No	*	*	*	*
R235098	R235098 - POL PIPELINE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R235099	R235099 - BIODIESEL READY FUEL STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2399	R2399 -	SYSTEM	*	No	*	*	*	*
R25	R25 - POL DISTRIBUTION / PIPELINE FACILITIES	MASTERSYSTEM	*	Yes	*	*	*	*
R2510	R2510 - POL PIPELINE	SYSTEM	*	Yes	*	*	*	*
R251099	R251099 - POL PIPELINE COMPONENT	SUBSYSTEM	LF	Yes	CIVIL	300	A	A+
R2516	R2516 -	SYSTEM	*	No	*	*	*	*
R251699	R251699 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2520	R2520 -	SYSTEM	*	No	*	*	*	*
R252099	R252099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2530	R2530 - SURGE STORAGE	SYSTEM	*	No	*	*	*	*
R253099	R253099 - SURGE STORAGE COMPONENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2599	R2599 - OTHER POL DISTRIBUTION / PIPELINE FACILITIES	SYSTEM	*	No	*	*	*	*
R26	R26 - OTHER LIQUID PETROLEUM PRODUCTS FACILITIES	MASTERSYSTEM	*	No	*	*	*	*
R2610	R2610 - DRUM AND CAN LOADING FACILITY	SYSTEM	*	No	*	*	*	*
R261099	R261099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2615	R2615 - PETROLEUM READY FUEL STORAGE FACILITY	SYSTEM	*	No	*	*	*	*
R261599	R261599 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2630	R2630 - TANK TRUCK OR TANK CAR LOADING FACILITY	SYSTEM	*	No	*	*	*	*
R263099	R263099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2640	R2640 - TANK TRUCK OR TANK CAR UNLOADING FACILITY	SYSTEM	*	No	*	*	*	*
R264099	R264099 -	SUBSYSTEM	EA	No	CIVIL	300	A	A+
R2699	R2699 - OTHER LIQUID PETROLEUM PRODUCTS FACILITIES	SYSTEM	*	No	*	*	*	*
S10	S10 - SPECIALIZED AND FLEET MOORINGS	MASTERSYSTEM	*	No	*	*	*	*
S1010	S1010 - SPREAD MOORING	SYSTEM	*	No	*	*	*	*
S101001	S101001 - RISER TYPE	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
S101002	S101002 - RISER-LEG	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
S1020	S1020 - BUOY DELPHIN	SYSTEM	*	No	*	*	*	*
S102001	S102001 - RISER TYPE	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S102002	S102002 - RISER-LEG	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S1030	S1030 - MID-MOOR	SYSTEM	*	No	*	*	*	*
S103001	S103001 - RISER TYPE	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S103002	S103002 - RISER-LEG	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S1040	S1040 - BOW-STERN MOORING	SYSTEM	*	No	*	*	*	*
S104001	S104001 - RISER TYPE	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S104002	S104002 - RISER-LEG	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S1050	S1050 - SINGLE POINT MOORING	SYSTEM	*	No	*	*	*	*
S105001	S105001 - RISER TYPE	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S105002	S105002 - RISER-LEG	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
S1099	S1099 - OTHER SPECIALIZED AND FLEET MOORINGS	SYSTEM	*	No	*	*	*	*
U20	U20 - ASHORE HYPERBARIC & DIVING FACILITIES	MASTERSYSTEM	*	No	*	*	*	*
U2010	U2010 - HYPERBARIC & DIVING AIR COMPRESSION	SYSTEM	*	No	*	*	*	*
U201001	U201001 - HYPERBARIC & DIVING AIR COMPRESSORS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U2020	U2020 - HYPERBARIC & DIVING AIR STORAGE	SYSTEM	*	No	*	*	*	*
U202001	U202001 -	SUBSYSTEM	CF	No	STRUCTURAL	300	A	A+
U202002	U202002 -	SUBSYSTEM	CF	No	STRUCTURAL	300	A	A+
U2030	U2030 - HYPERBARIC& DIVING GAS STORAGE	SYSTEM	*	No	*	*	*	*
U203001	U203001 -	SUBSYSTEM	CF	No	STRUCTURAL	300	A	A+
U203002	U203002 -	SUBSYSTEM	CF	No	STRUCTURAL	300	A	A+
U203003	U203003 -	SUBSYSTEM	CF	No	STRUCTURAL	300	A	A+
U203004	U203004 -	SUBSYSTEM	CF	No	STRUCTURAL	300	A	A+
U2040	U2040 - HYPERBARIC & DIVING PIPING	SYSTEM	*	No	*	*	*	*
U204001	U204001 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204002	U204002 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204003	U204003 - HYPERBARIC & DIVING AIR LP VOLUME TANKS	SUBSYSTEM	CF	No	STRUCTURAL	300	A	A+
U204004	U204004 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U204005	U204005 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204006	U204006 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204007	U204007 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204008	U204008 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204009	U204009 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204010	U204010 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204011	U204011 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U204012	U204012 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U2050	U2050 - RECOMPRESSION CHAMBER	SYSTEM	*	No	*	*	*	*
U205001	U205001 - RECOMPRESSION CHAMBER HULLS	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
U205002	U205002 - RECOMPRESSION CHAMBER AIR PRESS. SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U205003	U205003 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U205004	U205004 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U205005	U205005 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U205006	U205006 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U205007	U205007 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U205008	U205008 - RECOMPRESSION CHAMBER LIGHTING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U205009	U205009 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U2060	U2060 - LOCK OUT TRAINER	SYSTEM	*	No	*	*	*	*
U206001	U206001 - LOCK OUT TRAINER HULLS	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
U206002	U206002 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U206003	U206003 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U206004	U206004 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U206005	U206005 -	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U206006	U206006 - LOCK OUT TRAINER LIGHTING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U206007	U206007 - DIVERS MONITORING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U2070	U2070 - DIVING SIMULATION FACILITY	SYSTEM	*	No	*	*	*	*
U207001	U207001 - DSF HULLS	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
U207002	U207002 - DSF AIR PRESSURIZATION SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207003	U207003 - DSF BUILT IN BREATHING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207004	U207004 - DSF DIVERS BREATHING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207005	U207005 - DSF FIRE EXTINGUISHING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207006	U207006 - DSF WETPOT FILL & DRAINS SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207007	U207007 - DSF COMMUNICATIONS SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207008	U207008 - DSF ATM. MONITORING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207009	U207009 - DSF ATM. CONDITIONING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207010	U207010 - DSF DIVERS MONITORING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207011	U207011 - DSF LIGHTING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207012	U207012 - DSF ELECTRICAL SUPPORT SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207013	U207013 - DSF SUPERVISORY CONTROL SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U207014	U207014 - DSF EMERGENCY BREATHING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U2080	U2080 - HYPERBARIC & DIVING CHARGING SYSTEMS	SYSTEM	*	No	*	*	*	*
U208001	U208001 - SCUBA CHARGING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U208002	U208002 - MK25 CHARGING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U208003	U208003 - MK16 CHARGING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U208004	U208004 - SEEDS & HEEDS CHARGING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U208005	U208005 - HABD CHARGING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U208006	U208006 - HALO FLASK CHARGING SYSTEMS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
U2090	U2090 - HYPERBARIC & DIVING UNMANNED CHAMBER	SYSTEM	*	No	*	*	*	*
U209001	U209001 -	SUBSYSTEM	SF	No	STRUCTURAL	300	A	A+
U209002	U209002 -	SUBSYSTEM	LF	No	STRUCTURAL	300	A	A+
U2099	U2099 - OTHER ASHORE HYPERBARIC & DIVING FACILITIES	SYSTEM	*	No	*	*	*	*
V10	V10 - BRIDGE STRUCTURE	MASTERSYSTEM	*	No	*	*	*	*
V1010	V1010 - SUBSTRUCTURE	SYSTEM	*	No	*	*	*	*
V101001	V101001 - FOUNDATIONS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V101002	V101002 - PIERS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V101003	V101003 - ABUTMENTS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V1020	V1020 - SUPERSTRUCTURE	SYSTEM	*	No	*	*	*	*
V102001	V102001 - RAILINGS	SUBSYSTEM	FT	No	CIVIL	300	A	A+
V102002	V102002 - DECKS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V102003	V102003 - BEAMS	SUBSYSTEM	FT	No	CIVIL	300	A	A+
V102004	V102004 - BEARINGS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V102005	V102005 - MOVABLE MECHANISM	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V102006	V102006 - CULVERT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V1030	V1030 - APPROACH	SYSTEM	*	No	*	*	*	*
V103001	V103001 - WINGWALLS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
V103002	V103002 - RETAINING WALLS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
V103003	V103003 - APPROACH SLABS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+

Required Facility Asset Fields

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
AssetNum	Change Date	Description	Long Description	MASTERSYSTEM	SYSTEM	SUBSYSTEM	Building Number	Site ID	Work Center	Asset Type	Asset Quantity	Inventory Category	Purchase Price	Budgeted Cost	Replacement Cost	Meter Group	Belongs to (Parent)	Contract Number	Task/Delivery Order Number	Drawing Reference ID	Warranty Expiration Date	Status Date	Installation Date	Asset Status	Classstructureid	Job Plan Code	Equipment Tag Number	Additional Location Information	Manufacturer	Model	Serial #	Asset Comment	PM Plan	PM Program
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

MODEL AND FACILITY DATA MATRIX

STEP 1: **Is This a BIM Project?** — **No**

STEP 2: Select **Yes** or **No** in **Column E** for each **MASTERSYSTEM**, **SYSTEM** and **SUBSYSTEM** that is **In** the **Project Scope**

CLASSIFICATION ID	MASTERSYSTEM / SYSTEM / SUBSYSTEM Name	System Type	UOM	In Scope (Yes or No)	Modeling Requirements: DESIGN MODEL — DISCIPLINE	DESIGN MODEL — LOD	DESIGN MODEL — GRADE	RECORD MODEL — GRADE
V1040	V1040 - PROTECTION	SYSTEM	•	No	•	•	•	•
V104001	V104001 - EXPANSION JOINTS	SUBSYSTEM	FT	No	CIVIL	300	A	A+
V104002	V104002 - WATERPROOFING	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V104003	V104003 - TOPPING OR OVERLAY (DECK OVERLAY)	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V104004	V104004 - DRAINAGE	SUBSYSTEM	FT	No	CIVIL	300	A	A+
V104005	V104005 - SLOPE WALLS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
V104006	V104006 - APPROACH BARRIERS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
V104007	V104007 - CORROSION CONTROL	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V104008	V104008 - PIER PROTECTION BARRIERS	SUBSYSTEM	EA	No	STRUCTURAL	300	A	A+
V104009	V104009 - CHANNEL PROTECTION	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V1050	V1050 - SIGNALS	SYSTEM	•	No	•	•	•	•
V105001	V105001 - SIGNALS	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V105002	V105002 - SIGNAGE	SUBSYSTEM	EA	No	CIVIL	200	B	B+
V105003	V105003 - LIGHTING	SUBSYSTEM	EA	No	ELECTRICAL	300	A	A+
V105004	V105004 - UTILITIES	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V105005	V105005 - GUARD TOWER	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V105006	V105006 - PAVEMENT MARKING	SUBSYSTEM	FT	No	CIVIL	300	A	A+
V1060	V1060 - SITE WORK	SYSTEM	•	No	•	•	•	•
V106001	V106001 - UTILITY RELOCATION	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V106002	V106002 - EXISTING STRUCTURES REMOVAL	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V106003	V106003 - EXCAVATION	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V106004	V106004 - COFFERDAM	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V106005	V106005 - EMBANKMENT	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V106006	V106006 - TRAFFIC MAINTENANCE	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V106007	V106007 - ENVIRONMENTAL MITIGATION	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V106008	V106008 - DEMOLITION	SUBSYSTEM	EA	No	CIVIL	300	A	A+
V1099	V1099 - OTHER BRIDGE STRUCTURE	SYSTEM	•	No	•	•	•	•
W10	W10 - CATHODIC PROTECTION SYSTEM	MASTERSYSTEM	•	No	•	•	•	•
W1010	W1010 - IMPRESSED CURRENT CP	SYSTEM	•	No	•	•	•	•
W101010	W101010 - RECTIFIERS	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+
W101020	W101020 - ANODES	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+
W101030	W101030 - TEST STATIONS/BOXES	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+
W101040	W101040 - DIELECTRIC INSULATING COUPLINGS	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+
W1020	W1020 - GALVANIC CP	SYSTEM	•	No	•	•	•	•
W102010	W102010 - ANODES	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+
W102020	W102020 - TEST STATIONS/BOXES	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+
W102030	W102030 - DIELECTRIC INSULATING COUPLINGS	SUBSYSTEM	EA	No	ELECTRICAL	200	A	A+
W1099	W1099 - OTHER CATHODIC PROTECTION SYSTEM	SYSTEM	•	No	•	•	•	•

Required Facility Asset Fields

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
AssetNum	Change Date	Description	Long Description	MASTERSYSTEM	SYSTEM	SUBSYSTEM	Building Number	Site ID	Work Center	Asset Type	Asset Quantity	Inventory Category	Purchase Price	Budgeted Cost	Replacement Cost	Meter Group	Belongs to (Parent)	Contract Number	Task/Delivery Order Number	Drawing Reference ID	Warranty Expiration Date	Status Date	Installation Date	Asset Status	Classstructureid	Job Plan Code	Equipment Tag Number	Additional Location Information	Manufacturer	Model	Serial #	Asset Comment	PM Plan	PM Program
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

SECTION 02 41 00

DEMOLITION
08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6	(2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Definitions

1.2.1.1 Demolition

Demolition is the process of tearing apart and removing any feature of a facility together with any related handling and disposal operations.

1.2.1.2 Demolition Plan

Demolition Plan is the planned steps and processes for managing demolition activities and identifying the required sequencing activities and disposal mechanisms.

1.2.2 Demolition Plan

Prepare a Demolition Plan and submit proposed demolition, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and airfield lighting, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan must be approved by Contracting Officer prior to work beginning.

1.2.3 General Requirements

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations on airfield pavements. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Comply with FAR 52.236-9 to protect existing vegetation, structures, equipment, utilities, and improvements. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal or demolition work performed under this contract. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.3.2 Trees

Protect trees within the project site which might be damaged during demolition and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition. Prior to start of work, the Government or utility provider will disconnect and seal utilities serving each area of alteration or removal upon written request from the Contractor.

1.3.4 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and

are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted . Where burning is permitted, adhere to federal, state, and local regulations.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Demolition Plan; G

Existing Conditions

SD-07 Certificates

Notification; G

1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSP A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debris on airfield pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where pedestrian and driver aircraft safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or

prop blast. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the site specific features being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. Provide a barricade consisting of a fence covered with a fabric designed to stop the spread of debris. Anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.9 EXISTING CONDITIONS

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs or electronic images with a minimum resolution of 3072 x 2304 pixels, capable of a print resolution of 300 dpi, will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results to the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Disassemble existing construction scheduled to be removed for reuse. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Designate materials for reuse onsite whenever possible.

3.1.1 Structures

a. Remove existing structures indicated to be removed to 5 feet below grade. Remove interior walls, other than retaining walls and partitions, to 5 feet below grade or to top of concrete slab on ground. Break up basement slabs to permit drainage. Remove sidewalks, curbs, gutters and street light bases as indicated.

b. Demolish structures in a systematic manner from the top of the structure to the ground. Complete demolition work above each tier or floor before the supporting members on the lower level are disturbed. Demolish concrete and masonry walls in small sections. Remove structural framing members and lower to ground by means of derricks, platforms hoists, or other suitable methods as approved by the Contracting Officer.

c. Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated and uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs as indicated to a depth of 36 inches below new finish grade. Demolition of concrete pavement on airfields and other heavy duty pavements will follow methods in Section 32 13 14.13 CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS.Provide neat sawcuts at limits of pavement removal as indicated. Move, grind and store pavement and slabs designated to be recycled and utilized in this project as directed by the Contracting Officer. Remove pavement and slabs not to be used in this project from the installation at Contractor's expense.

3.1.4 Airfield Lighting

Remove existing airfield lighting as indicated and terminate in a manner satisfactory to the Contracting Officer. Remove edge lights, as indicated and dispose of off station .

3.1.5 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990.

3.1.6 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.7 Items With Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished or deconstructed until all demolition in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, become the property of the Contractor and must be removed from Government property. Materials approved for storage by the Contracting Officer must be removed before completion of the contract. Title to materials resulting from demolition and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.3.2 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable combustible material off the site .

3.4 CLEANUP

Remove debris and rubbish from project site and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials

resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan . Storage of removed materials on the project site is prohibited.

3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property .

3.5.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil per Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02 61 13

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL
02/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D5434	(2012) Field Logging of Subsurface Explorations of Soil and Rock

1.2 SYSTEM DESCRIPTION

The section includes the following Attachments:

A. Soil Management Plan (SMP) for FY24 MCAF Project P-012/AJJY183012, North Aircraft Parking Ramp, Joint Region Marianas, Andersen AFB, Guam

B. Performance Work Statement (PWS) for General Radioactive Material (G-RAM)/Low-Level Radioactive Waste (LLRW)

Comply with and implement the SMP and PWS. The project site includes contaminated areas with Per- and polyfluoroalkyl substances (PFAS), heavy metals (arsenic, lead), petroleum substances, and other residual contamination. G-RAM/LLRW can be encountered.

The construction workers can be exposed by incidental ingestion, dermal contact, and inhalation of soil and dust. Provide engineering and administrative hazard mitigation measures to minimize exposures from contaminants and low-level radiation. The mitigation measures must include hazard communication and engineering controls including erosion and dust controls, donning appropriate PPE, etc.

All personnel performing duties with potential for exposure to onsite contaminants and radiation must have 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, hazard communication, and job-specific health and safety training.

Provide submittals specified in the SMP and PWS.

1. SMP Submittal List

a. Qualification of Professional Engineer (PE) or Environmental Consultant (EC)

b. SMP Work Plan including detaeild Contractor's means and methods for PFAS-impacted soil management

c. Additional PFAS testing report with sampling procedures

d. Geomembrane specification and Geomembrane manufacturer's installation instructions

e. SMP Closure Report

f. Topographic survey drawings for PFAS-Impacted Soil Relocation Area. Include GPS coordinates showing the relocation boundary and depth.

2. G-RAM/LLRW PWS Submittal List

a. Qualification of Radiation Safety Officer (RSO)

b. Radiation Work Plan

c. Qualification of Nuclear Regulatory Commission (NRC) licensed service provider

d. Key Personnel Qualification for G-RAM/LLRW

e. Report for G-RAM Site Screening Level

f. Weekly G-RAM/LLRW Inventory Report

g. Final G-RAM/LLRW Status Survey Report

h. G-RAM/LLRW Closure Report

1.2.1 Design Requirements

1.2.1.1 SMP Work Plan

Submit an Excavation Work Plan within 60 calendar days after notice to proceed. Do not perform work at the site, with the exception of site inspections and surveys, until the work plan is approved. Prepare draft for Government review, draft-final for regulatory review and final versions of the Excavation Work Plan. Allow 30 calendar days for Government review and 30 calendar days for regulatory review. Allow 45 days for comment resolution following each review and preparing the next version of the document. No adjustment for time or money will be made if resubmittals of the work plan are required due to deficiencies in the plan. At a minimum, include the following in the work plan:

a. Schedule of activities.

b. Method of excavation and equipment to be used.

c. Shoring or side-wall slopes proposed.

d. Dewatering and Leachate Management Plan which includes: anticipated sources and quantities of water that will enter the excavation, means of removing water from the excavation, means of storage and treatment, discharge requirements, and discharge methods.

e. Storage methods and locations for liquid and solid contaminated material. Provide design details for stockpiles including but not limited to: geomembrane liner and cover, berms, anchors/ballast for cover, vehicle access points, and leachate collection sumps.

f. Haul routes.

g. Decontamination procedures developed in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

h. Temporary use areas required for staging equipment and supplies, for temporary storage of excavated materials, or for stockpiles.

i. Closure Report

1.2.1.2 G-RAM/LLRW Screening, Handling, Storage, and Disposal

Conduct G-RAM/LLRW screening in accordance with the PWS and approved Radiation Work Plan. The Contractor will be responsible for handling, packaging, storage, and disposal of G-RAM/LLRS, if discovered. Retain a Radiation Safety Officer (RSO). Coordinate with the Naval Sea Systems Command Detachment (NAVSEADET) Radiological Affairs Support Office (RASO) through the Contracting Officer on G-RAM management, handling, and disposal.

Assume discovering and disposing of four cubic yards of G-RAM/LLRW and other impacted materials, including soil, for the base bid work. In addition to the disposal, provide screening, monitoring, contamination control, and decontamination to manage discovered G-RAM, LLRW, and other impacted materials in accordance with the approved Radiation Work Plan.

1.2.1.2.1 Background Radiation and Site Screening Level

Determine the Site Screening Level for the Radiation Scan/Surveys.

1.3 PRE-INSTALLATION MEETING

Conduct a pre-installation meeting at least 30 business days prior to the start of contaminated soil excavation and G-RAM/LLRW screening operations on the project. The pre-installation meeting is to be arranged by the Contractor and is to follow the written pre-installation meeting agenda submitted prior to the meeting. The purpose of this meeting is to review the requirements of this specification and the associated plans. The following individuals must be in attendance at this meeting: Contractor's Project Manager, Site Foreman, RSO, NRC-licensed service provider, Contracting Officer, and respective Government stakeholders (e.g., RASO).

Record pre-installation meeting minutes and publish via email within 48 hours to all attendees. The minutes must be re-published within 48 hours via email pending any subsequent comments from the attendees.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Pre-Installation Meeting Agenda

Pre-Installation Meeting Minutes; G

SMP Work Plan; G

Pre-Installation Examination Report

Pre-Construction Equipment Examination

Qualification of Professional Engineer (PE) or Environmental Consultant (EC); G

Qualification of Nuclear Regulatory Commission (NRC) Licensed Service Provider; G

Key Personnel Qualification for G-RAM/LLRW; G

Radiation Work Plan; G

Qualification Of Radiation Safety Officer (RSO); G

SD-02 Shop Drawings

Surveys

SD-03 Product Data

Specifications Of Geomembrane; G

SD-06 Test Reports

Report for G-RAM Site Screening Level; G

Additional PFAS Testing Report With Sampling Procedures; G

SD-07 Certificates

Qualifications; G

SD-08 Manufacturer's Instructions

Geomembrane Manufacturer's Installation Instructions; G

SD-10 Operation and Maintenance Data

Weekly G-RAM/LLRW Inventory Report; G

SD-11 Closeout Submittals

SMP Closure Report; G

Final G-RAM/LLRW Status Survey Report; G

G-RAM/LLRW Closure Report; G

Topographic Survey Drawings for PFAS-Impacted Soil Relocation Area; G

1.5 QUALITY CONTROL

1.5.1 Regulatory Requirements

1.5.1.1 Permits and Licenses

Coordinate and obtain all necessary permits or notifications prior to the initiation of the relevant activities. Submit documentation of the completed permitting or permit equivalent to the Contracting Officer in accordance with Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS. Comply with all Federal, Guam, and local regulations. Obtain the permits and certifications, and meet the substantive regulatory requirements necessary for the execution of the project. For any of the above-listed items requiring a longer time frame, copies of applications, and scheduled dates for receiving final approval, must be included.

1.5.1.2 Environmental Protection

Develop and implement environmental protection requirements in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

1.5.2 Qualifications

1.5.2.1 NRC Licensed Service Provider

Submit the qualification of NRC licensed service provider. Submit evidence of successful completion of at least 1 project of comparable size and scope for G-RAM/LLRW screening, handling/management, or disposal. Include the copy of the respective NRC license in the qualification submittal.

1.5.2.2 Key Personnel Qualification For G-RAM/LLRW

Provide key personnel with a minimum of 3 years of G-RAM/LLRW experience. Include the Site Foreman, quality control personnel, and supervisory engineering and technical staff involved with operation in key personnel. Perform all G-RAM/LLRW work under the supervision of an NRC-Licensed or qualified person. Submit a list of these personnel with their qualifications.

1.5.2.3 Key Personnel Qualification for Contaminated Soil Management

Retain a Professional Engineer (PE) or an Environmental Consultant (EC) experienced with soil investigation and removal/remediation. The PE or EC is required to evaluate the provided information; to incorporate PFAS testing and management requirements; and to develop Work Plans and a Closure Report. The PE or EC must have a minimum of five (5) years of experience managing environmental investigation and soil remedial/removal action projects. Professional licensing or professional registration is desired. Submit the Certification and Resume of the Contractor's PE or EC showing successful completion of soil investigation and removal/remediation.

1.5.2.4 Lab Validation

Perform testing by a DoD Environmental Laboratory Accreditation Program (DoD ELAP) accredited commercial testing laboratory meeting the requirements of Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS and approved by the Contracting Officer. Submit testing laboratory validation for the testing to be performed. Do not permit work requiring testing

until the Contracting Officer approves use of the testing laboratory.

1.6 PROJECT SITE CONDITIONS

1.6.1 Existing Conditions

The existing site conditions are presented in the SMP and PWS. The existing conditions presented are the result of site investigations at specific locations; variations in the existing site conditions could occur. Perform an independent interpretation of the site characterization data. Notify the Contracting Officer within 48 hours if discrepancies between the data provided and actual field conditions are discovered.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Backfill

After excavation of PFAS-contaminated soil, provide backfill in accordance with Section 31 00 00 EARTHWORK and project plans/drawings.

2.1.2 Topsoil for PFAS-Relocation Area

Comply with the SMP requirements. Provide a minimum 1-ft clean topsoil cap with vegetated cover. Provide topsoil in accordance with the requirements in Section 31 00 00 EARTHWORK. Stripping existing topsoil for re-use on-site is allowed if it meets requirements specified in Section 31 00 00.

2.1.3 Geomembrane

Submit specifications of geomembrane to be used.

PART 3 EXECUTION

Furnish labor, materials, and equipment necessary to implement the SMP and PWS.

3.1 EXAMINATION

3.1.1 Surveys

Perform surveys immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Provide cross-sections on 25-foot intervals and at break points for all excavated areas.

3.1.2 Conditions

Conduct a pre-installation examination of the on-site infrastructure, utility conduits, monitoring points, site access constraints, and infrastructure. Photographically document, with identifying labels, the existing condition of infrastructure and utilities, particularly for comparison to post-excavation conditions. Verify locations of critical utilities that cannot be disrupted and those utilities that would potentially have significant impacts on excavation and public safety. Submit a Pre-Installation Examination Report documenting the examination activity. Obtain all necessary utility clearances before initiation of subsurface work.

3.1.3 Pre-Construction Equipment Examination

Conduct a pre-construction examination of the excavation equipment for any damage, defect, and dilapidation. Submit the results of the pre-construction examination to the Contracting Officer for review and information. The Contracting Officer may conduct an independent examination to ascertain the condition and functionality of the equipment. Based on this examination, the Contracting Officer has the right to reject any damaged, defective or dilapidated equipment. The cost associated with equipment or control replacement or repair, and delays caused by the rejection must be borne by the Contractor. Routinely and properly inspect and maintain the equipment to provide the project execution as required by the contract schedule. Any schedule delay and cost associated with power failure, improper functioning of equipment and controls, unavailability of labor and materials, etc., must be the responsibility of the Contractor.

3.2 PREPARATION

3.2.1 Mobilization

Do not disturb the contaminated areas and G-RAM/LLRW Area of Interest until the SMP Work Plan and Radiation Work Plan have been approved by the Contracting Officer and the Contractor has received written confirmation. Delays caused by the Contractor's failure to meet regulatory requirements must result in no additional cost to the Government. In accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES, the equipment which is rented and/or previously used for other site remediation must be decontaminated and tested for contaminants of concern before being brought to the site.

3.2.2 Clearing

Perform clearing to the limits shown on the drawings.

3.3 CONTAMINATED MATERIAL REMOVAL

Notify the Contracting Officer 14 calendar days prior to the start of excavation of contaminated material. The Contractor is responsible for contacting regulatory agencies in accordance with the applicable reporting requirements, if required.

3.3.1 Excavation

Excavate areas of contamination to meet the requirements in the project drawings. Excavate additional material as directed by the Contracting Officer. Maintain an excavation log describing visible signs of contamination encountered for each area of excavation. Prepare excavation logs in accordance with ASTM D5434.

Use methods and equipment that result in minimal disturbance to remaining soil beyond the excavation limits. Remove and dispose of any material that becomes contaminated as a result of the Contractor's operation at no additional cost to the Government. Stage operations to minimize the time the contaminated soil is exposed to the weather.

3.3.2 Shoring, Sloping, or Bracing

Implement shoring, sloping, bracing, or any other excavation health and safety requirements in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

3.3.3 Dewatering

Divert surface water to prevent entry into the excavation. Conduct excavation and backfilling operations at the site in a manner that minimizes the amount of surface water which may collect in the open excavation.

Encountering groundwater or contaminated groundwater is not anticipated. However, if the construction dewatering is required, conduct dewatering in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. Limit dewatering to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met. Do not perform dewatering without prior approval of the Contracting Officer. Conduct dewatering in accordance with the Dewatering and Leachate Management Plan developed as part of the Excavation Work Plan.

3.3.3.1 Collection and Disposal of Incidental Contaminated Water

Collect rinsewater, decontamination water, or leachate from contaminated soil stockpiles. Containerize, sample, and analyze contaminant absorbed material and dispose of based on the waste characterization results.

3.3.4 Contaminated Material Storage

Place material in temporary storage immediately after excavation. The following paragraphs describe acceptable methods of material storage. Provide storage units that are in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, clearly label each unit with an identification number and keep a written log to track the source of contaminated material in each temporary storage unit.

3.3.4.1 Contaminated Material Stockpiles

Comply with the SMP and G-RAM/LLRW PWS.

3.3.5 Backfilling and Finishing/Finish Operations

Backfill excavations immediately after contaminated materials have been removed. Conduct backfilling and finishing operations in accordance with Section 31 00 00 EARTHWORK and construction plan/drawings.

3.3.6 Treatment and Disposal of G-RAM, LLRW, and Radioactive Soil

Perform offsite disposal of heavy metal contaminated soil, G-RAM, LLRW, and radioactive soil in accordance with this Section, SMP, PWS, and Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Furnish labor, materials, and equipment necessary for collecting, storing, packaging, shipping, and disposing of contaminated or regulated materials.

3.3.7 Closeout Reports

Submit a SMP Closure Report and G-RAM/LLRW Closure Report. Submit 2 copies of each Closeout Report within 60 calendar days of completing work at the site. Label the report with the contract number, project name, location, date, name of general Contractor, and the Government agency contracting for the work. Refer to closure report requirements specified in the SMP and PWS. As a minimum, include the following information:

a. A cover letter signed by a responsible company official and principal personnel who is a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.

b. A narrative report including, but not limited to, the following:

(1) site conditions, ground water elevation, and cleanup goals;

(2) excavation logs;

(3) field screening readings;

(4) quantity of materials removed/excavated from each area of contamination;

(5) quantity of relocation of contaminated soil

(6) quantity of water/product removed during dewatering;

(7) sampling locations and sampling methods;

(8) sample collection data such as time of collection and method of preservation;

(9) sample chain-of-custody forms; and

(10) source of backfill.

c. Copies of all chemical and physical test results.

d. Copies of all manifests and land disposal restriction notifications.

e. Copies of all certifications of final disposal signed by the responsible disposal facility official.

f. Waste profile sheets.

g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 50 feet of excavation, sample locations, and sample identification numbers. Show on-site stockpile, storage, treatment, loading, and relocation or disposal areas on the drawings. Provide separate cross-sections of each excavation area before and after excavation and after backfilling, based on survey data. The topographic drawing must show the lateral and vertical extents and GPS coordinates of the encapsulated PFAS-impacted soil, including the ground elevations prior to PFAS-impacted soil placement and the finish grade of the top of the relocation after the impacted soil is encapsulated and capped.

h. Progress Photographs. Use color photographs to document progress of the work. Take a minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions before work begins. After work has been started, photographically record weekly activities at each work location. Provide photographs including:

(1) Soil removal and sampling.

(2) Dewatering operations.

(3) Unanticipated events such as spills and the discovery of additional contaminated material.

(4) Contaminated material/water storage, handling, treatment, and transport.

(5) Site or task-specific employee respiratory and personal protection.

(6) Fill placement and grading.

(7) Post-construction photographs. After completion of work at each site, take a minimum of four views of each excavation site.

Include a digital version of all photos shown in the report with the Closure Report. Provide photographs with a minimum of 300 pixels per inch resolution for all photo files. Provide photos in a lossless compression file format that does not lose any pixels in the compression process (e.g. .TIFF, .PNG and .GIF). Ensure no loss of original resolution from the raw photo if converted to a lossless format. Create digital images and metadata that meet or exceed the specifications of the Exchangeable Image File Format (EXIF) version 2.3 or higher. In addition to the raw digital photo submissions, submit a PDF document as part of the Closeout Report displaying all required progress or other photos organized into separate documents. Render the photos in the PDF with a resolution that represents the original photo resolution to the human eye. Place photos according to their proper orientation (portrait or landscape). Create an index with bookmarks for each PDF organized by submittal section and suborganized by work area (if applicable) and then by date in the sequence which they were taken.

Process all raw photos for inclusion in the PDF submission with a border including a 0.5 inch caption at the base of each photo for descriptive information. Include the following information for each photographic image in the caption:

Project Name
Contract Number
Contractor Name
Date
Station and Offset
Photo Number
Orientation View
Work Element Depicted
General Project Area

ATTACHMENTS

A. Soil Management Plan for FY24 MCAF Project P-012/AJJY183012, North Aircraft Parking Ramp, Joint Region Marianas, Andersen AFB, Guam

B. G-RAM/LLRW Performance Work Statement

C. Soil Screening Survey Report for FY24 MCAF Project P-012/AJJY183012, North Aircraft Parking Ramp, Joint Region Marianas, Andersen AFB, Guam (2025)

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SOIL MANAGEMENT PLAN
FY24 MCAF PROJECT P-012/AJJY183012
NORTH AIRCRAFT PARKING RAMP
JOINT REGION MARIANAS, ANDERSEN AFB, GUAM

Contract No. N62742-20-D-0002
MNA Project 3035_1

9 January 2026

Prepared by
Myounghee Noh & Associates, L.L.C., dba MNA Environmental
Design, Studies, and Consulting Services
98-025 Hekaha Street, Suite 215A, Aiea, HI 96701
Tel (808) 484-9214
www.mnaenvironmental.com

TABLE OF CONTENTS

LIST OF ABBREVIATIONS ..... **iii**

EXECUTIVE SUMMARY ..... **iv**

1.0 INTRODUCTION **1**

2.0 SITE BACKGROUND **1**

2.1 General Geology and Hydrogeology 1

2.1.1 Sinkholes 1

2.2 Project Screening Levels 2

2.2.1 PFAS 2

2.2.2 Other Contaminants Excluding PFAS 3

2.3 PFAS-Release Areas and Soil Sampling 3

2.3.1 IRP Site 78A, FTA #3 3

2.3.2 B2550 Former FTA 4

2.4 Heavy Metals (Arsenic and Lead) and PFAS-Impacted Soil in B2550 Compound 5

3.0 P-012 PROJECT SOIL MANAGEMENT PLAN (SMP) **5**

3.1 PFAS-Impacted Soil 5

3.1.1 Assumed P-012 PFAS-Impacted Soil Areas 6

3.1.2 PFAS-Impacted Soil Relocation Area 7

3.2 Heavy Metals (Arsenic and Lead) and PFAS-Impacted Soil 8

3.3 Erosion and Dust Control 8

3.4 Professional Engineer (PE) or Environmental Consultant (EC) 9

3.5 Construction Worker Protection 9

3.6 Best Management Practices (BMP) 9

3.6.1 Delineation and Demarcation 9

3.6.2 Green Waste Management 10

3.6.3 Construction Cross-Contamination Prevention and Decontamination 10

3.6.4 Disturbed Impacted Areas 10

3.6.5 Temporary Stockpiling of Impacted Soil Outside Impacted or Relocation Areas 10

3.6.6 Sampling and Analysis for Construction Use 10

3.7 Closure Report 11

TABLES

Table 1. PFAS Project Screening Levels (PSL) – 2025 DoD Residential Screening Levels 2
Table 2. Summary of Assumed PFAS-Impacted Areas 7

APPENDIX

Appendix A Figures

Figure 1. Project Vicinity Map
Figure 2. Project Location Map
Figure 3. Known PFAS Release Areas
Figure 4-1. Historical PFAS Detections at Site 78A, FTA-3
Figure 4-2. Historical PFAS Detections at Bldg. 2550, Former FTA
Figure 4-3. Historical PFAS Detections at Site 78A and Bldg. 2550 (Overlay with Topographic Map)
Figure 5-1. Assumed PFAS-Impacted Areas and Relocation Area
Figure 5-2. Detailed Limits and Grading Plan – Assumed PFAS-Impacted Areas and Relocation Area
Figure 5-3. PFAS-Impacted Soil Relocation Area Grading Exhibit-1
Figure 5-4. PFAS-Impacted Soil Relocation Area Grading Exhibit-2
Figure 6. Lead- and Arsenic- Impacted Soil for Excavation and Disposal

LIST OF ABBREVIATIONS

AAFB	Andersen Air Force Base
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CNMI	Commonwealth of the Northern Mariana Islands
DoD	Department of Defense
EPA	Environmental Protection Agency, United States
ERP	Environmental Restoration Program
FTA	Firefighter Training Area
GEPA	Guam Environmental Protection Agency
G-RAM	General Radioactive Material
HDOH	State of Hawaii Department of Health
HHRA	Human Health Risk Assessment
HAZWOPER	Hazardous Waste Operations and Emergency Response
IRP	Installation Restoration Program
JRM	Join Region Marianas
MCAF	Military Construction Air Force
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
MNA	Myounghee Noh & Associates, L.L.C., dba MNA Environmental
MSL	Mean Sea Level
NAVFAC	Naval Facilities Engineering Systems Command
OWS	Oil-Water Separator
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFAS	Polyfluoroalkyl Substances
PSL	Project Screening Levels
ROD	Record of Decision
RSL	Regional Screening Levels, EPA, U. S.
SMP	Soil Management Plan
SWMU	Solid Waste Management Unit
TPESL	Tropical Pacific Environmental Screening Level, Hawaii Department of Health
USAF	U.S. Air Force

EXECUTIVE SUMMARY

The project, FY24 Military Construction Air Force (MCAF) Project P-012 North Aircraft Parking Ramp, will construct an aircraft parking ramp that includes a parking apron with six parking positions and associated taxiways and shoulders, airfield fence, and hydrant fueling pits and piping to accommodate aircraft. The project is located on the north side of the AAFB airfield (Appendix A, Figures 1 and 2). The project site includes the following impacted areas:

- Installation Restoration Program (IRP) Site 78A, Firefighter Training Area (FTA) #3 (Figures 3, 4-1, & 4-3) [Contaminants: Per- and polyfluoroalkyl substances (PFAS)]
  [**Note**: The PFAS detections exceeding the Project Screening Levels (PSL) were found outside of the current Site 78A FTA #3 boundary (78A-01, 78A-04, and 78A-09) as shown in Figures 4-1 and 4-3. The Navy Environmental Restoration Program (ERP) will expand the Site 78A FTA #3 boundary to include these PFAS exceedance areas as shown Figures 5-1 and 5-2].
- Bldg. 2550, Former FTA (Figures 3, 4-2, & 4-3) [Contaminants: PFAS]
- Bldg. 2550 Compound, heavy metals (arsenic and lead) impacted areas (Figure 6) [Contaminants: Arsenic and lead. Assume the soil is impacted by PFAS.]

The NAVFAC and USAF present this Soil Management Plan (SMP) for the PFAS-impacted soil and heavy metals/PFAS-impacted soil in the planned P-012 project site. The PFAS-Impacted Areas and depth have not been fully delineated. The Navy ERP is currently conducting a remedial investigation (RI) to determine the nature and extent of PFAS and will provide additional sampling data to the P-012 project as it becomes available. Site mitigation measures will be determined with input from the installation, regulatory agencies, and the public, as the site progresses through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. The MCAF P-012 project will implement the SMP to effectively manage impacted soil due to the required construction activities.

Selected Soil Screening Levels: The PFAS Residential Screening Levels (RSLs) established by the U.S. Environmental Protection Agency (EPA) in November 2024 and incorporated into Department of Defense (DOD) screening levels in January 2025 were selected as the PSL for PFAS (Table 1). For the other contaminants (e.g., arsenic, lead) excluding PFAS, the Tropical Pacific Soil Environmental Screening Levels (TPESL) for the industrial land use established by the Hawaii Department of Health (HDOH) were selected as the PSL. The TPESL are soil screening levels used in tropical areas outside of Hawaii, including Guam and the Commonwealth of the Northern Mariana Islands (CNMI). The Guam EPA (GEPA) adopted the TPESL for use in Guam in 2014.

PFAS-Impacted Soil Management (Relocation): The horizontal boundary of the PFAS-impacted soil has not been determined. PFAS was detected at concentrations exceeding the RSLs/DOD screening levels in the P-012 design samples collected from 1.5-2.5 ft bgs (B-30 and B-33); 1.5-3 ft bgs (B-20, B-21, B-22, B-23, and B-24); and 8.5-9.5 ft bgs (B-27). Therefore, the depth of PFAS-impacted soil has not been vertically delineated at the site.

Based on the available historical site use (Section 2.3), the historical PFAS releases occurred in the Fire Training Areas. The project assumes that PFAS-impacted firefighting water and stormwater were likely to discharge or migrate into nearby open (non-jungle) areas, which are relatively downgradient; therefore, high levels of PFAS-impacted soil can be present in the open downgradient areas. Thus, the assumed PFAS-Impacted Soil Areas will be limited to the open areas within the planned concrete paved apron and its immediate area to support the apron pavement, as shown in Figures 5-1 and 5-2 (purple hatched areas).

- Assumed Area 1: Area within Site 78A FTA #3 [Vertical impacted depth: 0-3 ft bgs]
- Assumed Area 2: Bldg. 2550 Form FTA [Vertical impacted depth: 0-3 ft bgs]
- Assumed Area 3: Dirt road and open area outside Site 78A FTA #3 [Vertical impacted depth: 0-3 ft bgs]

The maximum excavation depth in the assumed PFAS-Impacted Soil Areas is 3 ft bgs based on the project grading plan. The P-012 project will assume the soil from the existing surface level to 3 ft bgs is PFAS-impacted exceeding the PSL. The Contractor will be required to conduct additional sampling if the maximum excavation construction depth is extended deeper than 3 ft bgs. All additional PFAS testing results with detailed sampling procedures shall be provided to the contracting officer.

The project grading plan has been developed to minimize earthmoving of PFAS-impacted soil. The extent of impacted soil excavation will be limited to the designated depth and width to complete the construction. The impacted soil outside the apron and its immediate structural supporting area will be left in place. The PFAS-impacted soil will remain in place, if undisturbed, according to the grading plan. If the grading plan requires excavation (e.g., soil cutting) within the assumed PFAS-impacted areas, the excavated soil between 0-3 ft bgs will be relocated to the PFAS-Impacted Soil Relocation Area. For example, the grading plan requires excavation of the top 1-ft surface soil, the excavation will be limited to the top 1-ft soil for relocation, and the impacted soil between 1-3 ft bgs will remain in place. For the fill areas, the top 0.5-ft (6 inches) impacted surface soil will be removed for clearing and grubbing. The impacted areas will be covered with a new concrete pavement (aircraft parking apron) when the P-012 construction is completed. The total relocated PFAS-impacted soil is approximately 22,891 cubic yards. The following table presents the summary of the PFAS-Impacted Soil Areas and anticipated excavation quantity.

Summary of Assumed PFAS-Impacted Areas

Assumed PFAS-Impacted Areas		Impacted Area (Square Yards)	Impacted Depth (ft bgs)	Excavation Quantity (Cubic Yards)
#1	Area within Site 78A FTA #3	12,737	0-3	6,505
#2	Bldg. 2550 Form FTA	7,800	0-3	7,800
#3	Dirt road & open area outside Site 78A FTA #3	16,438	0-3	8,586
	Total	**36,975**	**--**	**22,891**

Note 1): The impacted depth is not an excavation depth. The extent of impacted soil excavation will be limited to the designated depth and width to complete the construction based on the project grading plan. Thus, the excavation depth varies depending on the locations

The impacted soil will be relocated to the PFAS-Impacted Soil Relocation Area which is Site 78A FTA #3 plus the expansion area, as shown in Figures 5-1 and 5-2 (brown hatched area). The Contractor shall provide a geomembrane barrier to wrap the relocated PFAS-impacted soil completely. As a final stabilization measure for the Relocation Area, the Contractor shall provide a minimum 1-ft layer of vegetated clean soil cap.

Heavy-Metals (Arsenic and Lead) and PFAS-Impacted Soil (Excavation and Disposal): The project includes arsenic and lead-impacted soil (Figure 6). Since the area is impacted by PFAS, the project will assume the soil is PFAS-impacted as well. The anticipated volume is approximately 20 cubic yards. The impacted soil will be excavated and disposed of at a permitted disposal facility.

The P-012 Project site includes PFAS impacted areas, General Radioactive Material (G-RAM) Area of Interest (AOI), and heavy-metal impacted areas. The Contractor shall retain a Professional Engineer (PE) or an Environmental Consultant (EC) experienced with soil investigation and removal/remediation. All personnel performing duties with potential for exposure to onsite contaminants must have 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, hazard communication, and job-specific health and safety training.

The Contractor must develop and implement a Stormwater Pollution Prevention Plan (SWPPP) including erosion and duct control plans in accordance with the CNMI and Guam Stormwater Management Manual (Horsley Witten Group Inc, 2006) to prevent migration of impacted soil during handing/managing impacted soil. Any earthwork related to impacted soil must be conducted with proper engineering control or protective measures.

All work involving hazardous, regulated, and/or impacted materials/waste must be conducted in a controlled manner protective of the workers, the facility users, and the environment in accordance with federal and Guam regulations and project requirements.

The Contractor shall provide the Draft and Final Closure Reports for review and approval by the Contracting Officer, and environmental regulators, and other stakeholders when the work related to the impacted soil is completed.

1.0 INTRODUCTION

The project, FY24 Military Construction Air Force (MCAF) Project P-012 North Aircraft Parking Ramp, will construct an aircraft parking ramp that includes a parking apron with six parking positions and associated taxiways and shoulders, airfield fence, and hydrant fueling pits and piping to accommodate various aircraft. The project is located on the north side of the AAFB airfield (Appendix A, Figures 1 and 2). The project includes demolition of existing buildings and utilities, including Bldg. 2550, 2551, and 2552. The project site includes the following impacted areas:

- Installation Restoration Program (IRP) Site 78A, Firefighter Training Area (FTA) #3 (Figures 3, 4-1, & 4-3)
  [Contaminants: Per- and polyfluoroalkyl substances (PFAS)]
- Bldg. 2550, Former FTA (Figures 3, 4-2, & 4-3)
  [Contaminants: PFAS]
- Bldg. 2550 Compound, heavy metals (arsenic, lead) and PFAS-impacted area (Figure 6)
  [Contaminants: Arsenic and lead. Assume the soil is impacted by PFAS.]

The NAVFAC and USAF present this Soil Management Plan (SMP) for the PFAS-impacted soil and heavy metals/PFAS-impacted soil in the footprint of the P-012 project site. The excavated PFAS-impacted soil will be relocated to the PFAS-Impacted Soil Relocation Area (Figures 5-1 and 5-2). The heavy metals and PFAS-impacted soil located at Bldg. 2550 Compound will be disposed of at a permitted disposal facility.

2.0 SITE BACKGROUND

2.1 General Geology and Hydrogeology

The project site is located on the northern limestone plateau of Guam. No wetlands or surface water are located within the project site. The thin soil and limestone bedrock are both porous and permeable, and rainwater readily infiltrates downward through interconnected pore spaces preventing the formation of surface streams, rivers, and lakes. The elevation of the project site is between 460 and 540 ft Mean Sea Level (MSL). Groundwater resources on northern Guam are encountered at approximately 400 to 600 ft below ground surface (bgs). The groundwater surface at the Main Base ranges between 3 and 4 ft above MSL and the freshwater lens ranges between 100- and 160-ft thick (NAVFAC, Marianas, 2014).

2.1.1 Sinkholes

Based on observation of karst features on the site, the University of Guam has been engaged to evaluate the extent of karst features. The Water & Environmental Research Institute at the University of Guam has identified two sinkholes within the project area (Figure 2).

This mitigation strategy includes identification of Karst features during site clearing and following the Contractor's geophysical investigation. The extents of karst features will be delineated using a geophysical method called Electrical Resistivity Tomography (ERT) to determine the location, depths and limits of karst features beneath or adjacent to airfield pavements. Identified Karst features such as sinkholes will be remediated with boulders and grout. Depending on the extents of karst features, modifications to the fill strategy may be required. The mitigation measures will be submitted to Guam Environmental Protection Agency (GEPA) for review and approval.

2.2 Project Screening Levels

2.2.1 PFAS

The U.S. EPA establishes the Regional Screening Levels (RSLs). The most current RSLs were issued in November 2024. Additionally, a Memorandum issued by the Assistant Secretary of Defense in January 2025 presents the Department of Defense (DoD) PFAS Screening levels that will be utilized for DoD branches under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Defense Environmental Restoration Program (ERP). The DoD PFAS screening levels are based on EPA's RSL tables dated November 2024 except where the EPA RSLs were below the method detection limits of EPA-approved analytical methods. These chemicals are PFOA and PFDA. The DoD Residential Screening Levels were selected as the project screening levels (PSL) for PFAS (Table 1).

Table 1. PFAS Project Screening Levels (PSL) – 2025 DoD Residential Screening Levels

Chemical Name	Abbreviation	CAS No.	[1] Nov. 2024 EPA RSL (µg/kg)		[2] PSL: 2025 DoD Memo Screening Levels (µg/kg) for Residential Land Use (HQ=0.1)
			Residential (HQ=0.1)	Industrial (HQ=0.1)	
Perfluorobutanoic acid	PFBA	375-22-4	7800	120,000	7,800
Perfluoro butane sulfonic acid	PFBS	375-73-5	1900	25,000	1900
Perfluorooctanoic acid	PFOA	335-67-1	0.019	0.078	0.070
Perfluorooctane sulfonic acid	PFOS	1763-23-1	0.63	8.2	0.63
Perfluorodecanoate	PFDA	335-76-2	0.013	0.16	0.060
Perfluorohexanoic acid	PFHxA	307-24-4	3,200	4,100	3,200
Perfluorohexane sulfonic acid	PFHxS	355-46-4	130	1600	130
Perfluorononanoic acid	PFNA	375-95-1	19	250	19
Hexafluoro propylene oxide dimer acid	HFPO-DA (Gen-X)	13252-13-6	23	350	23

1) U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2024).
2) Department of Defense (DoD) Assistant Secretary of Defense (ASD) Memorandum for Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program (January 2025)
3) The PFAS screening levels assume multiple PFAS are present and therefore use a hazard quotient (HQ) = 0.1

2.2.2 Other Contaminants Excluding PFAS

The PSL for contaminants excluding PFAS are the State of Hawaii, Hawaii Department of Health (HDOH), Tropical Pacific Soil Environmental Screening Levels (TPESL) for the restricted (commercial/industrial) land use (State of Hawaii, Department of Health, Fall 2017). The TPESL are soil screening levels used in tropical areas outside of Hawaii, including Guam and the Commonwealth of the Northern Mariana Islands. The GEPA adopted the TPESL for use in Guam in 2014.

2.3 PFAS-Release Areas and Soil Sampling

The project site includes two known PFAS Release Areas, Site 78A FTA #3 and Bldg. 2550, Former FTA (Figure 3). Another IRP Site 26, FTA # 2, is located near the project area, however, the site will not be disturbed as part of the project.

Discrete soil samples from Site 78A FTA #3 and Bldg. 2550, Former FTA were collected as part of the following program/contract. The samples were analyzed via EPA method 1663 for PFAS.

- Andersen AFB PFAS Site Investigation under the Navy ERP contract in 2023
- P-012 MCAF design task orders in 2022 and 2023

The sampling locations and depths are presented in Figure 4-1 for Site 78A FTA #3 and Figure 4-2 for Bldg. 2550, Former FTA.

2.3.1 IRP Site 78A, FTA #3

2.3.1.1 Historical Site Investigation and 2014 Record of Decision

The IRP Site 78A occupies approximately 10 acres northwest of AAFB airfield (Figure 3). The area was used for firefighter training between 1955 and 1973. The first investigation at Site 78 was performed in 1994. This was a site reconnaissance without any sampling. Based on the information obtained during the initial site reconnaissance, additional field investigation was recommended for the site. In 2000, as part of the Phase I remedial action, Site 78 was revisited and a number of potential sources of contamination were identified, including a 135-foot diameter burn pit with a 1-foot-high soil berm, a cleared area surrounding the burn pit, a metal-framed rusting structure, and approximately fifty 55-gallon drums. Of the 50 drums, 5 were still intact and contained fluids, while the remaining drums were in a rusty or deteriorated condition. The drum labels indicated that the drums contained lube oil, hydraulic oil, and fuel oil. A follow-up Phase II remedial action investigation was completed at Site 78 in 2003. The Phase II remedial action included site reconnaissance, a geophysical survey, a soil gas survey, and surface and subsurface soil sampling. During the 2010 remedial investigation, several areas of empty drums were identified on the eastern boundary of the site. In addition, a 2-inch underground drain line was discovered and traced to approximately 200 feet of the northwest portion of the former fire training burn pit. The 5 intact 55-gallon drums observed during the Phase I remedial action were not observed during the RI site reconnaissance. The fate of these drums is unknown.

The 2010 remedial investigation confirmed that the presence of soil contaminants including polycyclic aromatic hydrocarbons (PAH) (benzo(a) anthracene, benzo(a)pyrene, benzo(a)pyrene, benzo(a)pyrene), heavy metals (lead, aluminum, copper), polychlorinated biphenyls (PCB), and dioxins exceeding the Region 9 U.S. EPA Primary Remediation Goals (PRG) mostly in the surface soil (0-1 ft bgs). The 2010 remedial investigation included a Human Health Risk Assessment (HHRA). The results of the HHRA indicated the only concern for human exposure to soil was for non-carcinogenic risk of aluminum in subsurface soil at Site 78 to potential future residential children. A risk management decision was made to eliminate aluminum in subsurface soil as a chemical of concern for future residential children, as the future site plan will likely be for industrial use as part of the flight line operations. All other exposure scenarios evaluated indicated no human health concerns. These scenarios included both non-carcinogenic and carcinogen evaluations for occasional users, site workers, and construction workers. In addition, there were no concerns for carcinogenic risks to residents. Overall, there were no unacceptable risks to public health or welfare to the environment identified at Site 78 (NAVFAC, Marianas, 2014). Following the remedial investigation, the 2014 Record of Decision (ROD) indicated No Further Action (NFA) for Site 78.

2.3.1.2 PFAS Soil Sampling and Results

Currently, the IRP Site 78A is reopening due to confirmed presence of PFAS-impacted soil and potential presence of General Radioactive Material (G-RAM). The ERP will conduct a remedial investigation of PFAS contamination and G-RAM survey.

Soil samples for PFAS analysis were collected using a discrete sampling method as presented in Section 2.3. The sampling locations, depths, and results are presented in Figures 4-1 and 4-3. PFOA, PFOS, and PFDA were reported to exceed the PSL. PFBA, PFHxA, PFHxS, and HFPO-DA were detected below the PSL.

2.3.1.3 Expansion of Site 78A FTA #3 Boundary

PFAS were reported exceeding the PSL outside of the current Site 78A FTA #3 area. These sampling locations are 78A-01, 78A-04, and 78A-09. The Navy ERP will expand the boundary of Site 78A FTA #3 to the south, including these PFAS exceedance areas (Figures 5-1 and 5-2).

2.3.1.4 G-RAM

The SMP does not include any plan for G-RAM screening and disposal. The Contractor shall develop and implement a Radiation Work Plan.

2.3.2 B2550 Former FTA

2.3.2.1 Historical Site Use

The former Solid Waste Management Unit-15 (SWMU-15) consists of three buildings, B2550, B2551, and B2552 including the septic system (septic tank and leaching field), all of which will

be demolished as part of this project (Figures 4-2 and 6). Historically, the SWMU-15 stored JP-4 Fuel Stoddard Solvent Engine/Hydraulic Lubricants Aircraft-Cleaning Compound; however, it is no longer in use. The current site use is a facility to store groundwater sampling and other IRP-related equipment (drums, IDW, etc.). The Cultural and Natural Resources department of AAFB also uses the area for storing vehicles and equipment. The as-built drawings for B2550/2551 indicate an Oil-Water Separator (OWS) and a septic tank/leaching field. According to the Oil Water Separator Management Plan (June 2011), AAFB programed the removal of 14 OWS that were no longer necessary due to operational changes. In 2010 AAFB submitted a Final Closure and Decommissioning Report for 14 Oil-Water Separator Removals at Andersen AFB (2010) to Guam EPA. The OWS installed at B2550 was part of the closure report. Upon removal of the OWS from B2550, soil samples were collected from the OWS footprint. Petroleum contaminants (Total Petroleum Hydrocarbon (TPH) and Benzo[a]pyrene) were found; the results were below the residential soil screening levels.

The Former FTA is identified in the vicinity B2550 paved and surrounded by open, grassy areas and could have been used for training (Figure 4-2). B2551 is a former jet engine testing facility, which was also used for firefighter training from 1955 to 1973 (USAF 1996). No other documentation of firefighter training activities at this area was found, although based on an interview with the chief fire inspector, Aqueous Film-Forming Foam (AFFF) was used for training during this active period, which could have resulted in a release to the environment.

2.3.3.2 PFAS Soil Sampling and Results

Soil samples for PFAS analysis were collected using a discrete sampling method. The sampling locations, depths, and results are presented in Figures 4-2 and 4-3. PFOA, PFOS, PFDA, and HFPO-DA were reported to exceed the PSL. Other PFAS including PFBA, PFHxA, PFHxS, and PHNA were detected below the PSL.

2.4 Heavy Metals (Arsenic and Lead) and PFAS-Impacted Soil in B2550 Compound

As part of the P-012 MCAF design tasks in 2022 and 2023, soil samples were collected in the vicinity B2550 compound to be demolished. A composite soil sampling method was utilized. Soil samples were collected along building perimeters. An elevated level of lead was reported at 310 mg/kg in the soil collected along the B2550/B2551 perimeter exceeding the residential TPESL for lead (200 mg/kg). Arsenic impacted soil was reported at 28 mg/kg in the soil collected from the transformer enclosure and perimeter exceeding the residential TPESL for arsenic (24 mg/kg). It was assumed that the soil is impacted by PFAS as well.

3.0 P-012 PROJECT SOIL MANAGEMENT PLAN (SMP)

3.1 PFAS-Impacted Soil

The PFAS-Impacted Area and depth have not been fully delineated. The Navy ERP is currently conducting a remedial investigation (RI) to determine the nature and extent of PFAS and will provide additional sampling data to the P-012 project as it becomes available. Site mitigation

measures will be determined with input from the installation, regulatory agencies, and the public, as the site progresses through the CERCLA process.

The MCAF P-012 project will implement the SMP to effectively manage PFAS-impacted soil due to the required construction activities within the assumed PFAS Impacted Areas and Relocation Area.

3.1.1 Assumed P-012 PFAS-Impacted Soil Areas

The horizontal boundary of the PFAS-impacted soil has not been determined. PFAS was detected at concentrations exceeding the RSLs/DOD screening levels in the P-012 design samples collected from 1.5-2.5 ft bgs (B-30 and B-33); 1.5-3 ft bgs (B-20, B-21, B-22, B-23, and B-24); and 8.5-9.5 ft bgs (B-27). The depth of PFAS-impacted soil has not been vertically delineated at the site.

Based on the available historical site use as presented in Section 2.3, the historical PFAS releases occurred in the Fire Training Areas. The project assumes that PFAS-impacted firefighting water and stormwater were likely to discharge or migrate into nearby open (non-jungle) areas, which are relatively downgradient; therefore, high levels of PFAS-impacted soil can be present in these open downgradient areas. Thus, the assumed PFAS-Impacted Soil Areas will be limited to the open areas within the planned concrete paved apron and its immediate area to support the apron pavement, as shown in Figures 5-1 and 5-2 (purple hatched areas).

- Assumed Area 1: Area within Site 78A FTA #3 [Vertical impacted depth: 0-3 ft bgs]
- Assumed Area 2: Bldg. 2550 Form FTA [Vertical impacted depth: 0-3 ft bgs]
- Assumed Area 3: Dirt road and open area outside Site 78A FTA #3 [Vertical impacted depth: 0-3 ft bgs]

The maximum excavation depth in the assumed PFAS-Impacted Soil Areas is 3 ft bgs based on the project grading plan. The P-012 project will assume the soil from the existing surface level to 3 ft bgs is PFAS-impacted exceeding the PSL. The Contractor will be required to conduct additional sampling if the maximum excavation construction depth is extended deeper than 3 ft bgs. All additional PFAS testing results with detailed sampling procedures shall be provided to the contracting officer.

The project grading plan has been developed to minimize earthmoving of PFAS-impacted soil. The extent of impacted soil excavation will be limited to the designated depth and width to complete the construction. The impacted soil outside the apron and its immediate structural supporting area will be left in place.

The PFAS-impacted soil will remain in place, if undisturbed, according to the grading plan. If the grading plan requires excavation (e.g., soil cutting) within the assumed PFAS-impacted areas, the excavated soil between 0-3 ft bgs will be relocated to the PFAS-Impacted Soil Relocation

Area. For example, the grading plan requires excavation of the top 1-ft surface soil, the excavation will be limited to the top 1-ft soil for relocation, and the impacted soil between 1-3 ft bgs will remain in place. For the fill areas, the top 0.5-ft (6 inches) impacted surface soil (organic topsoil layer) will be removed for clearing and grubbing and relocated. The impacted areas will be covered with a new concrete pavement (aircraft parking apron) when the P-012 construction is completed. The total relocated PFAS-impacted soil is approximately 22,891 cubic yards. Table 2 presents the summary of the PFAS-Impacted Soil Areas and anticipated excavation quantity.

Table 2. Summary of Assumed PFAS-Impacted Areas

Assumed PFAS-Impacted Areas		Impacted Area (Square Yards)	[1)]Impacted Depth (ft bgs)	Excavation Quantity (Cubic Yards)
#1	Area within Site 78A FTA #3	12,737	0-3	6,505
#2	Bldg. 2550 Form FTA	7,800	0-3	7,800
#3	Dirt road & open area outside Site 78A FTA #3	16,438	0-3	8,586
	Total	**36,975**	**--**	**22,891**

Note 1): The impacted depth is not an excavation depth. The extent of impacted soil excavation will be limited to the designated depth and width to complete the construction based on the project grading plan. Thus, the excavation depth varies depending on the locations.

3.1.2 PFAS-Impacted Soil Relocation Area

The previous PFAS soil test confirmed the presence of PFAS-impacted soil outside of the current Site 78A FTA #3 boundary (Section 2.3.1.3). The Navy ERP will expand the boundary of Site 78A FTA #3 to include the area with PFAS detection exceeding the PSL. The excavated impacted soil will be relocated to the PFAS-Impacted Soil Relocation Area (brown hatched area) which is Site 78A FTA #3 plus the expansion area (Figures 5-1 and 5-2). The anticipated soil volume to be relocated is 22,891 cubic yards.

The relocated soil will be wrapped with a 20-mil geomembrane barrier. The geomembrane panels will be seamed. A minimum 1 ft of clean soil cap with vegetated cover will be provided as a final stabilization measure.

3.1.2.1 Geomembrane

A chemically resistant geomembrane liner free of holes and other damage will be used to wrap the excavated impacted soil. Non-reinforced geomembrane liners must have a minimum thickness of 20 mils. Scrim reinforced geomembrane liners must have a minimum weight of 40 lbs/1000 square feet. The ground surface on which the geomembrane is to be placed must be free of rocks and any other object which could damage the membrane.

3.1.2.2 Installation of Geomembrane Barrier

Prior to placing geomembrane lines, the Contractor will conduct clearing and grading of the relocation area in accordance with Figures 5-3 and 5-4. The geomembrane panels shall be installed and seamed in accordance with the geomembrane manufacturer's recommendations and requirements listed in this section. Where the geomembrane manufacturer's recommendations

disagree with the requirements of this section, the Contractor will follow the more stringent requirement.

1) At least 30 calendar days prior to placement, submit geomembrane manufacturer's installation instructions.
2) Do not elongate, wrinkle, scratch, or otherwise damage the geomembrane. Replace or repair geomembrane damaged during installation.
3) The underlying soil surface (if present) does not contain stones, litter, or organic matter which may be damaging to the geomembrane. Remove rocks and any other material which could damage the geomembrane must be removed from the surface to be covered with the geomembrane.
4) Only deploy geomembrane panels that can be anchored and seamed together the same day. Place adequate ballast on the geomembrane, without damaging the geomembrane, to prevent uplift by wind. On side slopes, anchor the geomembrane at the top and deploy down the slope to minimize wrinkles. Minimize dragging of geomembrane panels over the ground surface.
5) Minimize wrinkles and tensile stresses in the geomembrane. Provide adequate slack to prevent the creation of tensile stress. Wrinkle height to width ratio for installed geomembrane exceeding 0.5 is unacceptable.
6) Overlap geomembrane panels a minimum of 3 inches and a maximum of 6 inches.
7) Clean the seam area to provide an area that is free of moisture, dust, dirt, and foreign material at the time of seaming. Do not use solvent for cleaning.
8) If grinding is required, follow a grinding process approved by the geomembrane manufacturer. Complete grinding in a manner that does not damage the geomembrane.
9) Repair fish mouths (half-cylinder openings/voids caused by wrinkling/shifting) in seam.
10) Protect exposed geomembrane edges at the end of each day or whenever an installation activity is temporarily suspended during the day.

3.2 Heavy Metals (Arsenic and Lead) and PFAS-Impacted Soil

The project includes arsenic and lead-impacted soil (Figure 6). Since the area is impacted by PFAS, the project will assume the soil is PFAS-impacted as well. The anticipated volume is approximately 20 cubic yards. The impacted soil will be excavated and disposed of at a permitted disposal facility.

3.3 Erosion and Dust Control

The Contractor will develop and implement a Stormwater Pollution Prevention Plan (SWPPP) including erosion and duct control plans in accordance with the CNMI and Guam Stormwater Management Manual (Horsley Witten Group Inc, 2006) to prevent migration of impacted soil during handing impacted soil.

A sinkhole is in the vicinity of Site 78A FTA #3, especially in the northeast of the FTA. There will be at least 100 ft of buffer distance between the relocation area and the sinkhole. The Contractor shall provide double layers of erosion control measures (e.g., 2 layers of silt fences, 2 layers of compost filter sock, or 2 layers of these in combination) spaced a minimum of 5 feet apart along the sinkhole boundary but close to the project area. The double layers of erosion control measures shall be maintained until PFAS-impacted soil is stabilized, such as when the impacted areas are covered with concrete paving materials and the relocation area is covered with a minimum 1-ft layer of vegetated clean soil cap.

3.4 Professional Engineer (PE) or Environmental Consultant (EC)

The Contractor shall retain a Professional Engineer (PE) or an Environmental Consultant (EC) experienced with soil investigation and removal/remediation. The PE or EC is required to evaluate the provided information; to incorporate PFAS testing and management requirements; and to develop the project-specific Work Plans using the Contractor's means and methods and a Closure Report. The PE or EC must have a minimum of five (5) years of experience managing environmental investigation and soil remedial/removal action projects.

The project requires a dedicated full-time Environmental Manager (EM) in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. If the EM meets the PE or EC qualifications for PFAS Management described in the section, the EM will be allowed to practice the PE or EC upon approval from the Contracting Officer. If not, the Contractor must retain the qualified PE or EC to manage impacted materials accordingly.

3.5 Construction Worker Protection

The P-012 Project site includes PFAS impacted areas, G-RAM Area of Interest (AOI), and heavy metal impacted areas. All personnel performing duties with potential for exposure to onsite contaminants must have 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, hazard communication, and job-specific health and safety training. After concerns or risks related to onsite contaminants are eliminated or mitigated, HAZWOPER-trained personnel will not be required. The Contractor shall comply with all requirements of 29 CFR 1910.120/29 CFR 1926.65 medical surveillance program and EM 385-1-1, Safety and Health Requirements Manual for workers performing cleanup operations and who will be exposed to contaminants. The Contractor shall provide appropriate personal protective measures.

3.6 Best Management Practices (BMP)

Any earthwork related to impacted soil without proper engineering control or protective measures must be prohibited. The Contractor must implement BMP measures.

3.6.1 Delineation and Demarcation

The Contractor shall clearly demarcate the PFAS-impacted areas and the relocation area using durable, high-visibility safety tapes, barrier fences, or equivalent methods. The demarcation must

be maintained until the completion of construction activities related to PFAS-impacted soil (e.g., installing final stabilization measures for PFAS-impacted areas and relocation area).

3.6.2 Green Waste Management

Green waste generated from the assumed PFAS-impacted areas must be processed onsite. The compost material will be reused in the PFAS-relocation area to support the vegetated cover of the 1-ft clean soil cap.

3.6.3 Construction Cross-Contamination Prevention and Decontamination

The Contractor will follow normal construction site storm water pollution prevention practices to limit dust emission or tracking of sediment off site. To ensure PFAS-impacted material does not leave the impacted and relocation areas, the Contractor must avoid tracking of soil on truck tires or worker boots. When a worker or truck leaves the Site 78A FTA #3, assumed PFAS-impacted areas, and PFAS-impacted soil relocation areas, they must stop to first dry brush the truck tires, buckets of excavators, or their boots within the boundary of the site. If conditions are too wet to enable effective dry brushing, the trucks, buckets, or boots will be rinsed before leaving these impacted areas. The decontamination shall be provided for the work related to the heavy metals-impacted areas/stockpile.

3.6.4 Disturbed Impacted Areas

If the impacted areas are disturbed or bare impacted soil is exposed, the area must be covered with plastic liners or equivalent, and perimeter control must be implemented with filter socks or equivalent along the disturbed boundary as a temporary erosion control measure.

3.6.5 Temporary Stockpiling of Impacted Soil Outside Impacted or Relocation Areas

The Contractor must determine appropriate temporary stockpiling locations to prevent the release or dispersion of impacted soil. The Contractor shall avoid stockpiling impacted soil outside of the assumed PFAS-impacted areas or the relocation area. However, if impacted soil is stockpiled outside of the assumed PFAS-impacted areas or relocation area, stockpiles must be constructed to isolate stored impacted materials from the environment using chemically resistant geomembrane liners. The temporary stockpile for the impacted soil must be wrapped with geomembrane liners. The liners must be anchored or ballasted to prevent it from being removed or damaged by wind.

3.6.6 Sampling and Analysis for Construction Use

If required, the Contractor shall provide additional sampling and analysis for the construction use based on the Contractor's discretion to complete the construction and waste management/ disposal. All abandoned waste debris stockpiles and construction and demolition waste/debris including the heavy metals impacted soil must be recycled or disposed of accordingly based on the waste characterization results and applicable federal and Guam regulations/requirements. The Contractor is responsible to provide all necessary sampling and analysis to recycle or dispose of waste or materials.

3.7 Closure Report

The Contractor shall provide the Draft and Final Closure Reports for review and approval by the Contracting Officer, and environmental regulators, and other stakeholders. The Contractor must address comments received from the regulators and stakeholders. The Closure Report must be labeled with the contract number, project name, location, date, and name of General Contractor for the work. The Closure Report must include the following information:

1) A cover letter signed by a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.
2) A narrative report including, but not limited to, the following:
    a. site conditions, ground water elevation, and cleanup criteria
    b. excavation logs and field observations
    c. quantity of impacted soil or materials excavated, reused, recycled, and/or disposed of from each area of contamination with a site plan indicating each action.
    d. Relocation/encapsulation of PFAS-impacted soil
    e. quantity of water/product removed during dewatering
    f. sampling locations and sampling methods
    g. sample collection data such as time of collection and method of preservation
    h. sample chain-of-custody forms
    i. source of backfill
    j. geomembrane barrier
3) Copies of all chemical and physical test results
4) Copies of all manifests and land disposal restriction notifications, if applicable
5) Copies of all certifications of final disposal signed by the disposal facility official responsible
6) Waste profile sheets
7) Scale drawings with GPS coordinates showing limits of each excavation, limits of contamination, excavation, sample locations, and sample identification numbers. On-site stockpile, storage, treatment, and loading, must also be shown on the drawings
8) Topographic drawings showing the lateral and vertical extents and GPS coordinates of the encapsulated PFAS-impacted soil, including the ground elevations prior to PFAS-impacted soil placement and the finish grade of the top of the relocation after the impacted soil is encapsulated and capped
9) Progress Photographs. Color photographs must be used to document the progress of the work.

References

HDOH. (2022, July 19). *PER- AND POLYFLUOROALKYL SUBSTANCES (PFASS)*. Retrieved from HDOH HEER Office: https://health.hawaii.gov/heer/environmental-health/highlighted-projects/per-and-polyfluoroalkyl-substances-pfass/

NAVFAC, Marianas. (2011). *b) Final Record of Decision for Installation Restoration Program Sites 10, 13, 15, 26, and 27, Andersen Air Force Base.*

NAVFAC, Marianas. (2014). *Record of Decision Site 78, Site-Wide Operable Unit, Andersen Air Force Base, Guam.*

State of Hawaii Department of Health. (Fall 2017). *Environmental Action Levels Surfer.* Retrieved from Environmental Hazard Evaluation and Environmental Action Levels: http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/environmental-hazard-evaluation-and-environmental-action-levels

State of Hawaii, Department of Health. (Fall 2017). Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater, Tropical Pacific Edition.

Horsley Witten Group Inc. (October 2006). CNMI and Guam Stormwater Management Manual

APPENDIX A FIGURES

Figure 1. Project Vicinity Map
Figure 2. Project Location Map
Figure 3. Known PFAS Release Areas
Figure 4-1. Historical PFAS Detections at Site 78A, FTA-3
Figure 4-2. Historical PFAS Detections at Bldg. 2550, Former FTA
Figure 4-3. Historical PFAS Detections at Site 78A and Bldg. 2550 (Overlay with Topographic Map)
Figure 5-1. Assumed PFAS-Impacted Areas and Relocation Area
Figure 5-2. Detailed Limits and Grading Plan - Assumed PFAS-Impacted Areas and Relocation Area
Figure 5-3. PFAS-Impacted Soil Relocation Area Grading Exhibit-1
Figure 5-4. PFAS-Impacted Soil Relocation Area Grading Exhibit-2
Figure 6. Lead- and Arsenic- Impacted Soil for Excavation and Disposal

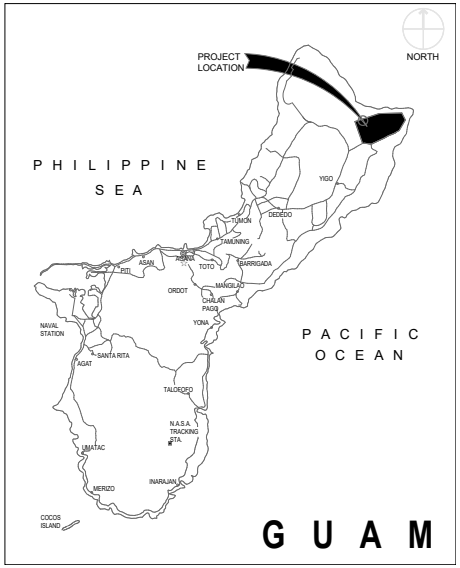
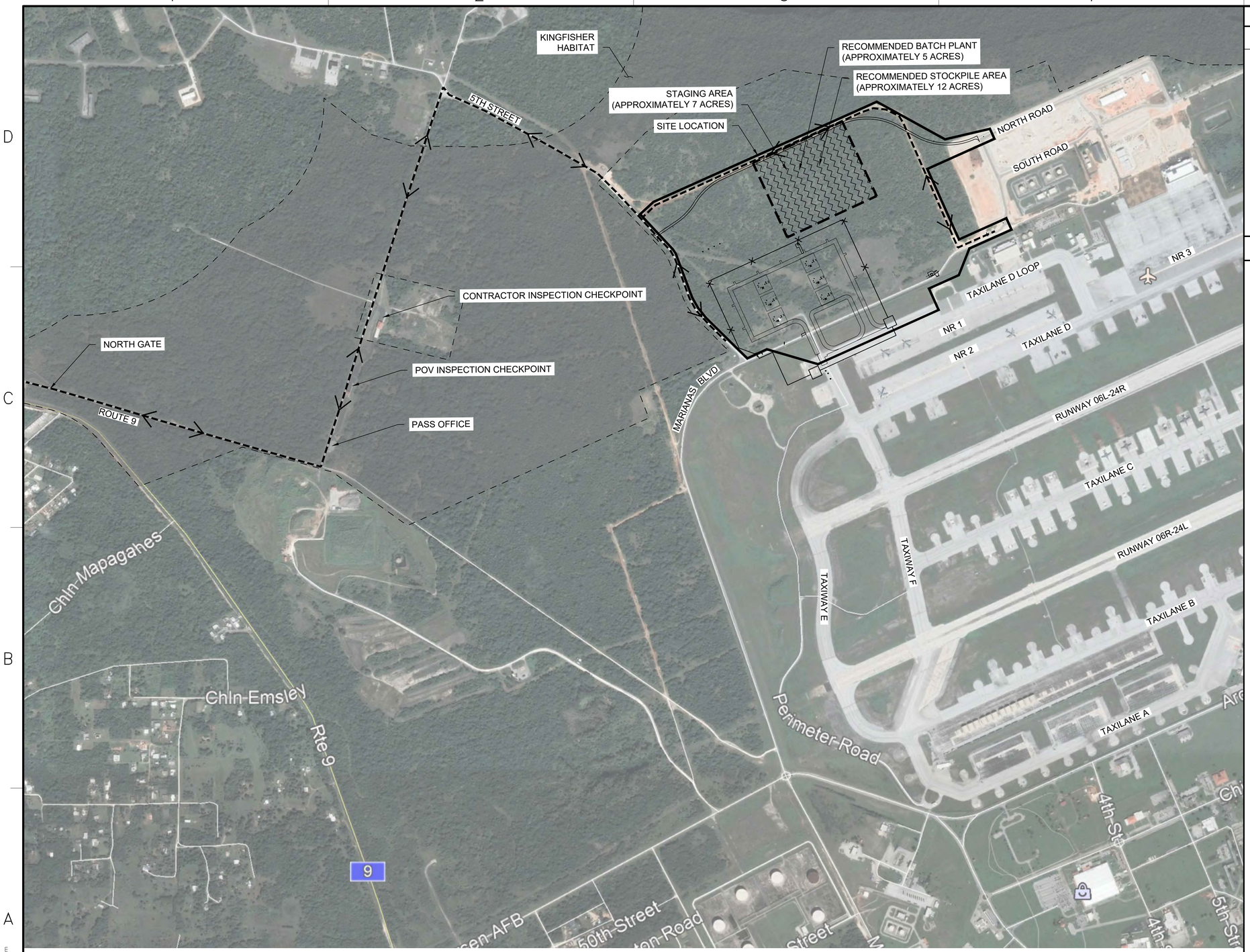


Figure 1. Project Vicinity Map



A1 LOCATION MAP AND HAUL ROUTE
SCALE: 1" = 600'

Figure 2. Project Location Map

GENERAL NOTES

A	AERIAL IMAGERY SHOWN IN DRAWINGS WERE OBTAINED THROUGH CIVIL 3D GEOREFERENCED MAP.

LEGEND

- SITE LOCATION
- RECOMMENDED BATCH PLANT
- KINGFISHER HABITAT
- STAGING AREA
- HAUL ROUTE

NAVFAC

Jacobs / BURNS McDONNELL
JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-21F0315
JEG NO. D3430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		GAM
BRANCH MANAGER		SMK
CHIEF ENG/ARCH		SMK
FIRE PROTECTION		JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP REVISION

LOCATION MAP AND HAUL ROUTE

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

GI001

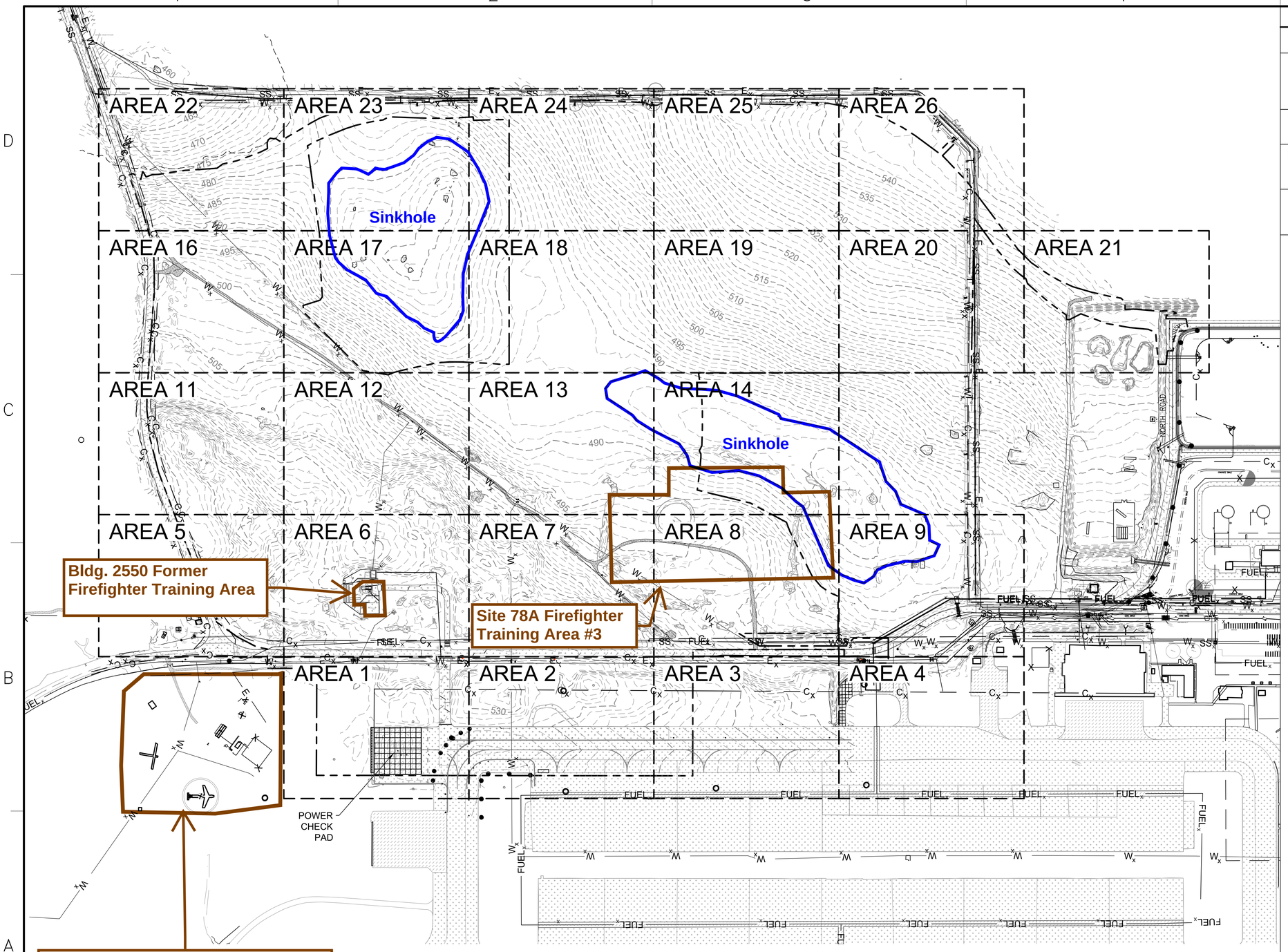
GRAPHIC SCALE
0 300' 600' 1200'
SCALE: 1"=600'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

65% DESIGN SUBMITTAL

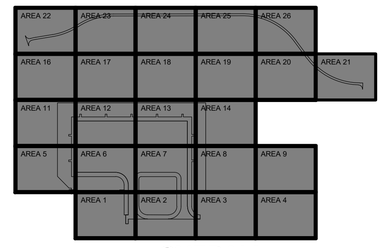
FILE NAME: U:\BLDG\NAVFAC Pacific\D3430603 - P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\P012_1665555_GI001.dwg
LAYOUT NAME: LOCATION MAP AND HAUL ROUTE
PLOTTED: 08/15/2025 10:12am
USER: RIOSE



A1 OVERALL EXISTING CONDITIONS
SCALE: 1" = 200'

GENERAL NOTES

A	TOPOGRAPHIC SURVEY PREPARED BY DUENAS CAMACHO & ASSOCIATES, INC. DATED JULY 19, 2022
B	HORIZONTAL AND VERTICAL CONTROL SURVEY WAS BASED FROM GGN-8 WITH A MEAN SEA LEVEL (MSL) 569.55', AS SHOWN, AND WITH THE FOLLOWING GRID COORDINATES: GRID VALUE 1993, NORTHING (FT) 682,406.3148, EASTING (FT) 386,184.7184
C	ALL DISTANCES, COORDINATES, AND DIMENSIONS SHOWN HEREON ARE IN INTERNATIONAL SURVEY FEET AND DECIMALS THEREOF, UNLESS OTHERWISE NOTED.
D	CONTOURS WERE DEVELOPED FROM SPOT ELEVATIONS USING A COMBINATION OF RTK GLOBAL POSITIONING SYSTEM (GPS) AND ELECTRONIC TOTAL STATIONS TOPOGRAPHIC SURVEY METHOD.
E	FIELD VERIFY EXISTING SITE CONDITIONS PRIOR TO THE COMMENCEMENT OF WORK AND REPORT ANY DISCREPANCIES TO THE CONTRACTING OFFICER. BECOME FAMILIAR WITH THE SITE CONDITIONS PRIOR OF BIDDING.



OVERALL
KEY PLAN

GRAPHIC SCALE
0 100' 200' 400'
SCALE: 1"=200'

NORTH ARROW
TRUE N

NAVFAC

Jacobs / BURNS McDONNELL
JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742211F0315
JEG NO. D3430603
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	JMH	DRW:	SMC	REV:	ATM
PM/DM					GAM
BRANCH MANAGER					SMK
CHIEF ENG/ARCH					SMK
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP REVISION

OVERALL EXISTING CONDITIONS

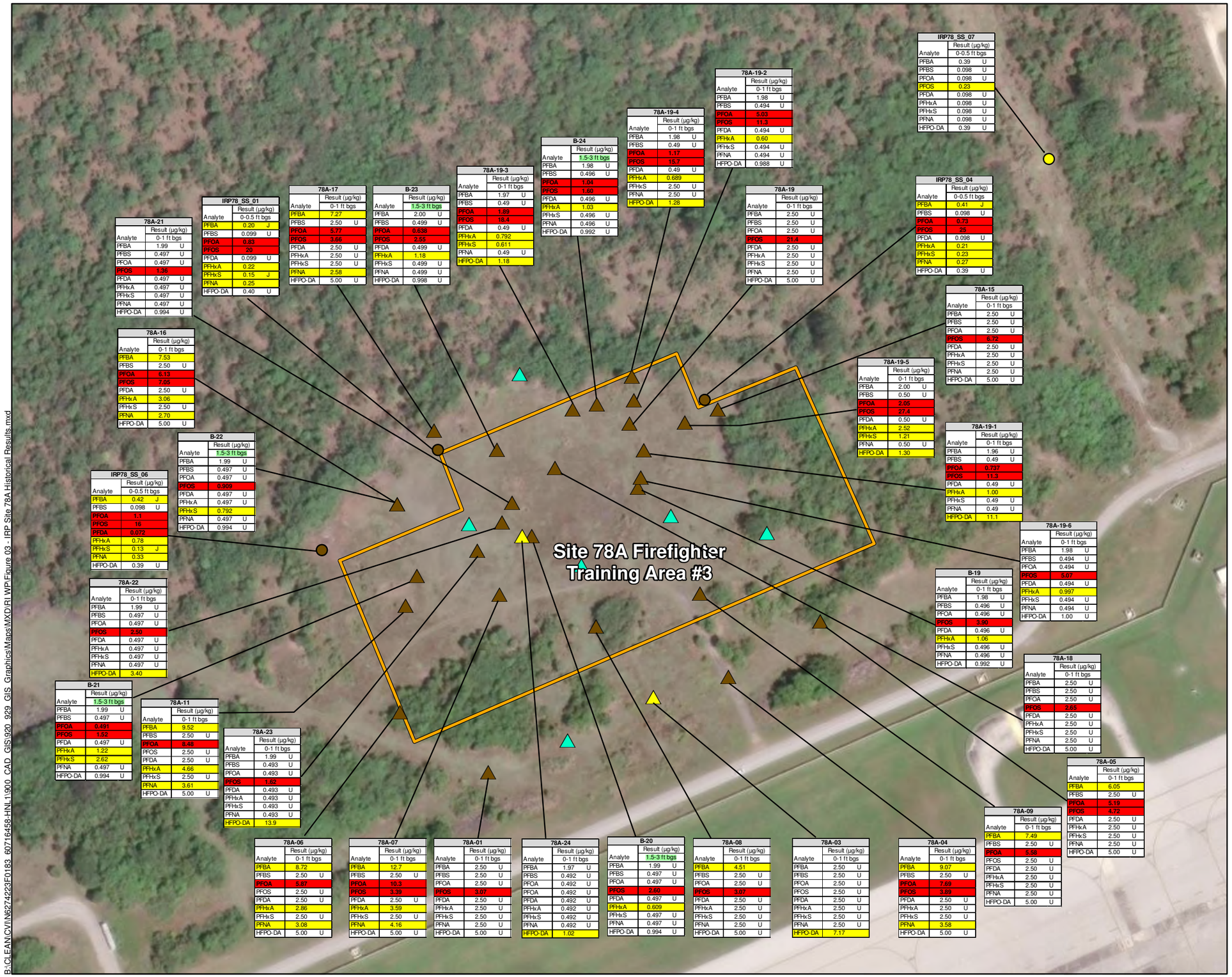
SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF
V-101

65% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT, USE GRAPHIC SCALES

FILE NAME: U:\BLDG\NAVFAC Pacific\D3430603 - P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\P012_1665555_V-101.dwg
LAYOUT NAME: OVERALL EXISTING CONDITIONS
PLOTTED: 08/15/2025 10:18am
USER: RIOSE

Figure 3. Known PFAS Release Areas



Legend

- Andersen AFB PFAS SI Sample Location with PFAS Exceedance
- Andersen AFB PFAS SI Sample Location with PFAS Detection
- P-012 MILCON Sample Location with PFAS Exceedance
- P-012 MILCON Sample Location with PFAS Detection
- P-012 MILCON Sample Location with no PFAS Detection
- Site 78A Firefighter Training Area

Notes

1. Abbreviations:
   AFB: Air Force Base
   bgs: below ground surface
   EPA: U.S. Environmental Protection Agency
   J: estimated concentration
   MILCON: Military Construction
   NPL: National Priorities List
   PFAS: Per- and Polyfluoroalkyl Substances
   RI: remedial investigation
   RSL: regional screening level
   SI: site inspection
   THQ: target hazard quotient
   TRL: target risk level
   U: Non-Detect
2. Map Projection: WGS 1984 UTM Zone 55N
3. Base Map:Esri, Maxar, Earthstar Geographics, and the GIS Community
4. Results are presented in micrograms per kilogram (µg/kg).
5. Soil project screening levels (PSLs) are based on the 2024 EPA RSL for residential land use (TRL = 1E-06, THQ = 0.1)
   Soil Project Screening Levels:

Acronym	Analyte	PSL (µg/kg)
PFBA	Perfluorobutanoic acid	7800
PFBS	Perfluorobutanesulfonic acid	1900
PFOA	Perfluorooctanoic acid	0.070
PFOS	Perfluorooctanesulfonic acid	0.63
PFDA	Perfluorodecanoic acid	0.060
PFHxA	Perfluorohexanoic acid	3200
PFHxS	Perfluorohexanesulfonic acid	130
PFNA	Perfluorononanoic acid	19
HFPO-DA	Hexafluoropropylene oxide dimer acid	23

Detection | Exceeds PSL

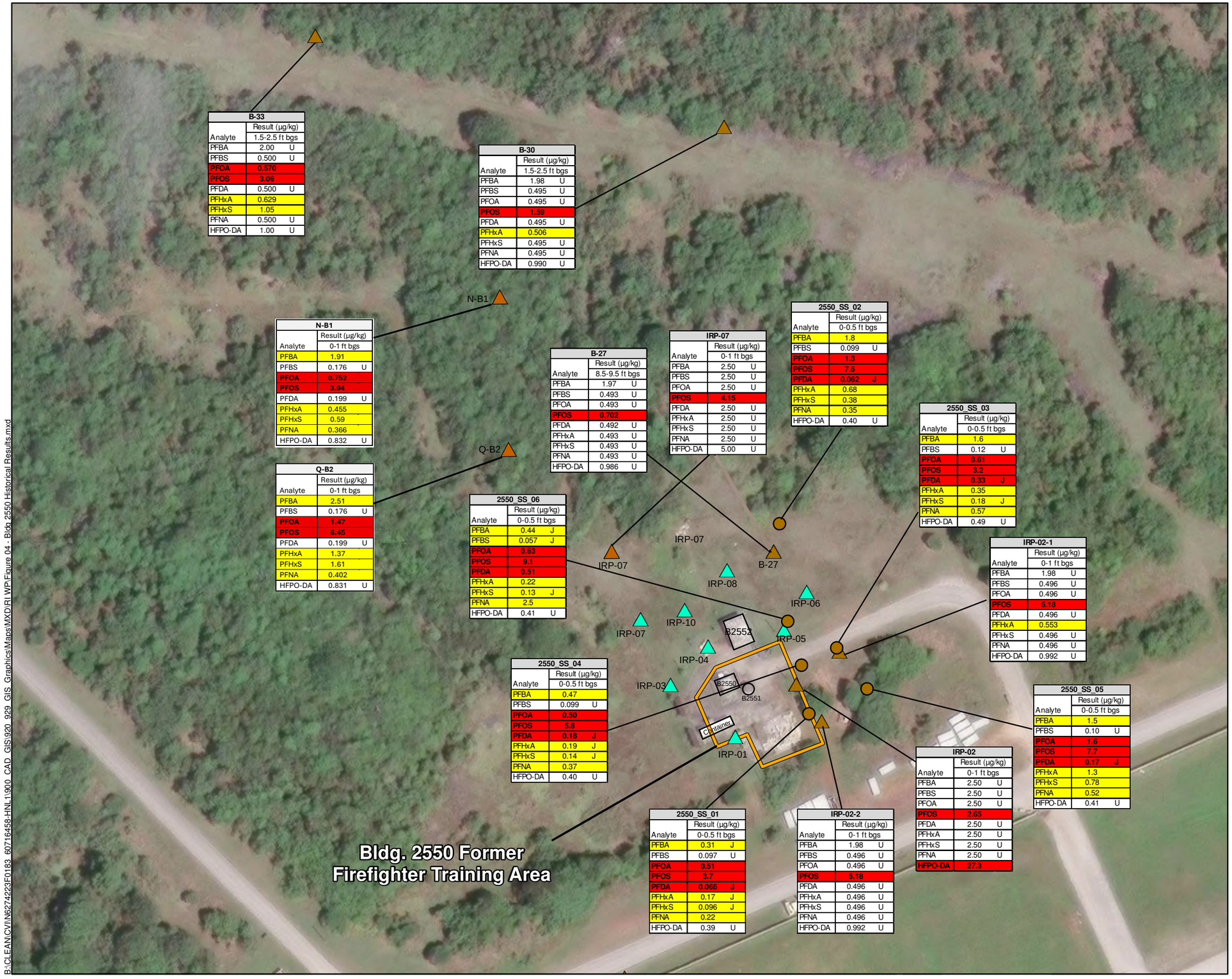
N

0 75 150 300 Feet

Figure 4-1.
Historical PFAS Detections at Site 78A, FTA #3

Reference: Figure 3, Historical PFAS Detections at Site 78A, RI Work Plan PFAS, Site 78A and Bldg. 2550, Andersen AFB NPL Site, Andersen AFB, Guam

B:\CLEAN\CV\IN\627223F0183 60716458-HNL1\900 CAD GIS\920 929 GIS Graphics\Maps\MXD\RI WP\Figure 03 - IRP Site 78A Historical Results.mxd



Legend

- Andersen AFB PFAS SI Sample Location with PFAS Detection
- P-012 MILCON Sample Location with no PFAS Detection
- P-012 MILCON Sample Location with PFAS Exceedance
- Bldg. 2550 Former Firefighter Training Area

Notes

1. Abbreviations:
   AFB: Air Force Base
   bgs: below ground surface
   EPA: U.S. Environmental Protection Agency
   J: estimated concentration
   MILCON: Military Construction
   NPL: National Priorities List
   PFAS: Per- and Polyfluoroalkyl Substances
   RI: remedial investigation
   RSL: regional screening level
   SI: site inspection
   THQ: target hazard quotient
   TRL: target risk level
   U: Non-Detect
2. Map Projection: WGS 1984 UTM Zone 55N
3. Base Map:Esri, Maxar, Earthstar Geographics, and the GIS Community
4. Results are presented in micrograms per kilogram (µg/kg).
5. Soil project screening levels (PSLs) are based on the 2024 EPA RSL for residential land use (TRL = 1E-06, THQ = 0.1)
   Soil Project Screening Levels:

Acronym	Analyte	PSL (µg/kg)
PFBA	Perfluorobutanoic acid	7800
PFBS	Perfluorobutanesulfonic acid	1900
PFOA	Perfluorooctanoic acid	0.070
PFOS	Perfluorooctanesulfonic acid	0.63
PFDA	Perfluorodecanoic acid	0.060
PFHxA	Perfluorohexanoic acid	3200
PFHxS	Perfluorohexanesulfonic acid	130
PFNA	Perfluorononanoic acid	19
HFPO-DA	Hexafluoropropylene oxide dimer acid	23

Detection Exceeds PSL

N

0 50 100 200 Feet

Figure 4-2.
Historical PFAS Detections at Bldg. 2550, Former FTA

Reference: Figure 4, Historical PFAS Detections at Bldg. 2550, RI Work Plan PFAS, Site 78A and Bldg. 2550, Andersen AFB NPL Site, Andersen AFB, Guam

B:\CLEAN\CV\IN\60274223\F0183_607164458-HNL.1\900_CAD_GIS\920_929_GIS_Graphics\Maps\MXD\RI WP\Figure 04 - Bldg 2550 Historical Results.mxd

GENERAL NOTES

Legend

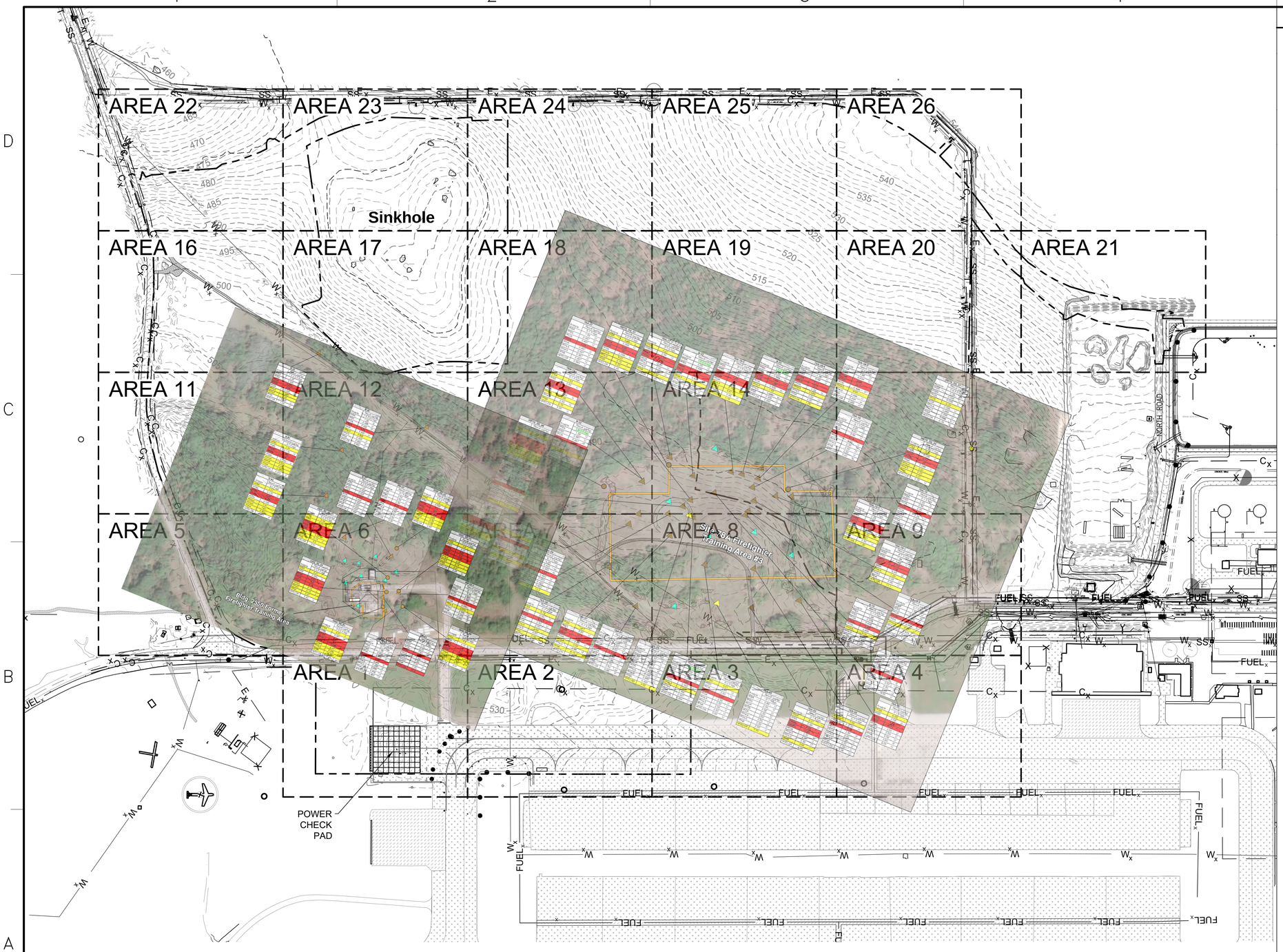
- Andersen AFB PFAS SI Sample Location with PFAS Detection
- P-012 MILCON Sample Location with no PFAS Detection
- P-012 MILCON Sample Location with PFAS Exceedance
- Bldg. 2550 Former Firefighter Training Area

Notes

1. Abbreviations:
   AFB: Air Force Base
   bgs: below ground surface
   EPA: U.S. Environmental Protection Agency
   J: estimated concentration
   MILCON: Military Construction
   NPL: National Priorities List
   PFAS: Per- and Polyfluoroalkyl Substances
   RI: remedial investigation
   RSL: regional screening level
   SI: site inspection
   THQ: target hazard quotient
   TRL: target risk level
   U: Non-Detect
2. Map Projection: WGS 1984 UTM Zone 55N
3. Base Map:Esri, Maxar, Earthstar Geographics, and the GIS Community
4. Results are presented in micrograms per kilogram (µg/kg).
5. Soil project screening levels (PSLs) are based on the 2024 EPA RSL for residential land use (TRL = 1E-06, THQ = 0.1)
   Soil Project Screening Levels:

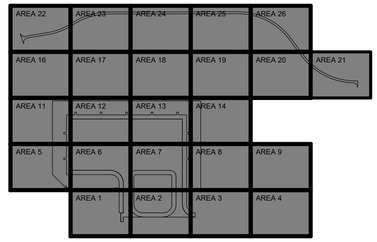
Acronym	Analyte	PSL (µg/kg)
PFBA	Perfluorobutanoic acid	7800
PFBS	Perfluorobutanesulfonic acid	1900
PFOA	Perfluorooctanoic acid	0.070
PFOS	Perfluorooctanesulfonic acid	0.63
PFDA	Perfluorodecanoic acid	0.060
PFHxA	Perfluorohexanoic acid	3200
PFHxS	Perfluorohexanesulfonic acid	130
PFNA	Perfluorononanoic acid	19
HFPO-DA	Hexafluoropropylene oxide dimer acid	23

Detection — Exceeds PSL



A1 OVERALL EXISTING CONDITIONS
SCALE: 1" = 200'

Figure 4-3. Historical PFAS Detections at Site 78A and Bldg. 2550 (Overlay with Topographic Map)



OVERALL KEY PLAN

GRAPHIC SCALE
0 100' 200' 400'
SCALE: 1"=200'

NORTH ARROW

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

Jacobs / BURNS McDONNELL
JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201

A/E Contract No. N62742-2D-0002
A/E Task Order No. N6274221F0315
JCG NO. C5430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	JMH	DRW:	SMC	REV:	ATM
PM/DM					GAM
BRANCH MANAGER					SMK
CHIEF ENG/ARCH					SMK
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

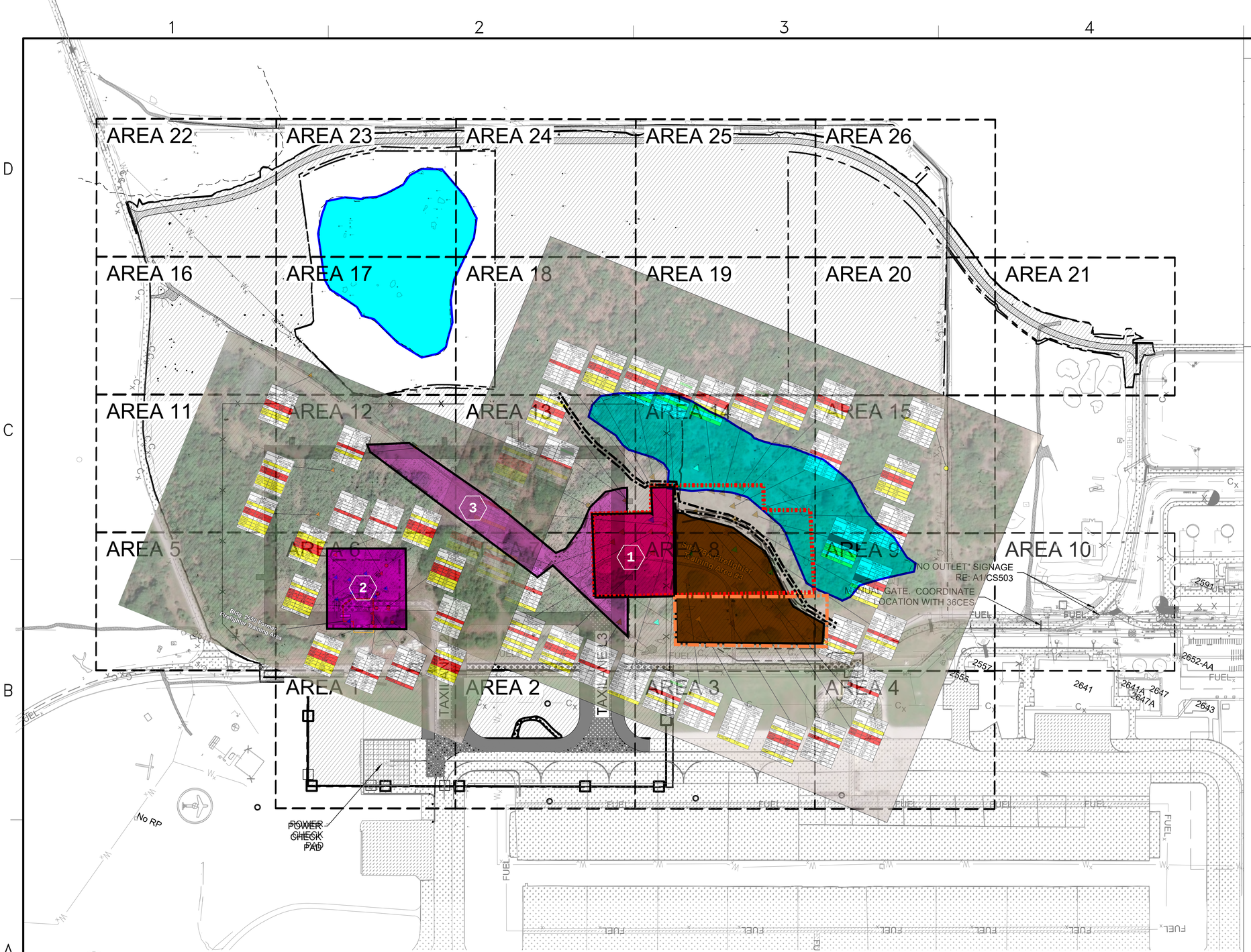
FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP REVISION

OVERALL EXISTING CONDITIONS

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF
V-101

65% DESIGN SUBMITTAL

FILE NAME: u:\BLDG\NAVFAC Pacific\D3430603 - P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\P012_1665555_V-101.dwg
LAYOUT NAME: OVERALL EXISTING CONDITIONS
PLOTTED: 08/15/2025 10:18am
USER: ROSE



A1 OVERALL SITE & PAVING PLAN
SCALE: 1" = 200'

Figure 5-1. Assumed PFAS-Impacted Areas and Relocation Area

GENERAL NOTES

Refer to Figure 5-2, Detailed Limits and Grading Plan for the PFAS-Impacted Soil Excavation and Relocation Areas.

LEGEND

REMOVE ASPHALT PAVEMENT

Sinkhole

Site 78A Firefighter Training Area #3

Expansion Area - Site 78A Firefighter Training Area #3

Assumed PFAS-Impacted Soil Areas with a depth of 0-3 ft bgs

1 Assumed Area 1: Area within Site 78A FTA #3

2 Assumed Area 2: Bldg. 2550 Form FTA

3 Assumed Area 3: Dirt road and open area outside Site 78A FTA #3

1. Excavate impacted soil as needed based on the project grading plan to relocate the soil to the PFAS-Impacted Soil Relocation Area.

2. Cut areas: The extent of impacted soil excavation will be limited to the designated depth and width to complete the construction.

3. Fill areas: Clear and grub the top 0.5-ft impacted soil for relocation.

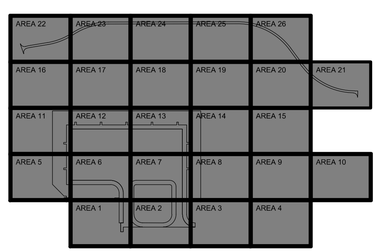
PFAS-Impacted Soil Relocation Area

1. Conduct clearing and grading of the relocation area in accordance with Figures 5-3 and 5-4 before placing a geomembrane barrier. The minimum required membrane thickness is 20 mils.

2. Wrap the excavated impacted soil completely with a geomembrane barrier. Seam geomembrane panels.

3. Provide a minimum of 1 ft of clean soil cap with vegetated cover as a final stabilization measure.

Provide and maintain double layers of erosion control measures along sinkhole boundary.



OVERALL KEY PLAN

GRAPHIC SCALE

0 100' 200' 400'

SCALE: 1"=200'

NORTH ARROW

TRUE N

NAVFAC

Jacobs / BURNS McDONNELL

JACOBS/BAM, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-21F0315
JEG NO. D3430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		GAM
BRANCH MANAGER		SMK
CHIEF ENG/ARCH		SMK
FIRE PROTECTION		JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY24 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

OVERALL DEMOLITION PLAN

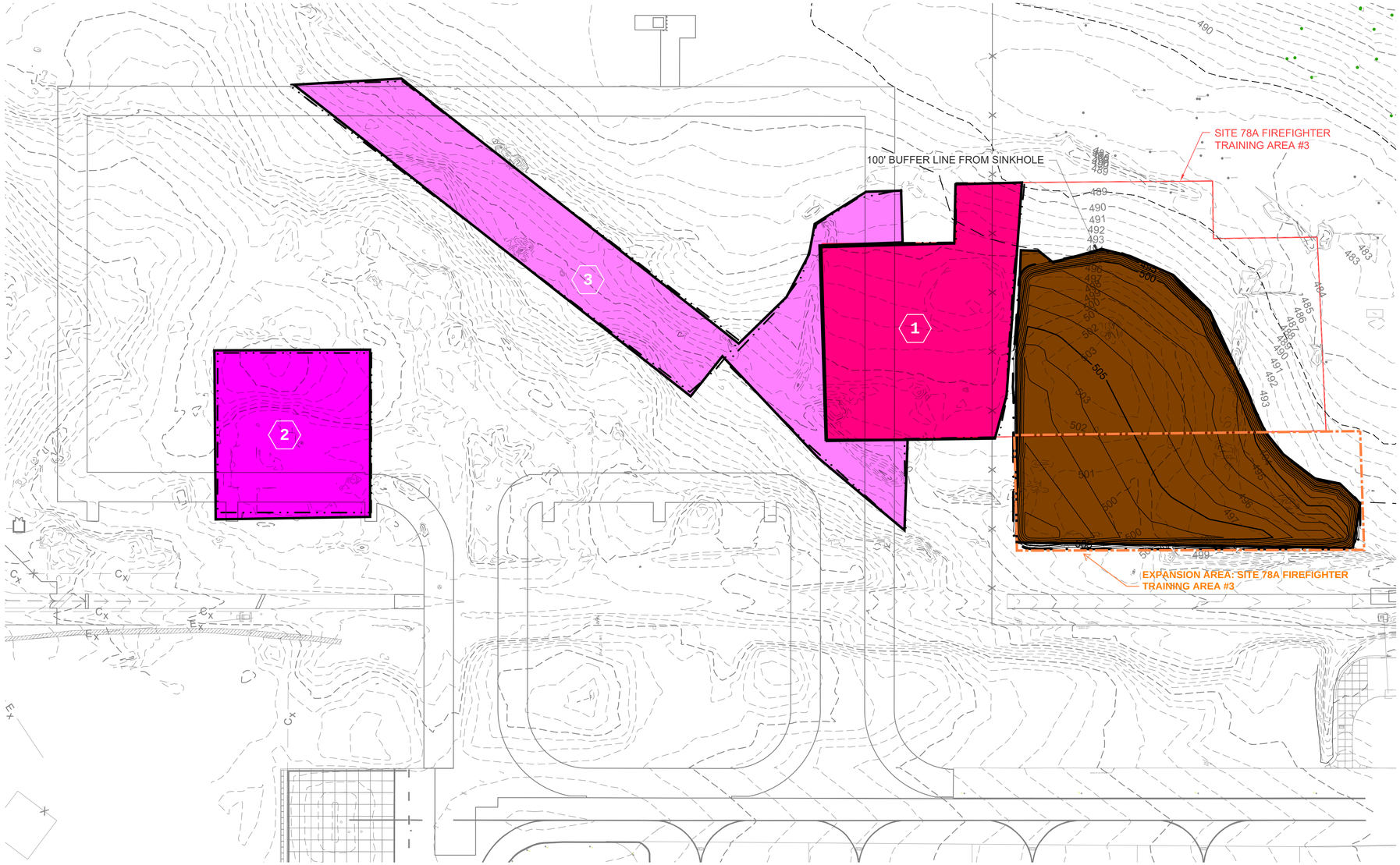
SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

CD101

REDESIGN BACKCHECK
100% QC SUBMITTAL

IF SHEET IS LESS THAN 22" X 34"
REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: U:\BLDG\NAVFAC Pacific\D3430603 - P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\P012_1665555_CD101.dwg
LAYOUT NAME: OVERALL DEMOLITION PLAN
PLOTTED: 12/17/2025 10:09pm
USER: CameroS



A1 PFAS EXCAVATION AND RELOCATION EXHIBIT
SCALE: 1" = 30'

Figure 5-2. Detailed Limits and Grading Plan - Assumed PFAS-Impacted Areas and Relocation Area

GENERAL NOTES

A CONTOURS ARE AT 1' INTERVALS

LEGEND

- LIMITS OF DISTURBANCE
- LIMITS OF GRADING
- EXISTING SINKHOLE
- 525 EXISTING MAJOR CONTOUR
- 524 EXISTING MINOR CONTOUR
- 524 MINOR CONTOUR
- 525 MAJOR CONTOUR
- PFAS EXCAVATION AREA
- LIMITS OF RELOCATED PFAS

Assumed PFAS-Impacted Soil Areas with a depth of 0-3 ft bgs

1 Assumed Area 1: Area within Site 78A FTA #3

2 Assumed Area 2: Bldg. 2550 Form FTA

3 Assumed Area 3: Dirt road and open area outside Site 78A FTA #3

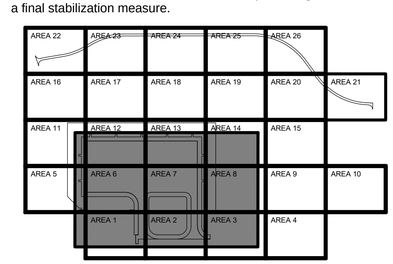
1. Excavate impacted soil as needed based on the project grading plan to relocate the soil to the PFAS-Impacted Soil Relocation Area.
2. Cut areas: The extent of impacted soil excavation will be limited to the designated depth and width to complete the construction.
3. Fill areas: Clear and grub the top 0.5-ft impacted soil for relocation.

PFAS-Impacted Soil Relocation Area

1. Conduct clearing and grading of the relocation area in accordance with Figures 5-3 and 5-4 before placing a geomembrane barrier. The minimum required membrane thickness is 20 mils.

2. Wrap the excavated impacted soil completely with a geomembrane barrier. Seam geomembrane panels.

3. Provide a minimum of 1 ft of clean soil cap with vegetated cover as a final stabilization measure.



KEY PLAN

GRAPHIC SCALE

0 15' 30' 60'

SCALE: 1"=30'

NORTH ARROW

TRUE N

NAVFAC

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

ANDREW T. MCCOY

Name

TX 96627 29 DEC 2025

Registration Number # Date

TEXAS REGISTERED ENGINEERING FIRM F-2966 SEAL

Jacobs / BURNS McDONNELL

JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-21F0315
JEG NO. D3430603 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	JMH	DRW:	SMC	REV:	ATM
PM/DM					GAM
BRANCH MANAGER					SMK
CHIEF ENG/ARCH					SMK
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY24 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

PFAS EXCAVATION AND RELOCATION EXHIBIT

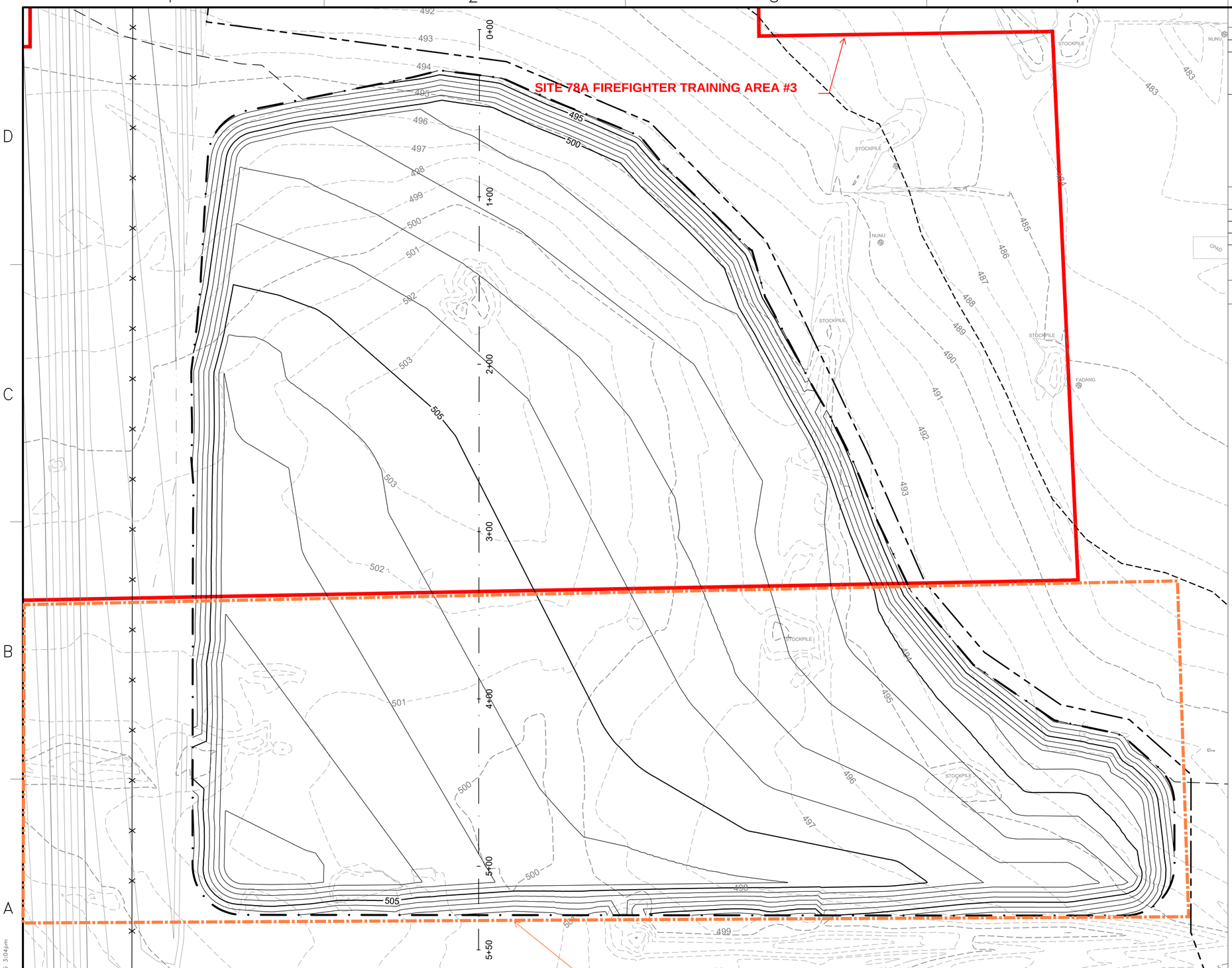
SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET 217 OF

EXHIBIT 1A

REDESIGN BACKCHECK
100% QC SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: U:\BLDG\NAVFAC Pacific\D3430603 - P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\Exhibits\P012_PFAS Relocation Grading Exhibit.dwg
LAYOUT NAME: PFAS Excavation and Relocation Exhibit
PLOTTED: 12/18/2025 3:01pm
USER: CameroS



A1 PFAS RELOCATION GRADING EXHIBIT
SCALE: 1" = 30'

Figure 5-3. PFAS-Impacted Soil Relocation Area Grading Exhibit-1

GENERAL NOTES

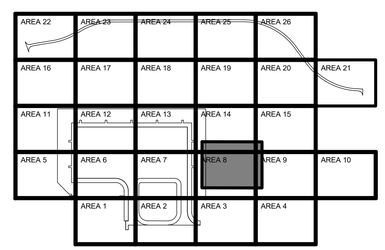
A	CONTOURS ARE AT 1' INTERVALS
B	ADJUST NEW AND EXISTING UTILITY COVERS TO NEW GRADE
C	ALL EXCAVATED SOIL WILL BE STOCKPILED ON SITE IN THE NORTHEAST CORNER AND NORTHWEST CORNER OF THE SITE. REFER TO SHEET GI001 FOR RECOMMENED STOCKPILE AREAS.

KEYNOTES

204	7' HIGH SECURITY FENCE, RE: B1/CS505 & C1/CS505
438	2.0' BOTTOM SWALE, RE: C1/CG502
485	RIP-RAP, RE: B4/CG501

LEGEND

- RIP-RAP, RE: B4/CG501
- LIMITS OF DISTURBANCE
- LIMITS OF GRADING
- 7' HIGH SECURITY FENCE, RE: C1/CS505
- EXISTING SINKHOLE
- 525 EXISTING MAJOR CONTOUR
- 524 EXISTING MINOR CONTOUR
- 524 MINOR CONTOUR
- 525 MAJOR CONTOUR
- CENTERLINE OF SWALE
- LIMITS OF RELOCATED PFAS
- HEADWALL, RE: A2/CG501
- CL CENTERLINE ELEVATION
- ME MATCH EXISTING ELEVATION
- XXX SLOPE (PERCENT)



KEY PLAN

GRAPHIC SCALE

0 15' 30' 60'

SCALE: 1"=30'

NORTH ARROW

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

ANDREW T. MCCOY
Name
TX 96627 29 DEC 2025
Registration Number # Date
TEXAS REGISTERED ENGINEERING FIRM F-2966 SEAL

Jacobs / BURNS MCDONNELL
JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0315
JCG NO. 03430603 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		GAM
BRANCH MANAGER		SMK
CHIEF ENG/ARCH		SMK
FIRE PROTECTION		JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND – PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY24 MCAF P-012/ AUY183012
NORTH AIRCRAFT PARKING RAMP
PFAS RELOCATION GRADING EXHIBIT

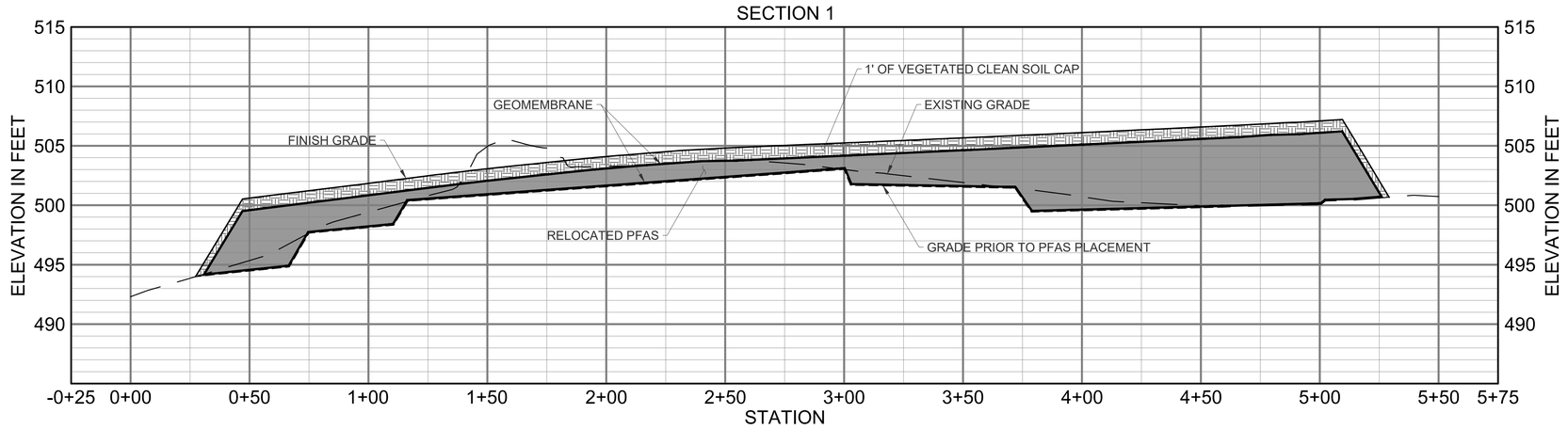
SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET 217 OF

REDESIGN BACKCHECK
100% QC SUBMITTAL

EXHIBIT 1B

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: u:\BLDG\NAVFAC Pacific\D3430603 – P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\Exhibits\P012_PFAS Relocation Grading Exhibit.dwg
LAYOUT NAME: PFAS Relocation Grading Exhibit
PLOTTED: 12/18/2025 3:04pm
USER: CamenoS



A1 PFAS RELOCATION GRADING EXHIBIT - SECTION 1
SCALE: 1" = 30'

Figure 5-4. PFAS-Impacted Soil Relocation Area Grading Exhibit-2

GRAPHIC SCALE
0 15' 30' 60'
SCALE: 1"=30'

PRELIMINARY FOR REVIEW ONLY
These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:
ANDREW T. MCCOY
Name
TX 96627 29 DEC 2025
Registration Number # Date
TEXAS REGISTERED ENGINEERING FIRM F-2966 SEAL

Jacobs / BURNS MCDONNELL
JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0315
JCG NO. 0343603 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	JMH	DRW:	SMC	REV:	ATM
PM/DM					GAM
BRANCH MANAGER					SMK
CHIEF ENG/ARCH					SMK
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM
FY24 MCAF P-012/ AUY183012
NORTH AIRCRAFT PARKING RAMP
PFAS RELOCATION GRADING EXHIBIT - SECTION 1

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET 217 OF
EXHIBIT 1C

REDESIGN BACKCHECK
100% QC SUBMITTAL

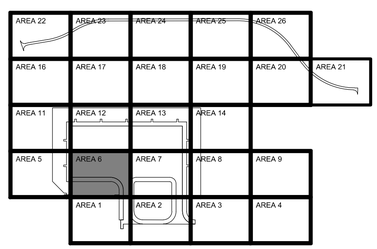
IF SHEET IS LESS THAN 22" X 34"
REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: U:\BLDG\NAVFAC Pacific\D3430603 – P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\Exhibits\P012_PFAS Relocation Grading Exhibit.dwg
LAYOUT NAME: Section 1
PLOTTED: 12/18/2025 2:59pm
USER: CamenoS

LEGEND

B2550/B2551: Lead-Impacted Soil along Building Perimeters
1. Excavated and dispose of Lead-Impacted Soil [Approx. 10 CY].
2. Concentration [Tropical Pacific Environmental Screening Level]
   Lead: 310 mg/kg [Residential: 200 mg/kg, Industrial: 800 mg/kg]
3. Horizontal excavation boundary: 0-2 ft lateral area from the edge of building footprints
4. Vertical excavation boundary: 0-1 ft below existing pavement
5. Assume the soil is PFAS-impacted.

Transformer Enclosure: Arsenic-Impacted Soil
1. Excavated and dispose of Arsenic-Impacted Soil [Approx. 10 CY].
2. Concentration [Tropical Pacific Environmental Screening Level]
   Arsenic: 28 mg/kg [Residential: 24 mg/kg, Industrial: 95 mg/kg]
3. Horizontal excavation boundary: Area within enclosure and 0-2 ft lateral from the enclosure
4. Vertical excavation boundary: 0-1 ft below ground surface



AREA 6
KEY PLAN

GRAPHIC SCALE
0 15' 30' 60'
SCALE: 1"=30'

NORTH ARROW
TRUE N

A1 EXISTING CONDITIONS - AREA 6
SCALE: 1" = 30'

Figure 6. Lead- and Arsenic-Impacted Soil for Excavation and Disposal

Jacobs / BURNS MCDONNELL
JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201

A/E Contract No.,N62742-20-D-0002
A/E Task Order No.,N6274221F0315
JCG NO.,13430603
A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	JMH	DRW:	SMC	REV:	ATM
PM/DM					GAM
BRANCH MANAGER					SMK
CHIEF ENG/ARCH					SMK
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND – PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJUY183012
NORTH AIRCRAFT PARKING RAMP REVISION
EXISTING CONDITIONS - AREA 6

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF
V-107

65% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: U:\BLDG\NAVFAC Pacific\13430603 – P-012 North Aircraft Parking Ramp\700 Working Documents\740 Sheets\740.01 Civil\P012_1665555_V-107.dwg
LAYOUT NAME: EXISTING CONDITIONS – AREA 6
PLOTTED: 08/14/2025 6:37pm
USER: Cameron.S

THIS PAGE INTENTIONALLY LEFT BLANK

G-RAM/LLRW

PERFORMANCE WORK STATEMENT

9 January 2026

Table of Contents

ABBREVIATION AND ACRONYMS ii
SECTION 1 INTRODUCTION 1
Section 1.1 Background: IRP Site 78A, Firefighter Training Area (FTA) 3 1
1.1.1 Site Description and Operational History 1
1.1.2 Current Site Status 1
1.1.2.1 Potential or Former Historical Radiological Use 3
1.1.2.2 Historical Radiological Investigations 3
Section 1.2 P-012 Project Potential Exposure Pathways and Worker Protection 3
Section 1.3 G-RAM/LLRW PWS Base and Optional Bid Schedule and Assumptions 3
SECTION 2 PROJECT REQUIREMENTS 4
Section 2.1 Qualifications and Training 4
2.1.1 Radiation Safety Officer (RSO) 4
2.1.2 NRC Licensed Service Provider 4
2.1.3 Key Personnel Qualification: G-RAM/LLRW Management 4
2.1.4 Training and Medical Surveillance Program for Construction Workers 4
Section 2.2 Radiation Work Plan (RWP) 4
Section 2.3 G-RAM/LLRW Screening, Monitoring, Contamination Control, and Decontamination 5
2.3.1. Background Radiation and Site Screening Level 5
2.3.2 Radiological Work Permit (RWP) 5
2.3.3 Radiation Screening/Surveys 5
2.3.4 Personal Exposure Monitoring 6
2.3.5 Personnel Contamination Surveys and Contamination Surveys of Common Areas, Wastes, and Equipment 6
2.3.6 Contamination Control and Decontamination 6
Section 2.4 G-RAM/LLRW Handling, Storage, Packaging, Transportation, and Disposal 6
2.4.1 Discovered G-RAM, LLRW, and Impacted Soil 6
2.4.2 Transportation and Disposal of G-RAM/LLRW 6
2.4.3 Final Status Survey of G-RAM/LLRW Storage Container/Unit 6
Section 2.5 G-RAM/LLRW Closure Report 7

TABLE

Table 1. G-RAM/LLRW PWS Base and Optional Bid Schedule and Assumptions 3

FIGURE

Figure 1. Location Map: IRP Site 78A, FTA 3 2

ABBREVIATION AND ACRONYMS

AAFB	Andersen Air Force Base
AOI	Area of Interest
FTA	Firefighter Training Area
G-RAM	General Radioactive Material
HAZWOPER	Hazardous Waste Operations and Emergency Response
IRP	Installation Restoration Program
JRM	Joint Region Marianas
LLRW	Low-Level Radioactive Waste
NAVFAC	Naval Facilities Engineering Systems Command
NAVSEADET	Naval Sea Systems Command Detachment
NRC	Nuclear Regulatory Commission
PPE	Personal Protective Equipment
PFAS	perfluoroalkyl and polyfluoroalkyl substances
PWS	Performance Work Statement
RASO	Radiological Affairs Support Office
RWP	Radiation Work Plan
RSO	Radiation Safety Officer

G-RAM/LLRW PERFORMANCE WORK STATEMENT (PWS)

FOR

FY2024 MCAF PROJECT P-012 / AJJY183012, NORTH AIRCRAFT PARKING RAMP

JOINT REGION MARIANAS, ANDERSEN AIR FORCE BASE, GUAM

SECTION 1 INTRODUCTION

The project site includes an Installation Restoration Program (IRP) Site, Site 78A, Firefighter Training Area (FTA) 3. Site 78A has been identified as a General Radioactive Material (G-RAM)/Low-Level Radioactive Waste (LLRW) Area of Interest (AOI) requiring further site evaluation. Conduct G-RAM/LLRW screening for the areas to be disturbed within the IRP Site. The Contractor will be responsible for handling, packaging, storage, and disposal of G-RAM/LLRW if discovered. Retain qualified workers and subcontractors until the radiation hazard is mitigated or eliminated. Coordinate with the Naval Sea Systems Command Detachment (NAVSEADET) Radiological Affairs Support Office (RASO) through the Contracting Officer on G-RAM/LLRW management, handling, packaging, storage, transportation, and disposal. Provide monitoring and engineering and administrative hazard mitigation measures to protect workers, site users, and the environment. The mitigation measures must include the following but are not limited: hazard communication, monitoring, and engineering controls, including erosion and dust controls, wearing appropriate Personal Protective Equipment (PPE), and decontamination. Comply with applicable federal and Guam regulations and project requirements including the following specification sections.

- 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES
- 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS
- 02 61 13 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL
- 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS

Section 1.1 Background: IRP Site 78A, Firefighter Training Area (FTA) 3

1.1.1 Site Description and Operational History

Site 78A occupies approximately 10 acres north of North Field on Andersen AFB Main Base. The site is located north of Marianas Boulevard, approximately 1,800 feet east of the intersection of 5th Street and Marianas Boulevard. The area was used for firefighter training between 1955 and 1973. The first investigation at Site 78A was performed in 1994. This was a site reconnaissance without any sampling. Based on the information obtained during the initial site reconnaissance, additional field investigation was recommended for the site. In 2000, as part of the Phase I remedial action, Site 78A was revisited and a number of potential sources of contamination were identified, including a 135-foot diameter burn pit with a 1-foot-high soil berm, a cleared area surrounding the burn pit, a metal-framed rusting structure, and approximately fifty 55-gallon drums. Of the 50 drums, 5 were still intact and contained fluids, while the remaining drums were in a rusty or deteriorated condition. The drum labels indicated that the drums contained lube oil, hydraulic oil, and fuel oil. A follow-up Phase II remedial action investigation was completed at Site 78A in 2003. The Phase II remedial action included site reconnaissance, a geophysical survey, a soil gas survey, and surface and subsurface soil sampling. During the 2010 remedial investigation, several areas of empty drums were identified on the eastern boundary of the site. In addition, a 2-inch underground drain line was discovered and traced to approximately 200 feet of the northwest portion of the former fire training burn pit. The 5 intact 55-gallon drums observed during the Phase I remedial action were not observed during the RI site reconnaissance. The fate of these drums is unknown. Following the remedial investigation, the 2014 Record of Decision (ROD) indicated No Further Action (NFA) for Site 78A. However, the IRP Site 78A is reopening due to confirmed presence of perfluoroalkyl and polyfluoroalkyl substances (PFAS)-contaminated soil and potential presence of G-RAM.

1.1.2 Current Site Status

This section describes observations based on the 2023 preliminary assessment site visit. The site was grass-covered and relatively flat. A large depression was observed on the eastern side of the site and mounds of rubble with burned and rusted metal were located in several locations around the perimeter of the cleared area. Debris included drums and what appeared to be to vehicle and aircraft parts.

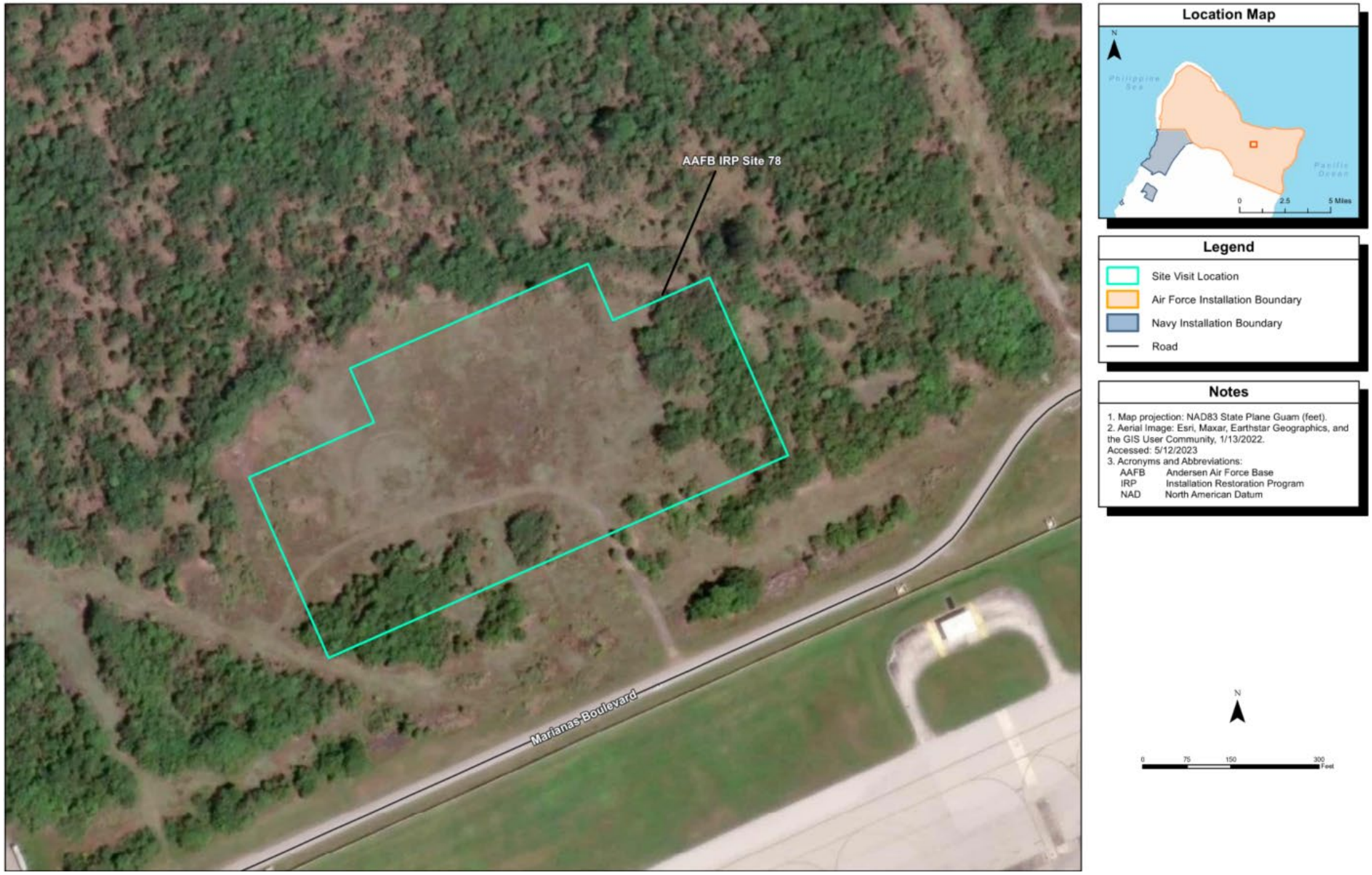


Figure 1. Location Map: IRP Site 78A, FTA 3

1.1.2.1 Potential or Former Historical Radiological Use

There are no documented radiological disposal activities at Site 78A; however, due to the timeframe of firefighting activities, there is potential that vehicles or aircraft containing radioluminescent components or other G-RAM-containing materials were used for firefighter training. Those materials may still be present on-site.

1.1.2.2 Historical Radiological Investigations

There are no records of historical radiological investigations for Site 78A. During the 2023 preliminary assessment site visit, the field team was equipped with a Ludlum Model 19 Exposure Rate Meter. Exposure rates observed around the perimeter of the site did not exceed notification levels. Measurements were made for health and safety purposes only; a detailed radiation survey was not conducted. Actions were taken to avoid any high exposure rates, so the rates detected may not be the highest within Site 78A.

Section 1.2 P-012 Project Potential Exposure Pathways and Worker Protection

Site 78A is considered an Area of Interest (AOI). While no direct impacts have been identified, historical firefighter training practices include the use of out-of-service aircraft that may have contained radioluminescent components or other G-RAM-containing materials. The preliminary Radionuclides of Potential Concern include cesium-137, radium-226, thorium-232, strontium-90, and uranium-238.

Currently, the site is covered with soil and vegetation with waste visible on the ground surface. The vegetative cover at the site reduces exposure to fugitive dust. However, the IRP site will be disturbed as part of the P-012 project. Various intrusive activities will be required including but are not limited to vegetation clearance, grubbing, grading, soil excavation/trenching, stockpiling, backfilling. The intrusive activities that disturb the soil and vegetation cover could result in possible exposure pathways to potentially radioactive soil and airborne material.

Abandoned debris may contain G-RAM due to the timeframe of firefighting activities based on historical firefighter training practices. Surface debris remains in the form of rusted metal. Debris may also be buried under soil and vegetation. Intrusive activities that uncover debris could result in possible exposure pathways to potentially radioactive material. Thus, there is risk of exposure to the construction workers authorized to be on the site. Provide monitoring and engineering and administrative hazard mitigation measures to protect workers and the environment. The mitigation measures must include the following but are not limited: hazard communication, monitoring, and engineering controls, including erosion and dust controls, wearing appropriate PPE, decontamination.

Section 1.3 G-RAM/LLRW PWS Base and Optional Bid Schedule and Assumptions

Table 1 presents assumptions for the Base and Optional Bid Schedule.

Table 1. G-RAM/LLRW PWS Base and Optional Bid Schedule and Assumptions

Tasks	P-012 Bid Assumptions
Section 2.1 Qualifications and Training	**Base Bid**
Section 2.2 Radiation Work Plan (RWP)	**Base Bid**
Section 2.3 G-RAM/LLRW Screening, Monitoring, Contamination Control and Decontamination	**Base Bid**. The G-RAM/LLRW screening areas will be limited to IRP Site 78A where the area will be disturbed by the project only.
Section 2.4 G-RAM/LLRW Handling, Storage, Packaging, Transportation, and Disposal	**Base Bid**. Assume discovering five (5) cubic yards of G-RAM/LLRW and other impacted materials, including soil, for the bid purposes. As part of this task, provide screening, monitoring, contamination control, and decontamination to manage discovered G-RAM, LLRW, and other impacted materials in accordance with the approved RWP.
Section 2.5 G-RAM/LLRW Closure Report	**Base Bid**

SECTION 2 PROJECT REQUIREMENTS

Section 2.1 Qualifications and Training

The Contractor must retain qualified workers and subcontractors.

2.1.1 Radiation Safety Officer (RSO)

Retain a Radiation Safety Officer (RSO) to ensure the safe use, handling, and management of G-RAM, LLRW, radioactive materials, and radiation-producing equipment. The RSO must develop and implement radiation safety programs, monitor radiation levels, and ensure compliance with all relevant regulations. The RSO or other qualified designee must be on-site during the construction activities, including screening, managing, handling, packaging, and storage of G-RAM/LLRW until the G-RAM/LLRW leaves the project site for a designated disposal facility. The RSO must produce documentation of qualification to serve as the Radiation Safety Officer. Examples include professional certification of completion certification of 40-Hour Radiation Safety Officer Training.

2.1.2 NRC Licensed Service Provider

Retain a Nuclear Regulatory Commission (NRC) licensed service provider(s) to conduct G-RAM screening, packaging, storage, and transportation. Submit Qualification of NRC Licensed Service Provider.

2.1.3 Key Personnel Qualification: G-RAM/LLRW Management

Provide key personnel with a minimum of 3 years of G-RAM/LLRW experience. Include the site foreman, quality control personnel, and supervisory engineering and technical staff. Perform all G-RAM/LLRW work under the supervision of NRC license procedures and .

2.1.4 Training and Medical Surveillance Program for Construction Workers

The P-012 Project site includes the potential for encountering G-RAM and areas contaminated with Perfluoroalkyl and polyfluoroalkyl substances (PFAS), heavy metals, and other contaminants. All personnel performing duties with potential for exposure to onsite contaminants must have 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, hazard communication, and job-specific health and safety training. After concerns or risks related to onsite contaminants are eliminated or mitigated, HAZWOPER-trained personnel will not be required. Job-specific training for G-RAM/LLRW must include the following:

- Site specific procedures for handling and storing radioactive materials;
- Health and safety hazards associated with exposure to the radioactive material that will be cleaned up or otherwise handled and the purpose and function of protective devices and precautions used to minimize exposure;
- Elements of the Accident Prevention Plan/Site Health and Safety Plan (APP/SSHP) and company specific procedures intended to provide protection from G-RAM/LLRW radiation exposure;
- Worker responsibility to report any unsafe acts which might result in exposure to G-RAM/LLRW;
- Appropriate worker response procedures to events that may result in worker exposure to G-RAM/LLRW;
- Personal protective equipment (PPE) requirements;
- Worker rights and responsibilities with respect to G-RAM/LLRW exposure.
- Applicable conditions of the contractor's NRC license and other project/contract requirements.

Comply with all requirements of 29 CFR 1910.120/29 CFR 1926.65 medical surveillance program and EM 385-1-1, Safety and Health Requirements Manual for workers performing cleanup operations and who will be exposed to contaminants. Identify required PPE.

Section 2.2 Radiation Work Plan (RWP)

Submit a Radiation Work Plan (RWP) within 45 calendar days after notice to proceed. Do not perform work at the IRP site,

except for site inspections and surveys, until the RWP is approved. Prepare the Draft and Final RWP for Government review. Allow 30 calendar days for Government review. No adjustment for time or money will be made if resubmittals of the work plan are required due to deficiencies in the plan. No construction or digging will be permitted without approval of the final RWP. At a minimum, include the following in the RWP:

1) Introduction (Site Background; Project Objectives; Project SOW)
2) Radiation Screening Requirements (Personnel and Responsibilities; Radiation Protection Plan; Radiological Posting Requirements; Radiation Detection Instruments; Inventory of Radioactive Materials)
3) Instrumentation (Survey Instruments; Daily Instrument Performance Checks; Radiation Detectors)
4) Screening/Survey Implementation and Procedures (Background Measurements; Site Screening Level; Personnel Surveys; Truck Surveys; Contamination Control; Characterization of Recovered Radioactive Material; G-RAM/LLRW Preparation, Management, and Shipping; Removal Plan; Final Status Survey)
5) Decontamination, Dismantling, and Disposition
6) Radioactive Materials Management, Transportation, and Disposal (DoD Coordination Procedures)
7) Documentation and Record Management
8) Closure Report

Section 2.3 G-RAM/LLRW Screening, Monitoring, Contamination Control, and Decontamination

Conduct G-RAM/LLRW screening for the areas to be disturbed within the IRP Site. Radiation screening and monitoring activities will include the following:

2.3.1. Background Radiation and Site Screening Level

Background measurements must be established prior to initiating radiation monitoring and radiological screening surveys. Determine the Site Screening Level for the Radiation Scan/Surveys. Submit a report for Site Screening Level describing the survey activities and findings. Obtain approval of the Site Screening Level from the Government.

2.3.2 Radiological Work Permit (RWP)

If exposures are expected to result in a dose in excess of 100 millirem total effective dose equivalent, a RWP must be issued to ensure that individuals observe the proper precautions while work is being performed in any area where hazards exist due to radiation, contamination, and/or airborne radioactivity. The RSO must develop, approve, and continually revise the RWP.

2.3.3 Radiation Screening/Surveys

Conduct gamma scan surveys of newly exposed excavation surfaces, waste piles/debris, and trucks with excavated materials/soils.

If the screening results discover elevated count rates above the Site Screening Level, and is determined to originate from something other than a natural material (e.g., gravel) or other common material (e.g., porcelain), to the extent practical, the G-RAM/LLRW must be removed, packaged in a plastic bag, bucket, or drum, and transported to the storage unit (e.g., Conex box or lockable storage container) established by the Contractor. The location of the storage unit must be approved by the AAFB RSO.

Trucks carrying excavated materials off-site must be surveyed. Before conducting the survey, the truck must be wiped to ensure there is no loose radioactive contamination. The truck surveys must include, at a minimum, gamma exposure rate measurements using a gamma exposure rate meter of the truck cab and nine other select contact points around the exterior of the truck. The measurements of the truck survey must be recorded on a survey form, and the truck must be identified by using either one or a combination of the cab number, truck number, cab license plate, and/or trailer license plate. If no measurement exceeds the Site Screening Level, then the truck can be released. As an alternative, dose rates can be taken as described and those points surveyed with an alpha/beta scintillation detector.

2.3.4 Personal Exposure Monitoring

Conduct periodic site dose rate surveys (e.g., start and end of workday, during an excavation event) and record observations.

2.3.5 Personnel Contamination Surveys and Contamination Surveys of Common Areas, Wastes, and Equipment

Prior to leaving the G-RAM/LLRW AOI or work area, personnel and small tools and items brought in and out of the work area must be surveyed ("frisked") by the site RSO or designated person. The personnel "frisk" will include, at a minimum, the hands, the bottoms of shoes, and any other contact point with potentially contaminated soil or material. If surveys measure contamination above background, the location of the elevated activity must be wiped down with a moist disposable towel until measurements of the area are indistinguishable from background.

2.3.6 Contamination Control and Decontamination

Control contamination and provide decontamination. Develop and implement the plans/procedure on site control and decontamination.

Section 2.4 G-RAM/LLRW Handling, Storage, Packaging, Transportation, and Disposal

The Contractor will be responsible for handling, storage, packaging, transportation, and disposal if G-RAM/LLRW is discovered. The tasks will include all necessary activities to conduct the work including personal exposure monitoring (Section 2.3.4); Personnel Contamination Surveys and Contamination Surveys of Common Areas, Wastes, and Equipment (Section 2.3.5); and Contamination Control and Decontamination (Section 2.3.6).

2.4.1 Discovered G-RAM, LLRW, and Impacted Soil

Segregate, identify, recover, and transport all G-RAM encountered during the screening and survey to the designated secure storage unit. Once suspected G-RAM is identified, notify the discovery to AAFB RSO and Navy RASO within 24 hours.

Place discovered G-RAM/LLRW in a plastic bag, then, containerize in a 55 gallon covered drum or equivalent container. Establish storage units (e.g., Conex box or lockable storage container) to store discovered G-RAM/LLRW, temporarily until disposal of the material, based on the approved RWP. Provide a label with a description of the contents and note on the label "TO BE DISPOSED AFTER APPROVAL FROM RASO". Apply the label to the exterior surface of the cover and site of the drum(s). Characterize all recovered G-RAM. Provide a Weekly G-RAM/LLRW Inventory Report including photography, labeling, and characterization. Provide the following data in the plastic bag and drum label:

- Activity:
- Contract No.:
- Material/Content:
- Isotope and Quantity (if known):

2.4.2 Transportation and Disposal of G-RAM/LLRW

All G-RAM/LLRW found must be securely stored in a storage unit at a designated secure site. Photographs and inventory of the items must be forwarded for further review by the AAFB RSO and Navy RASO. At the end of the screening activities, arrangements must be made for disposal through the Navy RASO, and the items must be disposed of through the proper LLRW route.

2.4.3 Final Status Survey of G-RAM/LLRW Storage Container/Unit

After the coordination and final disposal of G-RAM/LLRW that was stored in the storage unit, the RSO must direct a Final Status Survey of the storage container before its demobilization. The purpose of the Final Status Survey is to ensure that the storage unit is free of contamination and is acceptable to be released for unrestricted use. Submit a Final G-RAM/LLRW Status Survey

Report. The following activities need to be completed before demobilization:

- Document verification that the storage unit is empty.
- A final clearance radiation survey of all storage unit areas, equipment, and tools to ensure that no contamination is present.
- The final clearance radiation survey that is documented in a survey form. The findings must be reported to the RSO, Navy Remedial Program Manager (RPM), AAFB RSO, and Navy RASO.
- Returning of all personnel radiation dosimetry badges to the site safety and health officer.

Section 2.5 G-RAM/LLRW Closure Report

Following the completion of all screening and disposal activities, submit a closure report. The closure report must include, at a minimum, a summary of the activities completed, radiation survey and screening results, and a RAM (e.g., G-RAM commodities) list along with associated characterization. At a minimum, the final report will include the following documentation:

1) Background measurements
2) Survey forms documenting periodic walk-around dose rate surveys
3) Gamma scan survey forms of newly exposed excavation surfaces
4) Gamma scan survey forms of piles (e.g., debris piles)
5) Gamma scan survey forms of trucks with excavated soils
6) Survey forms documenting periodic contamination surveys and surveys of equipment release from the work site
7) G-RAM/LLRW inventory and characterization survey results
8) G-RAM/LLRW disposal records
9) Photographs of RAM recovered
10) Survey forms documenting results of the storage unit Final Status Survey
11) Instrument daily response check data forms
12) Instrument calibration records

SOIL SCREENING SURVEY REPORT
FY24 MCAF PROJECT P-012 NORTH AIRCRAFT PARKING RAMP, ANDERSEN AFB, GUAM

Contract No. N62742-20-D-0002
MNA Project 3035_1

19 December 2025

Myounghee Noh & Associates, L.L.C., dba MNA Environmental
Design, Studies, and Consulting Services
98-025 Hekaha Street, Suite 215A, Aiea, HI 96701
Tel (808) 484-9214
www.mnaenvironmental.com

TABLE OF CONTENTS

LIST OF ABBREVIATIONS ..... **iii**
1.0 INTRODUCTION **1**
2.0 SITE BACKGROUND **1**
2.1 General Geology and Hydrogeology 1
2.2 Known and Potential Contaminated Areas 1
2.2.1 IRP Field Office Site, B2550 (Former SWMU-15) *2*
2.2.2 IRP Site 26, Fire Training Area (FTA) #2 ..... *2*
2.2.3 IRP Site 78A, Former Fire Training Area (FTA) #3 ..... *2*
2.2.4 Building 2641, HSC-25 Hangar ..... ***Error! Bookmark not defined.***
2.2.5 IRP Site 68, Waste Debris ..... ***Error! Bookmark not defined.***
2.2.6 Soil Stockpiles *3*
2.3 Chemicals of Potential Concern (COPC) 3
2.3.1 PFAS *3*
2.3.2 Other Persistent Contaminants *4*
3.0 SOIL SCREENING LEVELS AND ANALYTICAL RESULTS **4**
3.1.1 PFAS *5*
3.1.2 Other Contaminants *5*
4.0 SOIL SAMPLING AND ANALYSIS **5**
5.0 CONCLUSION AND RECOMMENDATION **14**

TABLES

Table 1. Summary of Known or Potential Contamination Sites 2
Table 1. U.S. EPA RSL for PFAS (November 2023) 5
Table 2. IRP Field Office Site: Soil Sampling and Analysis Summary 7
Table 3. Site 78A Area: Soil Sampling and Analysis Summary 9
Table 4. Other Areas and Stockpiles: Soil Sampling and Analysis Summary 12

APPENDICES

Appendix A Figures

Figure 1. Location Map
Figure 2. IRP and Potential PFAS Release Sites
Figure 3. IRP Field Office, B2550: Sampling Locations for PFAS Analysis
Figure 4. Site 78A, FTA-3: Sampling Locations for PFAS Analysis
Figure 5. Building 2641: Sampling Locations for PFAS Analysis
Figure 6. Soil Sampling Locations from Geotechnical Survey Borings
Figure 7. Surface Multi-Incremental Soil Sampling Locations
Figure 8. IRP Field Office Site Soil Sampling Locations
Figure 9. Stockpile Soil Sampling Locations

Appendix B Summary of Analytical Results

Table B-1. PFAS: IRP Compound (Sample ID: IRP-01 to IRP-10)
Table B-2. PFAS: Site 78A FTA-3 (Samples ID: S78A-01 to S78A-10)
Table B-3. PFAS: Site 78A FTA-3 (Sample ID: S78A-11 to S78-20)
Table B-4. PFAS: Site 78A FTA-3 (Sample ID: S78A-19-1 to S78A-19-6 and S78A-21 to 24)
Table B-5. PFAS: Geotechnical Borings, B-19 to B-24
Table B-6. PFAS: Geotechnical Borings, B-27 to B-33
Table B-7. PFAS: Site 26 FTA and Building 2641
Table B-8. Other Contaminants: IRP Compound
Table B-9. Other Contaminants: Site 78A FTA-3
Table B-10. Other Contaminants: Existing Dirt Road Areas and Perimeter Road
Table B-11. Other Contaminants: S26 and B2641 Areas
Table B-12 Stockpile Analytical Results

Appendix C Visual Stockpile Observation

Appendix D Laboratory Analytical Reports

LIST OF ABBREVIATIONS

bgs	below ground surface
COC	Chain-of-Custody
COPC	Chemicals of Potential Concern
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
EPA	Environmental Protection Agency, United States
ERA	Ecological Risk Assessment
FTA	Firefighter Training Area
HDOH	State of Hawaii Department of Health
HHRA	Human Health Risk Assessment
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
LCS/LCSD	Laboratory Control Sample/ Laboratory Control Sample Duplicate
µg/kg	micrograms per kilogram
MEC	Munitions and Explosives of Concern
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	Myounghee Noh & Associates, L.L.C., dba MNA Environmental
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFAS	Polyfluoroalkyl Substances
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goals, EPA, U. S.
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Levels, EPA, U. S.
TAL	Target Analyte List
TCLP	Toxic Characteristic Leaching Procedure
TPESL	Tropical Pacific Environmental Screening Level, Hawaii Department of Health
TPH-DRO/RRO	Total Petroleum Hydrocarbons as Diesel/Residual Range Organics
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

Myounghee Noh & Associates, L.L.C. (MNA), under contract with Jacobs, conducted a soil screening survey for FY24 MCAF Project P-012 North Aircraft Parking Ramp, Andersen Air Force Base, Guam (Appendix A, Figure 1). The project includes the design to construct an aircraft parking apron with associated taxiways and shoulders, flightline maintenance support facility, utility buildings, airfield fence, and hydrant fueling pits and piping required to accommodate bombers, tankers, and other aircraft. New utilities will be installed including a fuel hydrant loop, fuel hydrant pits at each parking position, and fire hydrants located around the perimeter. The project will demolish existing buildings in the Installation Restoration Program (IRP) Field Office Site including B2550, B2551, and B2552. The purpose of the screening survey was to identify any presence of potentially hazardous soil contaminants associated with soil disturbance and construction.

2.0 SITE BACKGROUND

2.1 General Geology and Hydrogeology

The project site is located on the northern plateau of Guam with flat-lying limestone and limited surface runoff. No wetlands or surface water are located within the project site. The thin soil and limestone bedrock are both porous and permeable, and rainwater readily infiltrates downward through interconnected pore spaces preventing the formation of surface streams, rivers, and lakes. The elevation of the project site is between 460 and 540 ft Mean Sea Level (MSL). Groundwater resources on northern Guam are encountered at approximately 400 to 600 ft below ground surface (bgs). The groundwater surface at the Main Base ranges between 3 and 4 ft above MSL and the freshwater lens ranges between 100- and 160-ft thick. The important factors governing the volume of freshwater in the lens are the effects of mixing freshwater and marine water, the permeability of the limestone formations, and the rate of recharge. Regionally, the groundwater flow direction in the Northern Guam Lens is from the limestone/volcanic contacts west toward the Philippine Sea (NAVFAC, Marianas, 2014).

2.2 Known and Potential Contaminated Areas

The known and potential contaminated sites are presented in Table 1 (Figure 2). Two sites are registered as Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites. The IRP Field Office site was identified as a former Solid Waste Management Unit (SWMU)-15. The four sites have potential Per- and polyfluoroalkyl substances (PFAS) contamination due to former fire trainings using Aqueous film forming foam (AFFF). AFFF is a firefighting agent used commercially and by the Department of Defense. Most commonly used to combat petroleum fires in aircraft accidents, hangars and during live-fire training exercises. AFFF are composed of hundreds perfluorinated compounds (PFCs). PFAS are often described as “forever chemicals” because they do not breakdown over time and can build up in the environment and our bodies.

Table 1. Summary of Known or Potential Contamination Sites

Site	Potential PFAS Contamination?	CERCLA Site?
IRP Field Office Site, B2550 (Former SWMU)	Yes	
IRP Site 26, FTA #2	Yes	Yes
IRP Site 78A, FTA #3	Yes	Yes

FTA firefighter training area
IRP installation restoration program site
SWMU Soil Waste Management Unit

2.2.1 IRP Field Office Site, B2550 (Former SWMU-15)

The former SWMU-15 unit consists of three buildings, B2550, B2551, and B2552 all of which will be demolished as part of this project (Figure 3). The 2006 EIS indicates the SWMU-15 stored JP-4 Fuel Stoddard Solvent Engine/Hydraulic Lubricants Aircraft-Cleaning Compound; however, it is no longer in use. The current site use (2022) is a facility to store groundwater sampling and other IRP-related equipment (drums, IDW, etc.). The Cultural and Natural Resources department of AAFB also uses the area for storing vehicles and equipment. The as-built drawings for B2550/2551 indicate an Oil-Water Separator (OWS) and a septic tank/leaching field. According to the Oil Water Separator Management Plan (June 2011), AAFB programed the removal of 14 OWS that were no longer necessary due to operational changes. In 2010 AAFB submitted a Final Closure and Decommissioning Report for 14 Oil-Water Separator Removals at Andersen Air Force Base, Guam (2010) to Guam EPA. The OWS for B2550 was part of the closure report. Upon removal of the OWS from B2550, soil samples were collected from the OWS footprint. Petroleum contaminants (Total Petroleum Hydrocarbon (TPH) and Benzo[a]pyrene) were found; the results were below the soil screening levels.

2.2.2 IRP Site 26, Firefighter Training Area (FTA) #2

Site 26 was a former firefighter training area located southeast of the P-012 Project Area (Figure 2). Firefighter training exercises, which took place from 1958 until 1988, consisted of filling the old burn pit with water and releasing fuel mixtures that were ignited then extinguished by firefighters. After the exercises, residual liquids were drained into an onsite oil/water separator. Field activities were conducted serially as part of investigations that took place between 1996 and 2002. A vapor extraction system was operated from 1998 through 2007. A noticeable drop in the VOC emission rate occurred since the initial operation of the system. Closure of the system was agreed upon by the USAF, EPA, and GEPA in March 2007 as removal rates had reached asymptotic notation (NAVFAC, Marianas, 2011). The Final Record of Decision (ROD) for Site 26 was made in 2011. During the meeting with Remedial Program Manager (RPM) on 23 June 2021, the RPM indicates this site also has potential PFAS contamination. Site 26 will not be disturbed as part of this project. The north area adjacent to Site 26 will be disturbed for a road improvement along Marians Blvd.

2.2.3 IRP Site 78, Former Firefighter Training Area (FTA) #3

Site 78 is located southeast of the project area (Figure 3). The ROD was completed in August 2014. The former land use was an FTA between 1955 and 1973. Various site investigations were conducted in 1996, 2000, and 2005. The presence of soil contaminants was confirmed, including

PAH (benzo(a) anthracene, benzo(a)pyrene, benzo(a)pyrene, benzo(a)pyrene), heavy metals (lead, aluminum, copper), PCB, and dioxins exceeding the Region 9 U.S. EPA Primary Remediation Goals (PRG) mostly in the surface soil (0-1 ft below ground surface, ft bgs). As part of the ROD preparation, a Human Health Risk Assessment (HHRA) was conducted. The results of the HHRA indicated the only concern for human exposure to soil was for non-carcinogenic risk of aluminum in subsurface soil at Site 78 to potential future residential children. A risk management decision was made to eliminate aluminum in subsurface soil as a chemical of concern for future residential children, as the future site plan will likely be for industrial use as part of the flight line operations. All other exposure scenarios evaluated indicated no human health concerns. These scenarios included both non-carcinogenic and carcinogen evaluations for occasional users, site workers, and construction workers. In addition, there were no concerns for carcinogenic risks to residents. Overall, there were no unacceptable risks to public health or welfare to the environment identified at Site 78. Therefore, no further action was deemed necessary to protect the public health or welfare, or the environment from actual or threatened releases of hazardous substances into the environment (NAVFAC, Marianas, 2014).

The future site use for the area is an aircraft parking ramp which will be constructed under P-012. The HHRA concluded that there will be no unacceptable risk to the construction workers. However, the site contains residual contaminants, the construction workers can be exposed by incidental ingestion, dermal contact, and inhalation of soils and dust. The Contractor must provide engineering and administrative mitigation measures to minimize exposures from the residual contaminants. The mitigation measures may include hazard communication and erosion and dust controls.

Due to the former land use, FTA#3 has site contamination with PFAS. In addition to PFAS contamination, FTA#3 has been identified as a low-level radiation concern site because of potential past releases of general radioactive material (G-RAM), such as but are not limited to dials, gauges, and markers. Due to the PFAS contamination and potential G-RAM releases, the IRP site investigation is planned for the FTA#3 site under the CERCLA.

2.2.4 Soil Stockpiles

During the site visit, stockpiles were observed at the project site. A visual stockpile assessment was conducted. The summary of observations is presented in Appendix C. Soil samples were collected from Stockpiles # 6-2, 6-4, 7-1, 7-3, 8-, 8-10, 13-1, and 13-3.

2.3 Chemicals of Potential Concern (COPC)

2.3.1 PFAS

PFAS were identified as COPC for IRF Field Office Site, IRP Site 26, and IRP Site 78A. There are thousands of PFAS, but only a small number have been evaluated for their risk to human health and the environment. In addition, little is known about the health and environmental risks of exposure to combinations of these chemicals. Early studies focused on two specific compounds: perfluoro octane sulfonate (PFOS) and perfluoro octanoate (PFOA). These compounds were phased out of use by US manufacturers in the 1990s; however, they remain a problem because

they can persist in the environment. Other PFAS of concern have been found to be widespread in the environment and require further study, including PFBS, PFHxS, PFPeA PFHxA, PFHpA, PFNA and PFDA. Some of the newer replacement compounds, such as HFPO-DA (GenX) and ADONA, are being evaluated for potential risks (HDOH, 2022).

In September 2022, U.S. EPA published a proposed rule, "PFOA and PFOS as CERCLA Hazardous Substances." If the proposed rule passes, PFOA and PFOS will be on the list of the CERCLA hazardous substances. For the soil screening survey, the soil samples were analyzed for PFAS in accordance with the draft EPA Method 1633.

2.3.2 Other Persistent Contaminants

The project site was used for FTA and military operations. The common COPCs for FTA and military operations are as follows:

- Total Petroleum Hydrocarbons as Diesel/Residual Range Organics (TPH-DRO/RRO) by the Environmental Protection Agency (EPA) Method 8015M/8015B
- Polycyclic Aromatic Hydrocarbons (PAH) by EPA Method 8270 SIM
- Target Analyte List Metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, zinc) by EPA Method 6010B and 7470A **or** Resource Conservation and Recovery Act (RCRA) 8 Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver) by EPA Method 6010B and 7470A
- Chlorinated pesticides by EPA Method 8081
- Polychlorinated Biphenyls (PCB) by EPA Method 8082A

The three buildings, B2550, B2551, and B2552 (to be demolished), were constructed in the early 1970s. Pesticide-impacted soils are likely to be present beneath slab or along the slabs for these buildings. Chlorinated pesticides are synthetic compounds that were historically used as insecticides on food crops and as termiticides in and around buildings. From the mid-to late 1980s, the use and commercial production of certain chlorinated pesticides (e.g., chlordane, heptachlor, aldrin, dieldrin, and endrin) have been prohibited in the U.S. and many other countries. However, residues from these and other chlorinated pesticides may still be present beneath and around structures that were treated prior to their prohibition. There is the potential that chlorinated pesticides were applied to the building or beneath foundation, which may have been previously present in the area. Soil samples were collected from stockpiles and analyzed for RCRA 8 metals and pesticides.

3.0 SOIL SCREENING LEVELS AND ANALYTICAL RESULTS

The future site use for the project site is commercial/industrial use, an airfield including aircraft parking aprons, hangars, and its ancillary structures. The nearest surface water is the Philippine Sea located approximately 3,300 ft to the northeast.

3.1.1 PFAS

EPA establishes Regional Screening Levels (RSLs) for many chemicals addressed under CERCLA. The most current RSLs were issued in November 2024. Additionally, a Memorandum issued by the Assistant Secretary of Defense in January 2025 presents the DoD PFAS Screening levels that will be utilized for DoD branches under the CERCLA and the Defense Environmental Restoration Program (DERP). The DoD PFAS screening levels are based on EPA's RSL tables dated November 2024 except where the EPA RSLs were below the Method Detection Limits (MDLs) of EPA-approved analytical methods. These chemicals are PFOA and PFDA.

For this soil screening survey, the analytical results were compared to the DoD PFAS Screening Levels for Residential Land Use (January 2025) and US EPA RSL for Industrial Land Uses (November 2024).

3.1.2 Other Contaminants

The analytical results for contaminants except PFAS were compared to the State of Hawaii, HDOH, Tropical Pacific Soil Environmental Screening Levels (TPESL) above a drinking water resource with shallow/deep depths of impacted soil for unrestricted (residential) and restricted (commercial/industrial) land uses (State of Hawaii, Department of Health, Fall 2017). The Tropical Pacific ESL is a soil screening guidance used in tropical areas outside of Hawaii, including Guam and the Commonwealth of the Northern Mariana Islands.

Table 2. PFAS Soil Screening Levels

Chemical Name	Abbreviation	CAS No.	[1] Nov. 2024 EPA RSL (mg/kg)		[2] 2025 DoD Memo Screening Levels (mg/kg) for Residential Land Use (HQ=0.1)
			Residential (HQ=0.1)	Industrial (HQ=0.1)	
Perfluorobutanoic acid	PFBA	375-22-4	7.8	120	7.8
Perfluorohexanoic acid	PFHxA	307-24-4	3.2	41	3.2
Perfluoro butane sulfonic acid	PFBS	375-73-5	1.9	25	1.9
Hexafluoro propylene oxide dimer acid	HFPO-DA (Gen-X)	13252-13-6	0.023	0.35	0.023
Perfluorooctanoic acid	PFOA	335-67-1	0.000019	0.000078	0.00007
Perfluorohexane sulfonic acid	PFHxS	355-46-4	0.13	1.6	0.13
Perfluorononanoic acid	PFNA	375-95-1	0.019	0.25	0.019
Perfluorodecanoate	PFDA	335-76-2	0.000013	0.00016	0.00006
Perfluorooctane sulfonic acid	PFOS	1763-23-1	0.00063	0.0082	0.00063
bis(trifluoromethylsulfonyl)amine	TFSI	82113-65-3	2.3	35	2.3

1) U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2024).
2) Department of Defense (DoD) Assistant Secretary of Defense (ASD) Memorandum for Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program (January 2025)
3) The PFAS screening levels assume multiple PFAS are present and therefore use a hazard quotient (HQ) = 0.1

4.0 SOIL SAMPLING AND ANALYSIS

Soil samples were collected using discrete, composite, or multi-incremental (MI) sampling methods. All samples were labeled and recorded on a chain-of-custody (COC) document. The samples were

placed in a cooler and chilled to approximately 4˚C with frozen gel ice and shipped to Torrent Laboratory Inc., Milpitas, California or Enthalpy Analytical laboratory, Berkeley, California.

MNA's field investigators donned new nitrile gloves before collecting each sample. The small non-disposable sampling equipment, such as the stainless-steel trowels, were decontaminated as follows: (1) wash with a non-phosphate detergent (Liquinox®) and potable water solution; (2) rinse with potable water; (3) spray with distilled water. The decontamination fluid was infiltrated to each sampling area after the sampling activities were completed. All disposable personal protective equipment and sampling equipment were double-bagged and disposed of in a municipal waste dumpster.

The summary of soil sampling and analytical results are presented in Tables 2 to 4. A summary of the analytical results is presented in Appendix B, and the complete laboratory reports are provided in Appendix D.

Table 3. IRP Field Office Site: Soil Sampling and Analysis Summary

Sample ID	Sampling Depth (ft below ground surface)	Sample Type (No. of Sub-samples)	Analytes (EPA Methods)								Notes/Findings	Date of Sample Collection (MM/DD/YYYY)	Figure No., Data Summary Table No., & Remarks
			PFAS (Draft 1633)	RCRA 8 Metals	TPH-DRO/RRO (8015)	PAHs (8270-SIM)	PCB (8082)	TAL Metals (6020/7471A)	TCLP - RCRA 8 Metal	Pesticides (8081)			
IRP-01	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-02	0-1	Discrete	X								PFAS, HEPO-DA: 0.0273 mg/kg	05/31/2022	Figure 3, Table B-1
IRP-02-1	0-1	Discrete	X								Soil sampling approx. 50 ft east from IRP-2	02/06/2023	Figure 3, Table B-1. Additional sampling since HEPO-DA was reported exceeding the RSL-Residential from IRP-02.
IRP-02-2	0-1	Discrete	X								Soil sampling approx. 50 ft south from IRP-2	02/06/2023	
IRP-03	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-04	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-05	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-06	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-07	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-08	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-09	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
IRP-10	0-1	Discrete	X								N/A	05/31/2022	Figure 3, Table B-1
B-27-1.5-2.5	1.5-2.5	Discrete	X								B-27 (Geotech boring)	02/09/2023	Figure 6, Table B-6
B-27-8.5-9.5	8.5-9.5	Discrete	X								B-27 (Geotech boring)	02/09/2023	Figure 6, Table B-6
B-28-1.5-2.5	1.5-2.5	Discrete	X								B-28 (Geotech boring)	02/10/2023	Figure 6, Table B-6
B-28-8.5-9.5	8.5-9.5	Discrete	X								B-28 (Geotech boring)	02/10/2023	Figure 6, Table B-6
IRP-A	0-1	MIS (10)				X	X	X	X	X	Sampling locations: IRP-01 through -10 except IRP-02-1 & 02-2	05/31/2022	Figure 3, Table B-8
IRP-B-1.5-2.5	1.5-2.5	MIS (6)			X	X	X	X		X	B-25 to B-29 and TP-5 (Geotech boring)	02/13/2023	Figure 6, Table B-8
B2550/B2551-0-1	0-1	Composite (8)		X	X	X	X			X	B2550 and B2551 will be demolished. Collect samples along the building perimeter. Lead: 310 mg/kg [TPESL Unrestricted: 200 mg/kg, Restricted: 800 mg/kg]	01/30/2023	Figure 8, Table B-8
B2552-0-1	0-1	Composite (5)		X	X	X	X			X	B2552 will be demolished Collect samples along building perimeter.	01/30/2023	Figure 8, Table B-8
B2552-1-2	1-2	Composite (5)		SB	SB	SB	SB			SB	Collect samples along the building perimeter. Laboratory standby sample. Since contaminants	01/30/2023	Figure 8, Table B-8

Sample ID	Sampling Depth (ft below ground surface)	Sample Type (No. of Sub-samples)	Analytes (EPA Methods)								Notes/Findings	Date of Sample Collection (MM/DD/YYYY)	Figure No., Data Summary Table No., & Remarks
			PFAS (Draft 1633)	RCRA 8 Metals	TPH-DRO/RRO (8015)	PAHs (8270-SIM)	PCB (8082)	TAL Metals (6020/7471A)	TCLP - RCRA 8 Metal	Pesticides (8081)			
											were not reported exceeding the residential TPESL, the sample was not analyzed.		
XFMR-0-1	0-1	Composite (8)		X	X	X	X			X	Collect samples along the transformer enclosure. Arsenic: 28 mg/kg [TPESL Unrestricted: 24 mg/kg, Restricted: 95 mg/kg]	01/30/2023	Figure 8, Table B-8
XFMR-1-2	1-2	Composite (8)		SB	SB	SB	SB			SB	Collect samples along the transformer enclosure. Laboratory standby sample. Since contaminants were not reported exceeding the residential TPESL, the sample was not analyzed.	01/30/2023	Figure 8, Table B-8

ID	identification
IRP	Installation Restoration Project
MIS	Multi-Incremental Sample. The analytical laboratory provided the laboratory MI sample process.
N/A	Not Available
PFAS	Polyfluoroalkyl Substances
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
RCRA 8 Metals	Resource Conservation Recovery Act (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)
RSL	Regional Screening Levels, EPA, U. S.
SB	Standby Sample for laboratory analysis
TAL Metals	Target Analyte List metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, & zinc)
TCLP	Toxic Characteristic Leaching Procedure
TPESL	Tropical Pacific Environmental Screening Levels, Hawaii Department of Health

Table 4. Site 78A Area: Soil Sampling and Analysis Summary

Sample ID	Sampling Depth (ft below ground surface)	Sample Type (No. of Sub-samples)	Analytes (EPA Methods)								Notes/Findings	Date of Sample Collection (MM/DD/YYYY)	Figure No., Data Summary Table No., & Remarks
			PFAS (Draft 1633)	RCRA 8 Metals	TPH-DRO/RRO (8015)	PAHs (8270-SIM)	PCB (8082)	TAL Metals (6020/7471A)	TCLP - RCRA 8 Metal	Pesticides (8081)			
S78A-A	0-1	MIS (11)				X	X	X	X	X	Sampling locations: S78a-07 and 11 to 20	06/01/2022	Figure 4, Table B-9
S78A-B	0-1	MIS (9)				X	X	X	X	X	Sampling locations: S78a-01 to 06, 08, 09, and 10	06/01/2022	Figure 4, Table B-9
S78A-C	1.5-3.0	MIS (8)			X	X	X	X		X	Sampling locations: Geotech borings and test pits including TP-3, TP-4, B-19, B-20, B-21, B-22, B-23, and B-24	02/20/2023	Figure 6, Table B-9
S78A-01	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-02	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-03	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-04	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-05	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-06	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-07	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-08	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-2
S78A-09	0-1	Discrete	X								N/A	06/01/2022	Figure 4, Table B-2
S78A-10	0-1	Discrete	X								N/A	06/01/2022	Figure 4, Table B-2
S78A-11	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-3
S78A-12	0-1	Discrete	X								Sampling location: within the former FTA	06/01/2022	Figure 4, Table B-3
S78A-13	0-1	Discrete	X								N/A	05/31/2022	Figure 4, Table B-3
S78A-14	0-1	Discrete	X								N/A	06/01/2022	Figure 4, Table B-3
S78A-15	0-1	Discrete	X								Refusal at surface. Sampling depth: 0-2 inches	06/01/2022	Figure 4, Table B-3
S78A-16	0-1	Discrete	X								N/A	06/01/2022	Figure 4, Table B-3
S78A-17	0-1	Discrete	X								N/A	06/01/2022	Figure 4, Table B-3
S78A-18	0-1	Discrete	X								N/A	06/01/2022	Figure 4, Table B-3
S78A-19	0-1	Discrete	X								PFAS - PFOS: 0.0214 mg/kg	06/01/2022	Figure 4, Table B-3
S78A-19-1	0-1	Discrete	X								PFOS: 0.0113 mg/kg	02/08/2023	Figure 4, Table B-4. Additional sampling since PFOS was reported exceeding the RSL-Residential from S78A-
S78A-19-2	0-1	Discrete	X								PFOS: 0.0113 mg/kg	02/08/2023	
S78A-19-3	0-1	Discrete	X								PFOS: 0.0184 mg/kg	02/08/2023	
S78A-19-4	0-1	Discrete	X								PFOS: 0.0157 mg/kg	02/08/2023	

Sample ID	Sampling Depth (ft below ground surface)	Sample Type (No. of Sub-samples)	Analytes (EPA Methods)								Notes/Findings	Date of Sample Collection (MM/DD/YYYY)	Figure No., Data Summary Table No., & Remarks
			PFAS (Draft 1633)	RCRA 8 Metals	TPH-DRO/RRO (8015)	PAHs (8270-SIM)	PCB (8082)	TAL Metals (6020/7471A)	TCLP - RCRA 8 Metal	Pesticides (8081)			
S78A-19-5	0-1	Discrete	X								PFOS: 0.0274 mg/kg	02/08/2023	19. Sampling locations: 50 ft or 100 ft away from S78A-19.
S78A-19-6	0-1	Discrete	X								PFOS: 0.00507 mg/kg	02/08/2023	
S78A-20	0-1	Discrete	X								N/A	06/01/2022	Figure 4, Table B-3
S78A-21	0-1	Discrete	X								Sampling location: within the former FTA	02/08/2023	Figure 4, Table B-4
S78A-22	0-1	Discrete	X								Sampling location: within the former FTA	02/08/2023	Figure 4, Table B-4
S78A-23	0-1	Discrete	X								Sampling location: within the former FTA	02/08/2023	Figure 4, Table B-4
S78A-24	0-1	Discrete	X								Sampling location: within the former FTA	02/08/2023	Figure 4, Table B-4
B-19-1.5-3.0	1.5-3.0	Discrete	X								B-19 (Geotech boring)	02/21/2023	Figure 6, Table B-5
B-19-20-21.5	20-21.5	Discrete	SB								B-19 (Geotech boring), Not Analyzed since no PFAS exceedance above the residential RSL from the sampling depths, 1.5-3.0 and 47-48.5 ft bgs	02/21/2023	Figure 6, Table B-5
B-19-47-48.5	47-48.5	Discrete	X								B-19 (Geotech boring)	02/21/2023	Figure 6, Table B-5
B-20-1.5-3.0	1.5-3.0	Discrete	X								B-20 (Geotech boring)	02/17/2023	Figure 6, Table B-5
B-20-20-21.5	20-21.5	Discrete	SB								B-20 (Geotech boring), Not Analyzed since no PFAS exceedance above the residential RSL from the sampling depths, 1.5-3.0 and 47-48.5 ft bgs	02/20/2023	Figure 6, Table B-5
B-20-47-48.5	47-48.5	Discrete	X								B-20 (Geotech boring)	02/20/2023	Figure 6, Table B-5
B-21-1.5-3.0	1.5-3.0	Discrete	X								B-21 (Geotech boring)	02/17/2023	Figure 6, Table B-5
B-21-20-21.5	20-21.5	Discrete	SB								B-21 (Geotech boring), Not Analyzed since no PFAS exceedance above the residential RSL from the sampling depths, 1.5-3.0 and 47-48.5 ft bgs	02/17/2023	Figure 6, Table B-5
B-21-47-48.5	47-48.5	Discrete	X								B-21 (Geotech boring)	02/17/2023	Figure 6, Table B-5
B-22-1.5-3.0	1.5-3.0	Discrete	X								B-22 (Geotech boring)	02/17/2023	Figure 6, Table B-5
B-22-20-21.5	20-21.5	Discrete	SB								B-22 (Geotech boring), Not Analyzed since no PFAS exceedance above the residential RSL from the sampling depths, 1.5-3.0 and 47-48.5 ft bgs	02/20/2023	Figure 6, Table B-5
B-22-47-48.5	47-48.5	Discrete	X								B-22 (Geotech boring)	02/20/2023	Figure 6, Table B-5
B-23-1.5-3.0	1.5-3.0	Discrete	X								B-23 (Geotech boring)	02/21/2023	Figure 6, Table B-5
B-23-20-21.5	20-21.5	Discrete	SB								B-23 (Geotech boring), Not Analyzed since no PFAS exceedance above the residential RSL from the sampling depths, 1.5-3.0 and 47-48.5 ft bgs	02/21/2023	Figure 6, Table B-5
B-23-47-48.5	47-48.5	Discrete	X								B-23 (Geotech boring)	02/21/2023	Figure 6, Table B-5

Sample ID	Sampling Depth (ft below ground surface)	Sample Type (No. of Sub-samples)	Analytes (EPA Methods)								Notes/Findings	Date of Sample Collection (MM/DD/YYYY)	Figure No., Data Summary Table No., & Remarks
			PFAS (Draft 1633)	RCRA 8 Metals	TPH-DRO/RRO (8015)	PAHs (8270-SIM)	PCB (8082)	TAL Metals (6020/7471A)	TCLP - RCRA 8 Metal	Pesticides (8081)			
B-24-1.5-3.0	1.5-3.0	Discrete	X								B-24 (Geotech boring)	02/22/2023	Figure 6, Table B-5
B-24-20-21.5	20-21.5	Discrete	SB								B-24 (Geotech boring), Not Analyzed	02/22/2023	Figure 6, Table B-5
B-24-47-48.5	47-48.5	Discrete	X								B-24 (Geotech boring)	02/22/2023	Figure 6, Table B-5
N-B1-0-1	0-1	Discrete	X								N-B1-0-1 (Geotech boring)	01/22/2024	Figure 6, Table B-6
Q-B2-0-1	0-1	Discrete	X								Q-B2-0-0-1 (Geotech boring)	01/22/2024	Figure 6, Table B-6

ID	identification
FTA	Fire Training Pit
MIS	Multi-Incremental Sample. The analytical laboratory provided the laboratory MI sample process.
N/A	Not Available
PFAS	Polyfluoroalkyl Substances
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
RCRA 8 Metals	Resource Conservation Recovery Act (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)
RSL	Regional Screening Levels, EPA, U. S.
SB	Standby Sample for laboratory analysis
TAL Metals	Target Analyte List metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, & zinc)
TCLP	Toxic Characteristic Leaching Procedure
TPESL	Tropical Pacific Environmental Screening Levels, Hawaii Department of Health

Table 5. Other Areas and Stockpiles: Soil Sampling and Analysis Summary

Sampling Location	Sample ID	Sampling Depth (ft below ground surface)	Sample Type (No. of Sub-samples)	Analytes (EPA Methods)								Notes/Findings	Date of Sample Collection (MM/DD/YYYY)	Figure No., Data Summary Table No., & Remarks
				PFAS (Draft 1633)	RCRA 8 Metals	TPH-DRO/RRO (8015)	PAHs (8270-SIM)	PCB (8082)	TAL Metals (6020/7471A)	TCLP - RCRA 8 Metal	Pesticides (8081)			
P6002 Hangar Area	B-30-1.5-2.5	1.5-2.5	Discrete	X								B-30 (Geotech boring)	02/15/2023	Figure 6, Table B-6
	B-30-28.5-29.5	28.5-29.5	Discrete	X								B-30 (Geotech boring)	02/16/2023	Figure 6, Table B-6
	B-33-1.5-2.5	1.5-2.5	Discrete	X								B-33 (Geotech boring)	02/15/2023	Figure 6, Table B-6
	B-33-28.5-29.5	28.5-29.5	Discrete	X								B-33 (Geotech boring)	02/16/2023	Figure 6, Table B-6
Existing Dirt Road Areas and Perimeter Road	GR1-0-1	0-1	MIS (50)			X	X	X	X		X	50 locations along the unpaved dirt road	02/07/2023	Figure 7, Table B-10
	GR1-1.5-2.5	1.5-2.5	MIS (5)			X	X	X	X		X	Geotech borings from B-30 to B-34 along the unpaved dirt road	02/15/2023	Figure 6, Table B-10
	GR2-0-1	0-1	MIS (50)			X	X	X	X		X	50 locations along the unpaved dirt road	02/07/2023	Figure 7, Table B-10
	GR2-1.5-2.5	1.5-2.5	MIS (10)			X	X	X	X		X	Geotech borings from B-1 to B-9 and TP-1 along the unpaved road to the north of project boundary.	02/20/2023	Figure 6, Table B-10
	PR-0-1	0-1	MIS (50)			X	X	X	X		X	50 locations along Perimeter Road	02/10/2023	Figure 7, Table B-10
	PR-1.5-2.5	1.5-2.5	MIS (9)			X	X	X	X		X	Geotech borings from B-10 to B-18 along Perimeter Road	02/15/2023	Figure 6, Table B-10
Area Near IR Site - S26	S26-A	0-1	Composite (3)				X	X	X		X	Sampling locations: S26-01, -02, & -03	06/01/2022	Figure 3, Table B-11
	S26-01	0-1	Discrete	X								N/A	06/01/2022	Figure 3, Table B-7
	S26-02	0-1	Discrete	X								PFAS – HEPO-DA: 0.0418 mg/kg	06/01/2022	Figure 3, Table B-7
	S26-03	0-1	Discrete	X								N/A	06/01/2022	Figure 3, Table B-7
North of B2641	B2641-A	0-1	Composite (3)				X	X	X		X	Sampling locations: S2641-01, -02, & -03	06/01/2022	Figure 5, Table B-11
	B2641-01	0-1	Discrete	X								N/A	06/01/2022	Figure 5, Table B-7
	B2641-02	0-1	Discrete	X								N/A	06/01/2022	Figure 5, Table B-7
	B2641-03	0-1	Discrete	X								N/A	06/01/2022	Figure 5, Table B-7
West Project Site	DA-04-0-1	0-1	MIS		X	X	X	X			X	N/A	01/26/2024	Figure 7, Table B-9
East Project site	DA-05-0-1	0-1	MIS		X	X	X	X			X	N/A	01/26/2024	Figure 7, Table B-9
Soil Stockpiles	Stockpile 6-2	Stockpile	Composite		X						X	Stockpile	07/29/2024	Figure 9, Table B-12
	Stockpile 6-4	Stockpile	Composite		X						X	Stockpile	07/29/2024	Figure 9, Table B-12
	Stockpile 7-1	Stockpile	Composite		X						X	Stockpile	07/29/2024	Figure 9, Table B-12
	Stockpile 7-3	Stockpile	Composite		X						X	Stockpile	07/29/2024	Figure 9, Table B-12
	Stockpile 8-6	Stockpile	Composite		X						X	Stockpile	07/29/2024	Figure 9, Table B-12

Sampling Location	Sample ID	Sampling Depth (ft below ground surface)	Sample Type (No. of Sub-samples)	Analytes (EPA Methods)								Notes/Findings	Date of Sample Collection (MM/DD/YYYY)	Figure No., Data Summary Table No., & Remarks
				PFAS (Draft 1633)	RCRA 8 Metals	TPH-DRO/RRO (8015)	PAHs (8270-SIM)	PCB (8082)	TAL Metals (6020/7471A)	TCLP - RCRA 8 Metal	Pesticides (8081)			
	Stockpile 8-10	Stockpile	Composite		X						X	Stockpile	07/29/2024	Figure 9, Table B-12
	Stockpile 13-1	Stockpile	Composite		X						X	Stockpile	07/29/2024	Figure 9, Table B-12
	Stockpile 13-3	Stockpile	Composite		X						X	Stockpile Cadmium: 21 mg/kg [TPESL Unrestricted: 14 mg/kg, Restricted: 74 mg/kg], Lead 430 mg/kg [TPESL Unrestricted: 200 mg/kg, Restricted: 800 mg/kg]	07/29/2024	Figure 9, Table B-12

MIS Multi-Incremental Sample. The analytical laboratory provided the laboratory MI sample process.
N/A Not Available
PFAS Polyfluoroalkyl Substances
PAH Polycyclic Aromatic Hydrocarbons
PCB Polychlorinated Biphenyls
RCRA 8 Metals Resource Conservation Recovery Act (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)
RSL Regional Screening Levels, EPA, U. S.
TAL Metals Target Analyte List metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, & zinc)
TCLP Toxic Characteristic Leaching Procedure
TPESL Tropical Pacific Environmental Screening Levels, Hawaii Department of Health

5.0 CONCLUSION AND RECOMMENDATION

MNA conducted a soil screening survey. Soil samples were collected based on the current site use and future site development plans which include building demolition and new site development. The objective of the screening survey was to identify the presence of potentially hazardous soil contaminants and associated risks that would be encountered during construction and earthwork.

The project site includes PFAS- and/or heavy metal impacted soil. A Soil Management Plan (SMP) will be developed. The Contractor must implement the SMP and update it as needed. The Contractor will be responsible for protecting construction workers. During construction, the construction workers can be exposed to contaminated soil and dust by incidental ingestion, dermal contact, and inhalation. The Contractor must provide engineering controls and administrative controls to minimize exposures from the residual contaminants in accordance with the EM-381-1-1 Safety and Health Requirements Manual and the requirements in the specifications. The mitigation measures must include hazard communication and erosion and dust controls.

References

HDOH. (2022, July 19). *PER- AND POLYFLUOROALKYL SUBSTANCES (PFASS)*. Retrieved from HDOH HEER Office: https://health.hawaii.gov/heer/environmental-health/highlighted-projects/per-and-polyfluoroalkyl-substances-pfass/

NAVFAC, Marianas. (2011). *Final Record of Decision for Installation Restoration Program Sites 10, 13, 15, 26, and 27, Andersen Air Force Base.*

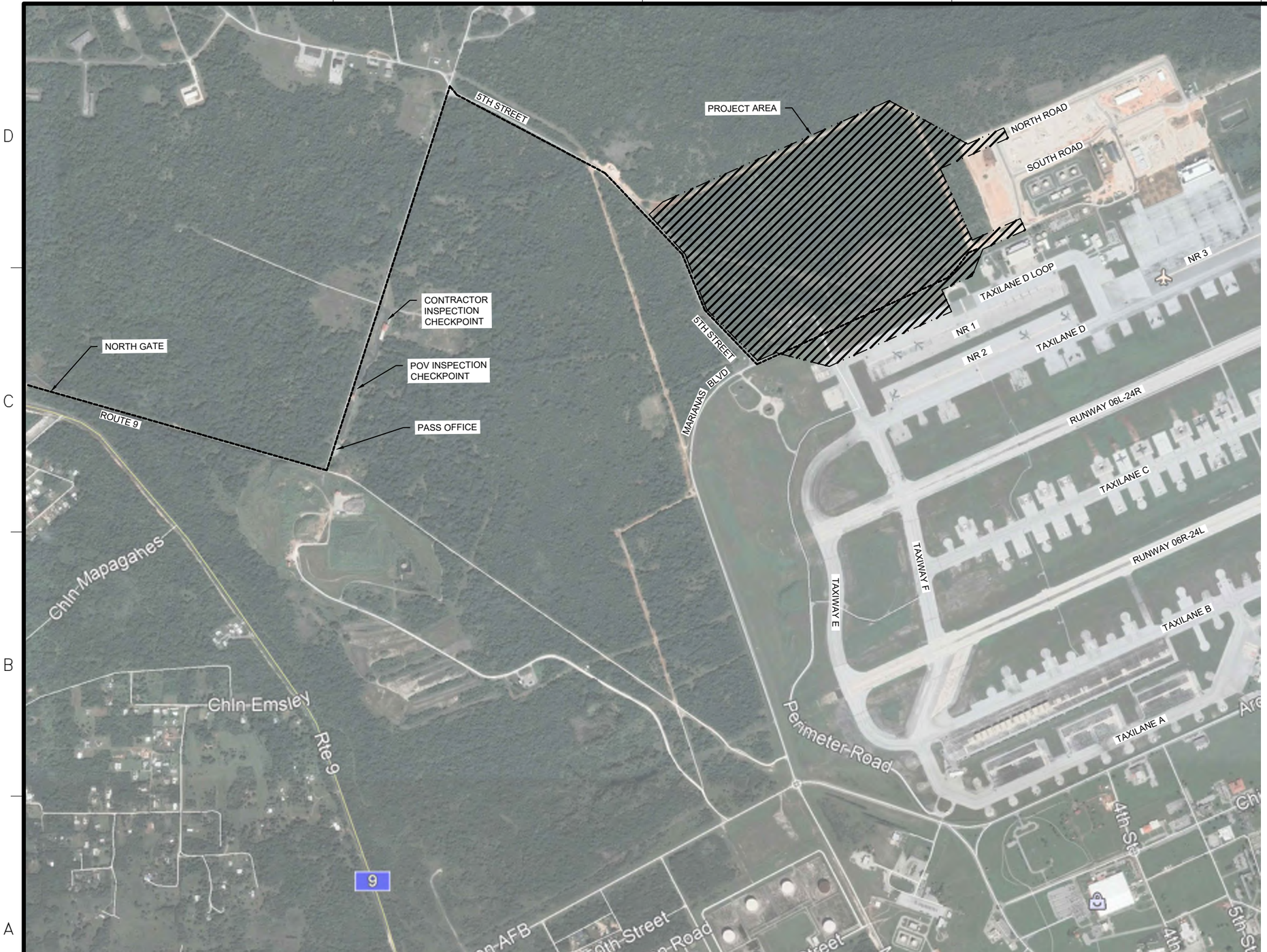
NAVFAC, Marianas. (2014). *Record of Decision Site 78, Site-Wide Operable Unit, Andersen Air Force Base, Guam.*

State of Hawaii Department of Health. (Fall 2017). *Environmental Action Levels Surfer.* Retrieved from Environmental Hazard Evaluation and Environmental Action Levels: http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/environmental-hazard-evaluation-and-environmental-action-levels

State of Hawaii, Department of Health. (Fall 2017). Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater, Tropical Pacific Edition.

APPENDIX A FIGURES

Figure 1. Location Map
Figure 2. IRP and Potential PFAS Release Sites
Figure 3. IRP Field Office, B2550: Sampling Locations for PFAS Analysis
Figure 4. Site 78A, FTA-3: Sampling Locations for PFAS Analysis
Figure 5. Building 2641: Sampling Locations for PFAS Analysis
Figure 6. Soil Sampling Locations from Geotechnical Survey Borings
Figure 7. Surface Multi-Incremental Soil Sampling Locations
Figure 8. IRP Field Office Site Soil Sampling Locations
Figure 9. Stockpile Soil Sampling Locations



A1 LOCATION MAP
SCALE: 1" = 600'

GRAPHIC SCALE

0 300' 600' 1200'

SCALE: 1"=600'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NAVFAC

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

EUNJIN KOTKOVETZ
Name
PE907465 DD MM 2023
Registration Number # Date
DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS MCDONNELL
JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62743-20-D-0002
A/E Task Order No. N6274221F0315
JCG NO. 234360/3
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	JMH	DRW:	SMC	REV:	ATM
PM/DM					XX
BRANCH MANAGER					XX
CHIEF ENG/ARCH					XX
FIRE PROTECTION					XX

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND – PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

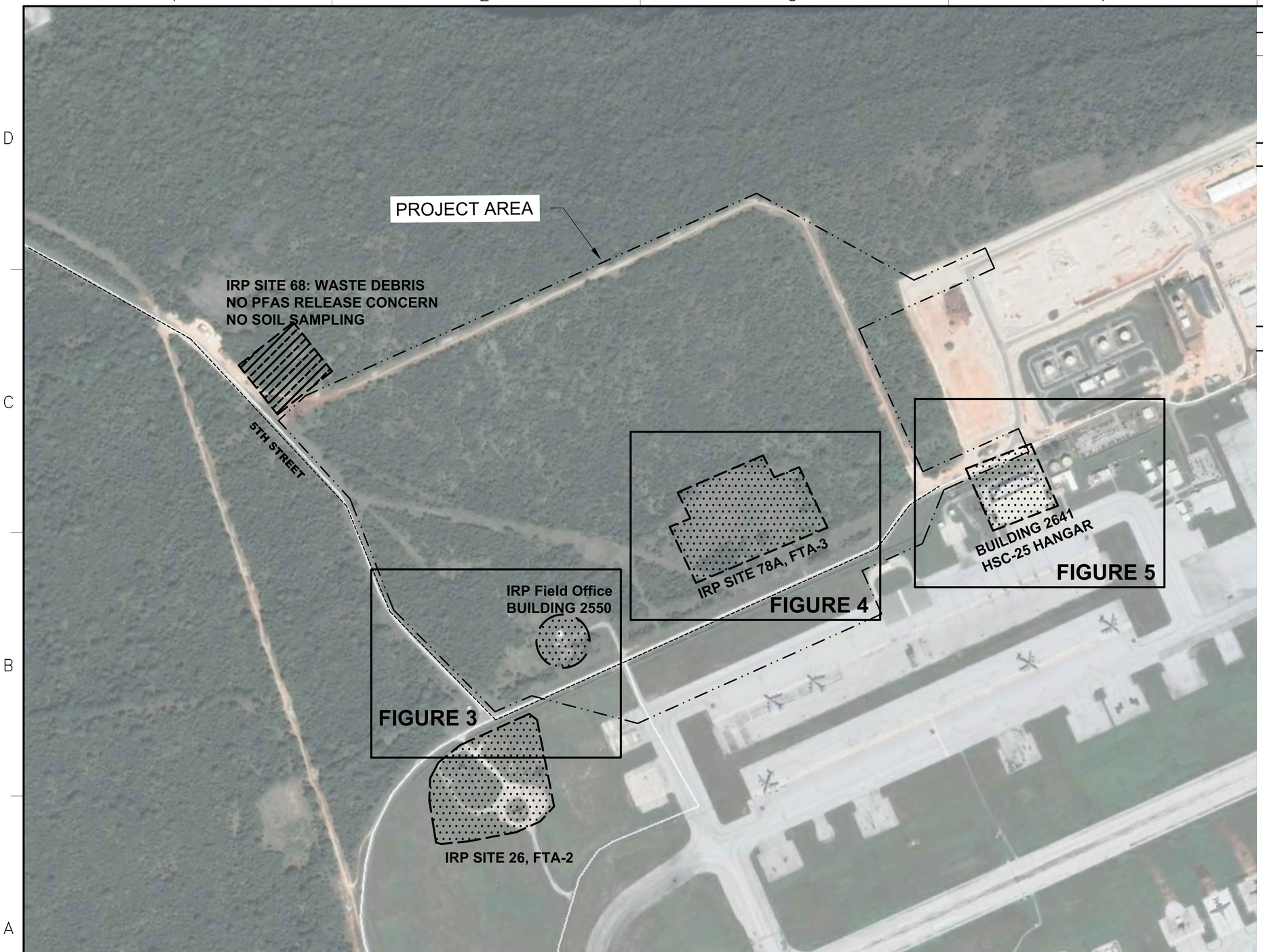
FY2024 MCAF P-012/ AJUY183012
NORTH AIRCRAFT PARKING RAMP

LOCATION MAP

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 1

65% DESIGN SUBMITTAL



A1 IRP AND POTENTIAL PFAS RELEASE SITES
SCALE: 1" = 300'

SOIL SAMPLING NOTES

NOT AVAILABLE

ACRONYMS AND ABBREVIATIONS

IRP	INSTALLATION RESTORATION PROGRAM
PFAS	PER- AND POLYFLUOROALKYL SUBSTANCES

LEGEND

SITE WITH POTENTIAL PFAS RELEASE

SITE WITHOUT PFAS RELEASE

GRAPHIC SCALE

0 150' 300' 600'

SCALE: 1"=300'

NORTH ARROW

TRUE N

NAVFAC

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

EUNJIN KOTKOVETZ

Name

PE907465 DD MM 2023

Registration Number # Date

DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742219T0315
JEG NO. D3430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

IRP AND POTENTIAL PFAS RELEASE SITES

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 2

65% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

A1 IRP FIELD OFFICE, B2550: SAMPLING LOCATIONS FOR PFAS ANALYSIS
SCALE: 1" = 50'

SOIL SAMPLING NOTES

SAMPLING DEPTH: 0-1 FT BELOW GROUND SURFACE

ACRONYMS AND ABBREVIATIONS

LEGEND

SITE WITH POTENTIAL PFAS RELEASE

SOIL SAMPLING LOCATION

GRAPHIC SCALE

0 25' 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

NAVFAC

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

EUNJIN KOTKOVETZ

Name

PE907465 DD MM 2023

Registration Number # Date

DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS & McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0315
JEG NO. D3430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

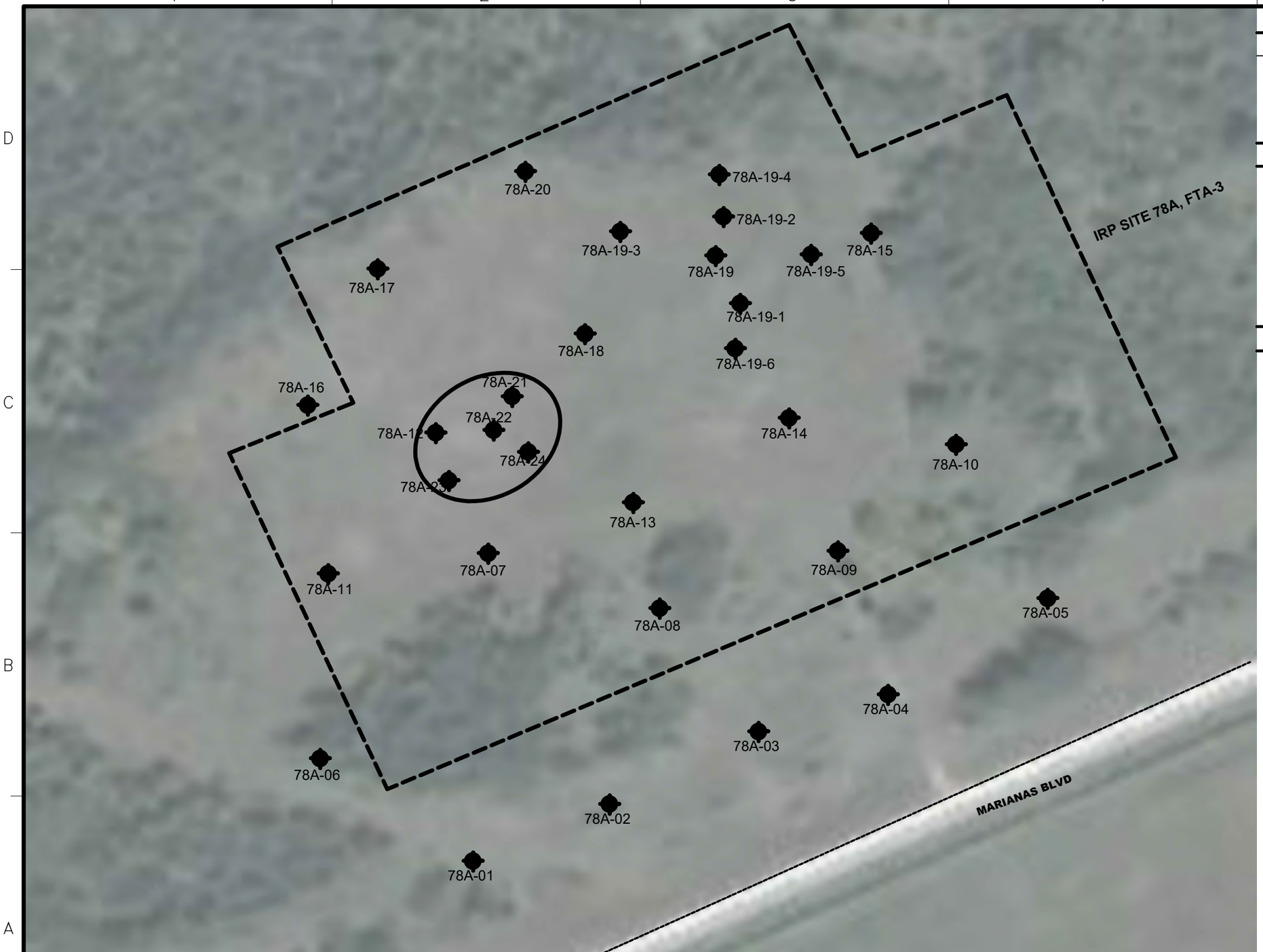
IRP FIELD OFFICE, B2550: SAMPLING LOCATIONS FOR PFAS ANALYSIS

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 3

65% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES



A1 SITE 78A, FTA-3: SAMPLING LOCATIONS FOR PFAS ANALYSIS
SCALE: 1" = 50'

SOIL SAMPLING NOTES

SAMPLING DEPTH: 0-1 FT BELOW GROUND SURFACE

ACRONYMS AND ABBREVIATIONS

LEGEND

SITE WITH POTENTIAL PFAS RELEASE

SOIL SAMPLING LOCATION

FORMER FIRE TRAINING PIT

GRAPHIC SCALE

0 25' 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

EUNJIN KOTKOVETZ

Name

PE907465 DD MM 2023

Registration Number # Date

DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742219F0315
JEG NO. D3430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

IRP SITE 78A, FTA-3: SAMPLING LOCATIONS

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 4

65% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

A1 BUILDING 2641: SAMPLING LOCATIONS FOR PFAS ANALYSIS
SCALE: 1" = 50'

SOIL SAMPLING NOTES

SAMPLING DEPTH: 0-1 FT BELOW GROUND SURFACE

ACRONYMS AND ABBREVIATIONS

LEGEND

SITE WITH POTENTIAL PFAS RELEASE

SOIL SAMPLING LOCATION

GRAPHIC SCALE

0 25' 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

NAVFAC

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

EUNJIN KOTKOVETZ

Name

PE907465 DD MM 2023

Registration Number # Date

DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742219F0315
JEG NO. D3430603

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

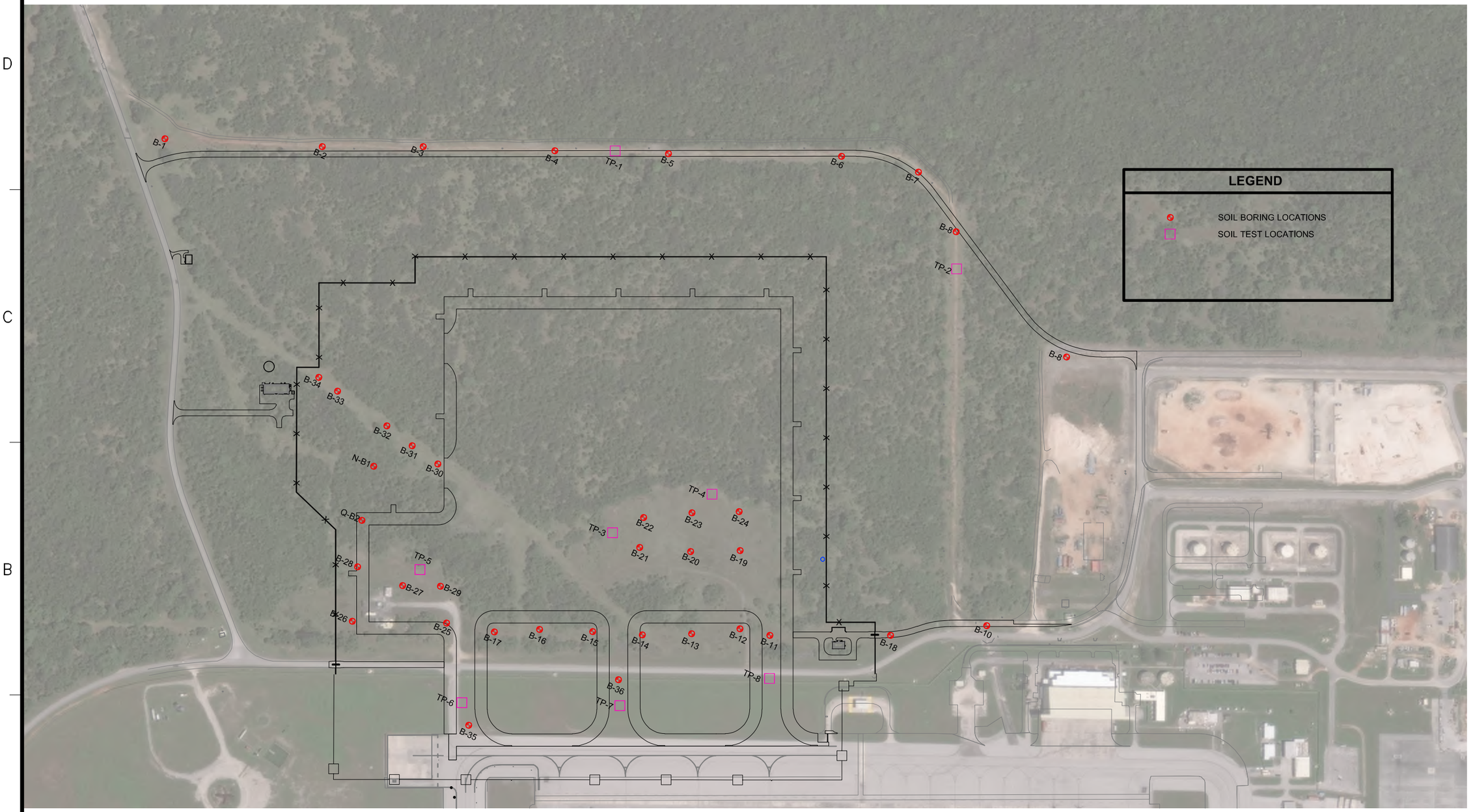
BUILDING 2641: SAMPLING LOCATIONS FOR PFAS ANALYSIS

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 5

65% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES



A1 SOIL SAMPLING LOCATIONS FROM GEOTECHNICAL SURVEY BORINGS
SCALE:

GRAPHIC SCALE
0 100' 200' 400'
SCALE: 1"=200'

NORTH ARROW
TRUE N

NAVFAC

PRELIMINARY FOR REVIEW ONLY
These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:
EUNJIN KOTKOVETZ
Name
PE907465 DD MM 2023
Registration Number # Date
DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS MCDONNELL
JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0015
JACOBS PROJ. D3435003
A/E INFO

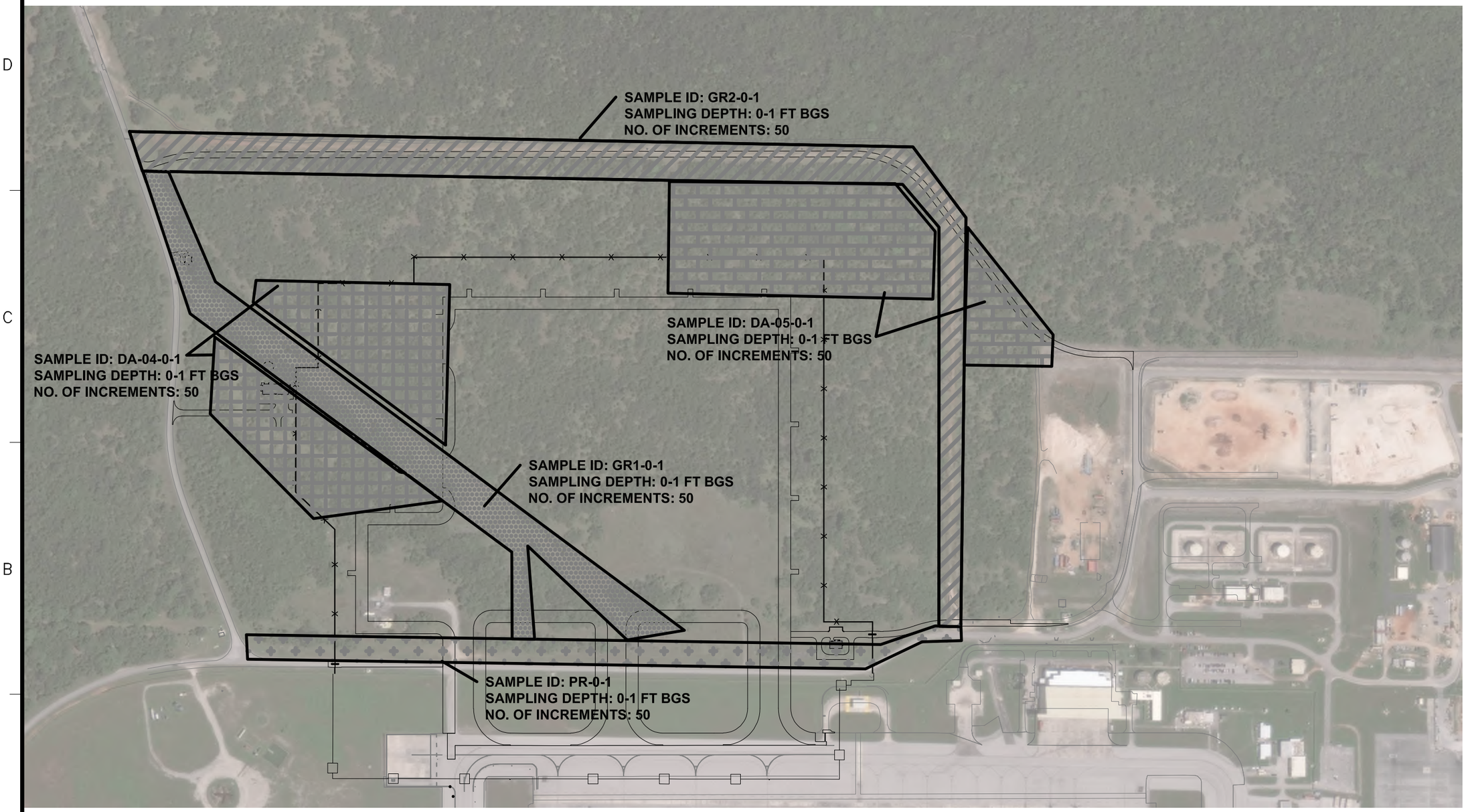
APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	HYL	DRW:	HYL	REV: JBH
PM/DM				XX
BRANCH MANAGER				XX
CHIEF ENG/ARCH				XX
FIRE PROTECTION				XX

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND – PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM
FY2024 MCAF P-012/ AUJY183012
NORTH AIRCRAFT PARKING RAMP
SOIL SAMPLING LOCATIONS FROM GEOTECHNICAL SURVEY BORINGS

SCALE: NTS
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF
FIGURE 6

GUAM EPA EXHIBIT
FOR REFERENCE ONLY



A1 SURFACE MULTI-INCREMENTAL SOIL SAMPLING LOCATIONS
SCALE:

GRAPHIC SCALE
0 100' 200' 400'
SCALE: 1"=200'

NORTH ARROW
TRUE N

PRELIMINARY FOR REVIEW ONLY
These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:
EUNJIN KOTKOVETZ
Name
PE807466 DD MM 2023
Registration Number # Date
DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS MCDONNELL
JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102
A/E Contract No. W9274S-25-D-4002
Task Order No. W9274S-25-F0016
JGS NO. 104040
A/E INFO.

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES: HYL	DRW: HYL	REV: JBH
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP
SURFACE MULTI-INCREMENTAL SOIL SAMPLING LOCATIONS

SCALE: NTS
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 7

GUAM EPA EXHIBIT
FOR REFERENCE ONLY

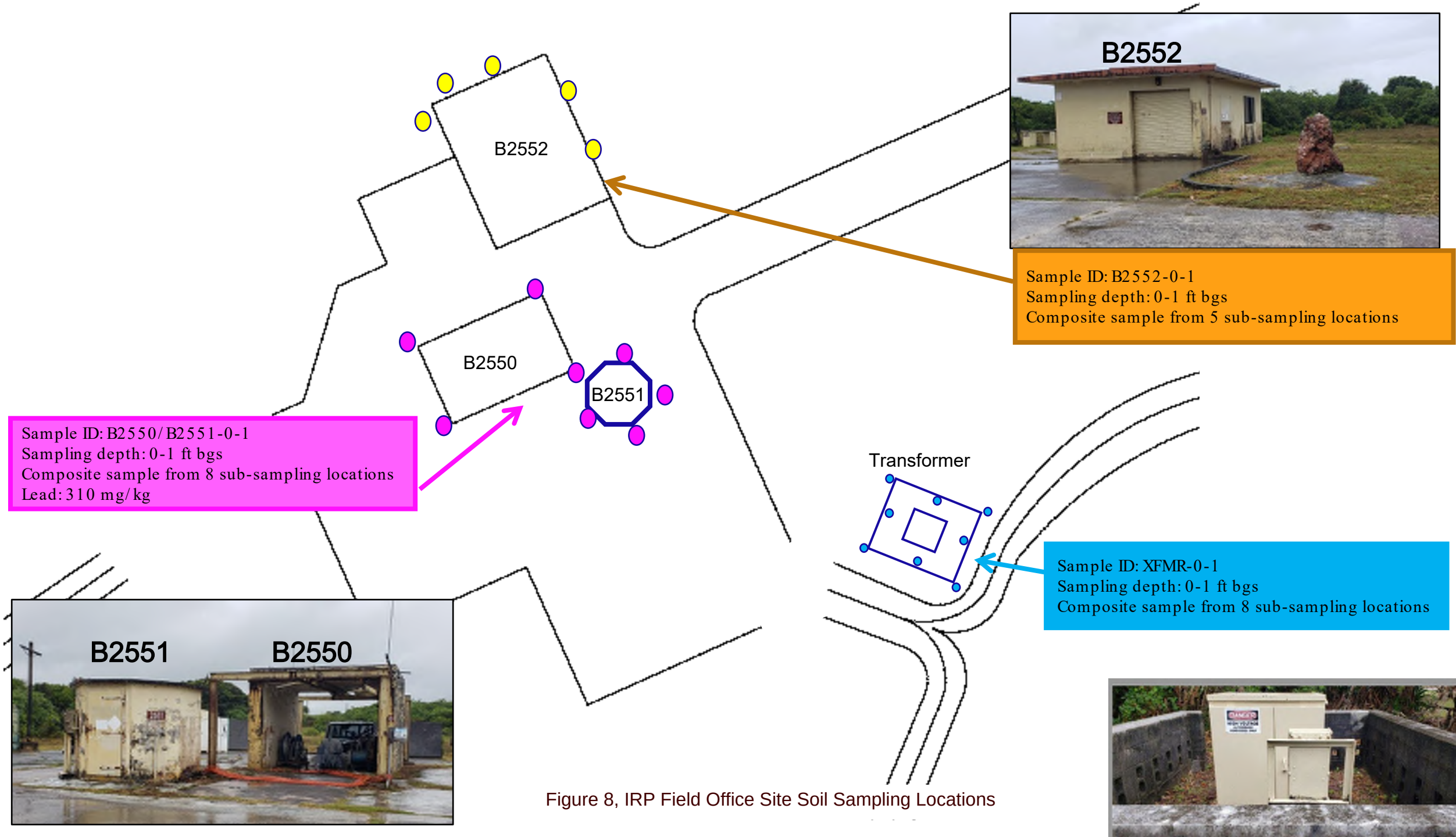
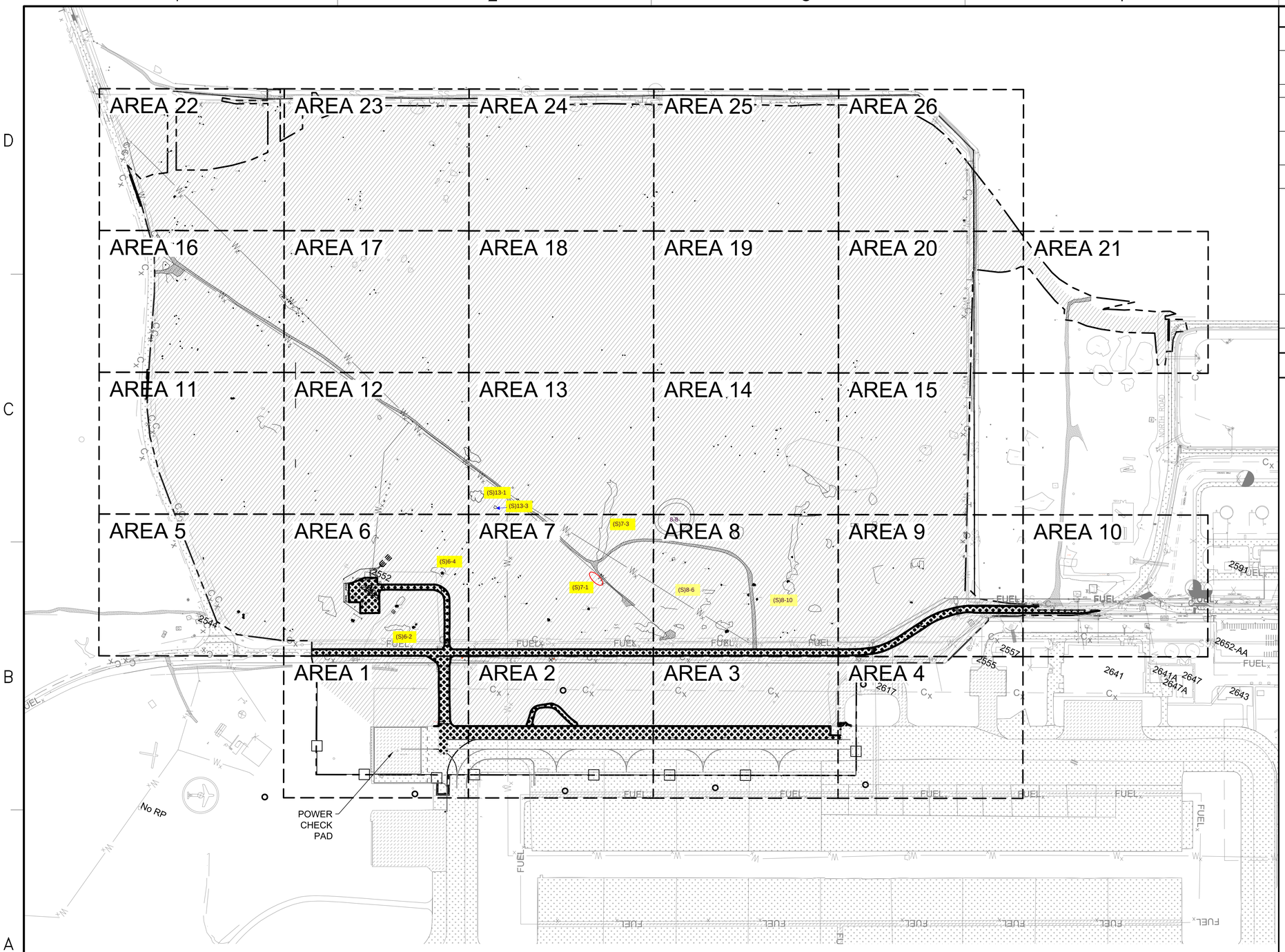


Figure 8, IRP Field Office Site Soil Sampling Locations



A1 OVERALL DEMOLITION PLAN
SCALE: 1" = 200'

(S) Notation: Soil Sampling was conducted.

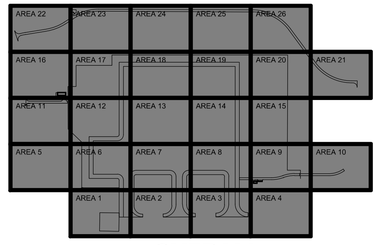
Figure 9. Stockpile Soil Sampling Locations

GENERAL NOTES

A	ALL EXISTING IMPROVEMENTS NOT SHOWN REMOVED ON DEMOLITION PLAN SHEETS MUST BE PROTECTED IN PLACE.
B	CONTRACTOR MUST SAWCUT A STRAIGHT EDGE ALONG EXISTING ASPHALT PAVEMENT FOR INSTALLATION OF NEW PAVEMENT.
C	PROTECT EXISTING EDGES OF PAVEMENT TO REMAIN.
D	EXISTING SECURITY FENCE MUST REMAIN IN PLACE UNTIL TEMPORARY OR PERMANENT FENCING IS INSTALLED AND ACCEPTED. THE AIRFIELD MUST BE SECURE AT ALL TIMES.
E	COMPLY WITH ENVIRONMENTAL REQUIREMENTS AND REGULATIONS. REFER TO DIVISIONS 01 AND 02 SPECIFICATIONS.
F	CLEAR AND GRUB AND REMOVE ALL WEEDS, STUMPS, ROOTS, ROCKS, CONCRETE DEBRIS AND TRASH.
G	ALL GREEN WASTE GENERATED FROM CLEARING AND GRUBBING TASKS AND CONSTRUCTION ACTIVITIES SHALL BE MANAGED, PROCESSED AND REUSED ON SITE. CONTRACTOR WILL BE REQUIRED TO PREPARE A GREEN WASTE MANAGEMENT PLAN THAT WILL BE INCLUDED IN THEIR OVERALL WASE MANAGEMENT PLAN. CONTRACTOR IS REQUIRED TO MONITOR GREEN WASTE PILES WEEKLY FOR CRB INFESTATION. IF THERE IS AN INFESTATION, THE PILES MUST GO THROUGH A GRINDER/SHREDDER PRIOR TO RESUMING COMPOST ACTIVITIES.
H	CONTRACTOR SHALL OBTAIN ANY NECESSARY DIG PERMITS 15 CALENDAR DAYS PRIOR TO THE START OF EXCAVATION.

LEGEND

- REMOVE ASPHALT PAVEMENT
- REMOVE DIRT ROAD
- EXISTING CONCRETE PAVEMENT TO REMAIN
- EXISTING ASPHALT PAVEMENT TO REMAIN
- LIMITS OF CLEARING AND GRUBBING
- LIMITS OF DISTURBANCE
- TEMPORARY FENCE (FREE ZONE BOUNDARY), RE: A1/CS508
- W_x REMOVE EXISTING WATERLINE
- W_x EXISTING WATERLINE
- E_x EXISTING UNDERGROUND ELECTRIC
- C_x EXISTING UNDERGROUND COMM.
- $FUEL_x$ EXISTING MAIN FUEL PIPE
- SS_x EXISTING SANITARY SEWER



OVERALL
KEY PLAN

GRAPHIC SCALE
0 100' 200' 400'
SCALE: 1"=200'

NORTH ARROW
TRUE N

NAVFAC

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

ANDREW T. MCCOY
Name
TX 96627 13 MAY 2024
Registration Number # Date
TEXAS REGISTERED ENGINEERING FIRM F-2966 SEAL

Jacobs BURNS MCDONNELL
JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0315
JEG NO. 034306O3 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: JMH	DRW: SMC	REV: ATM
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND – PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND (JRM)
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AUX183012
NORTH AIRCRAFT PARKING RAMP

OVERALL DEMOLITION PLAN

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF
CD101

95% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34"
REDUCED PRINT. USE GRAPHIC SCALES

APPENDIX B SUMMARY OF ANALYTICAL RESULTS

Table B-1. PFAS: IRP Compound (Sample ID: IRP-01 to IRP-10)
Table B-2. PFAS: Site 78A FTA-3 (Samples ID: S78A-01 to S78A-10)
Table B-3. PFAS: Site 78A FTA-3 (Sample ID: S78A-11 to S78-20)
Table B-4. PFAS: Site 78A FTA-3 (Sample ID: S78A-19-1 to S78A-19-6 and S78A-21 to 24)
Table B-5. PFAS: Geotechnical Borings, B-19 to B-24
Table B-6. PFAS: Geotechnical Borings, B-27 to B-33
Table B-7. PFAS: Site 26 FTA and Building 2641
Table B-8. Other Contaminants: IRP Compound
Table B-9. Other Contaminants: Site 78A FTA-3
Table B-10. Other Contaminants: Existing Dirt Road Areas and Perimeter Road
Table B-11. Other Contaminants: S26 and B2641 Areas
Table B-12 Stockpile Analytical Results

Table B-1. PFAS: IRP Field Office Site (Sample ID: IRP-01 to IRP-10)

Sample ID [Sampling g Depth (ft bgs)] / Analytes	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)												EPA RSL, THQ=0.1 (mg/kg)	
	IRP-01 [0-1]	IRP-02 [0-1]	IRP-02-1 [0-1]	IRP-02-2 [0-1]	IRP-03 [0-1]	IRP-04 [0-1]	IRP-05 [0-1]	IRP-06 [0-1]	IRP-07 [0-1]	IRP-08 [0-1]	IRP-09 [0-1]	IRP-10 [0-1]	Residential	Industrial
4-2 Fluorotelomer sulfonic acid (4:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.00198)	ND (0.00198)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
6-2 Fluorotelomer sulfonic acid (6:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.00198)	ND (0.00198)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
8-2 Fluorotelomer sulfonic acid (8:2FTS)	ND (0.005)	ND (0.0025)	ND (0.00198)	ND (0.00198)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
10:2 Fluorotelomer sulfonic acid (10:2FTS)	ND (0.0025)	ND (0.0025)	Not Analyzed	Not Analyzed	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro butanoic acid (PFBA)	ND (0.0025)	ND (0.0025)	ND (0.00198)	ND (0.00198)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**7.8 (n)**	**120 (n)**
Perfluoro pentanoic acid (PFPeA)	ND (0.0025)	ND (0.0025)	ND (0.000992)	ND (0.000992)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro butane sulfonic acid (PFBS)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**1.9 (n)**	**25 (n)**
Perfluoro hexanoic acid (PFHxA)	ND (0.0025)	ND (0.0025)	**0.000553**	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**3.2 (n)**	**41 (n)**
Perfluoro pentane sulfonoic acid (PFPeS)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro heptanoic acid (PFHpA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro hexane sulfonic acid (PFHxS)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.13 (n)**	**1.6 (n)**
Perfluoro octanoic acid (PFOA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro nonanoic acid (PFNA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro heptane sulfonic acid (PFHpS)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro octane sulfonic acid (PFOS)	ND (0.0025)	**0.00265**	**0.00518**	**0.00457**	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00415**	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.013 (n)**	**0.16 (n)**
Perfluoro decanoic acid (PFDA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro nonane sulfonic acid	ND (0.001)	ND (0.001)	ND (0.000496)	ND (0.000496)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
NMeFOSAA	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
NEtFOSAA	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro undecanoic acid (PFUnA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro decane sulfonic acid (PFDS)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro dodecanoic acid (PFDoDA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro tridecanoic acid (PFTrDA)	ND (0.001)	ND (0.001)	ND (0.000496)	ND (0.000496)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluoro tetradecanoic acid (PFTeDA)	ND (0.001)	ND (0.001)	ND (0.000496)	ND (0.000496)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluorooctane sulfonamide (PFOSA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorobutane sulfonamide (FBSA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
HFPO-DA	ND (0.005)	**0.0273**	ND (0.000992)	ND (0.000992)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	**0.023 (n)**	**0.35 (n)**
ADONA	ND (0.0025)	ND (0.0025)	ND (0.000992)	ND (0.000992)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorohexanesulfonamide (FHxSA)	ND (0.005)	ND (0.005)	Not Analyzed	Not Analyzed	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
9-Cl-PF3ONS (9-Cl-PF3ONS)	ND (0.0025)	ND (0.0025)	ND (0.000992)	ND (0.000992)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
11-Cl-PF3OUdS (11-Cl-PF3OUdS)	ND (0.0025)	ND (0.0025)	ND (0.000992)	ND (0.000992)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Ethyl perfluorooctane sufonamide (NEtFOSA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Methyl perfluorooctane sulfonamide (NMeFOSA)	ND (0.0025)	ND (0.0025)	ND (0.000496)	ND (0.000496)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--

Criteria: U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2023). **When multiple PFAS are encountered at a site, a 0.1 Target Hazard Quotient (THQ) is applied to the screening level when it is based on noncarcinogenic endpoints.**
(n): noncarcinogenic

Blue = value indicate results exceed Residential RSL

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-2. PFAS: Site 78A FTA-3 (Samples ID: S78A-01 to S78A-10)

Analytes \ Sample ID [Sampling g Depth (ft bgs)]	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)										EPA RSL, THQ=0.1 (mg/kg)	
	S78A-01 [0-1]	S78A-02 [0-1]	S78A-03 [0-1]	S78A-04 [0-1]	S78A-05 [0-1]	S78A-06 [0-1]	S78A-07 [0-1]	S78A-08 [0-1]	S78A-09 [0-1]	S78A-10 [0-1]	Residential	Industrial
4-2 Fluorotelomer sulfonic acid (4:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
6-2 Fluorotelomer sulfonic acid (6:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
8-2 Fluorotelomer sulfonic acid (8:2FTS)	ND (0.005)	ND (0.0025)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
10:2 Fluorotelomer sulfonic acid (10:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro butanoic acid (PFBA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00907**	**0.00605**	**0.00872**	**0.0127**	**0.00451**	**0.00749**	ND (0.0025)	**7.8 (n)**	**120 (n)**
Perfluoro pentanoic acid (PFPeA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00432**	**0.00318**	**0.00414**	**0.00599**	ND (0.0025)	**0.00362**	ND (0.0025)	--	--
Perfluoro butane sulfonic acid (PFBS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**1.9 (n)**	**25 (n)**
Perfluoro hexanoic acid (PFHxA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00286**	**0.00359**	ND (0.0025)	ND (0.0025)	ND (0.0025)	**3.2 (n)**	**41 (n)**
Perfluoro pentane sulfonoic acid (PFPeS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro heptanoic acid (PFHpA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	0.00255	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro hexane sulfonic acid (PFHxS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.13 (n)**	**1.6 (n)**
Perfluoro octanoic acid (PFOA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00769**	**0.00519**	**0.00587**	**0.0103**	**0.00377**	**0.00558**	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro nonanoic acid (PFNA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00358**	ND (0.0025)	**0.00308**	**0.00416**	ND (0.0025)	**0.00255**	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro heptane sulfonic acid (PFHpS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro octane sulfonic acid (PFOS)	**0.00307**	ND (0.0025)	ND (0.0025)	**0.00389**	**0.00472**	ND (0.0025)	**0.00339**	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.013 (n)**	**0.16 (n)**
Perfluoro decanoic acid (PFDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro nonane sulfonic acid	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
NMeFOSAA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
NEtFOSAA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro undecanoic acid (PFUnDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro decane sulfonic acid (PFDS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro dodecanoic acid (PFDoDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro tridecanoic acid (PFTrDA)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluoro tetradecanoic acid (PFTeDA)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluorooctane sulfonamide (PFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorobutane sulfonamide (FBSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
HFPO-DA	ND (0.005)	ND (0.005)	**0.00717**	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	**0.023 (n)**	**0.35 (n)**
ADONA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorohexanesulfonamide (FHxSA)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
9-Cl-PF3ONS (9-Cl-PF3ONS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
11-Cl-PF3OUdS (11-Cl-PF3OUdS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Ethyl perfluorooctane sufonamide (NEtFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Methyl perfluorooctane sulfonamide (NMeFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--

Criteria: U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2023). **When multiple PFAS are encountered at a site, a 0.1 Target Hazard Quotient (THQ) is applied to the screening level when it is based on noncarcinogenic endpoints.**
(n): noncarcinogenic

Blue = value indicate results exceed Residential RSL

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-3. PFAS: Site 78A FTA-3 (Sample ID: S78A-11 to S78-20)

Analytes \ Sample ID [Sampling g Depth (ft bgs)]	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)										EPA RSL, THQ=0.1 (mg/kg)	
	S-78A-11 [0-1]	S78A-12 [0-1]	S78A-13 [0-1]	S78A-14 [0-1]	S78A-15 [0-1]	S78A-16 [0-1]	S78A-17 [0-1]	S78A-18 [0-1]	S78A-19 [0-1]	S78A-20 [0-1]	Residential	Industrial
4-2 Fluorotelomer sulfonic acid (4:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
6-2 Fluorotelomer sulfonic acid (6:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
8-2 Fluorotelomer sulfonic acid (8:2FTS)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
10:2 Fluorotelomer sulfonic acid (10:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro butanoic acid (PFBA)	**0.00952**	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00753**	**0.00727**	ND (0.0025)	ND (0.0025)	ND (0.0025)	**7.8 (n)**	**120 (n)**
Perfluoro pentanoic acid (PFPeA)	**0.00442**	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00375**	**0.0038**	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro butane sulfonic acid (PFBS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**1.9 (n)**	**25 (n)**
Perfluoro hexanoic acid (PFHxA)	**0.00466**	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00306**	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**3.2 (n)**	**41 (n)**
Perfluoro pentane sulfonoic acid (PFPeS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro heptanoic acid (PFHpA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro hexane sulfonic acid (PFHxS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.13 (n)**	**1.6 (n)**
Perfluoro octanoic acid (PFOA)	**0.00848**	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00613**	**0.00577**	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro nonanoic acid (PFNA)	**0.00361**	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00270**	**0.00258**	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro heptane sulfonic acid (PFHpS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro octane sulfonic acid (PFOS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.00672**	**0.00705**	**0.00366**	**0.00265**	**0.0214**	ND (0.0025)	**0.013 (n)**	**0.16 (n)**
Perfluoro decanoic acid (PFDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro nonane sulfonic acid	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
NMeFOSAA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
NEtFOSAA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro undecanoic acid (PFUnDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro decane sulfonic acid (PFDS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro dodecanoic acid (PFDoDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro tridecanoic acid (PFTrDA)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluoro tetradecanoic acid (PFTeDA)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluorooctane sulfonamide (PFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorobutane sulfonamide (FBSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
HFPO-DA	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	**0.023 (n)**	**0.35 (n)**
ADONA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorohexanesulfonamide (FHxSA)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
9-Cl-PF3ONS (9-Cl-PF3ONS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
11-Cl-PF3OUdS (11-Cl-PF3OUdS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Ethyl perfluorooctane sufonamide (NEtFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Methyl perfluorooctane sulfonamide (NMeFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--

Criteria: U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2023). **When multiple PFAS are encountered at a site, a 0.1 Target Hazard Quotient (THQ) is applied to the screening level when it is based on noncarcinogenic endpoints.**
(n): noncarcinogenic

Blue = value indicate results exceed Residential RSL

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-4. PFAS: Site 78A FTA-3 (Sample ID: S78A-19-1 to S78A-19-6 and S78A-21 to 24)

Analytes \ Sample ID [Sampling g Depth (ft bgs)]	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)										EPA RSL, THQ=0.1 (mg/kg)	
	S-78A-19-1 [0-1]	S-78A-19-2 [0-1]	S-78A-19-3 [0-1]	S-78A-19-4 [0-1]	S-78A-19-5 [0-1]	S-78A-19-6 [0-1]	S78A-21 [0-1]	S78A-22 [0-1]	S78A-23 [0-1]	S78A-24 [0-1]	Residential	Industrial
4-2 Fluorotelomer sulfonic acid (4:2FTS)	ND (0.00196)	ND (0.00198)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.00197)	ND (0.00197)	--	--
6-2 Fluorotelomer sulfonic acid (6:2FTS)	ND (0.00196)	ND (0.00198)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.00197)	ND (0.00197)	--	--
8-2 Fluorotelomer sulfonic acid (8:2FTS)	ND (0.00196)	ND (0.00198)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.00197)	ND (0.00197)	--	--
10:2 Fluorotelomer sulfonic acid (10:2FTS)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
Perfluoro butanoic acid (PFBA)	ND (0.00196)	ND (0.00198)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.00197)	ND (0.00197)	**7.8 (n)**	**120 (n)**
Perfluoro pentanoic acid (PFPeA)	ND (0.000980)	ND (0.000988)	ND (0.000986)	ND (0.000990)	**0.001**	ND (0.000998)	ND (0.000994)	ND (0.000998)	ND (0.000986)	ND (0.000984)	--	--
Perfluoro butane sulfonic acid (PFBS)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	**1.9 (n)**	**25 (n)**
Perfluoro hexanoic acid (PFHxA)	**0.0010**	**0.000600**	**0.000792**	**0.000689**	**0.00252**	**0.000997**	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	**3.2 (n)**	**41 (n)**
Perfluoro pentane sulfonoic acid (PFPeS)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro heptanoic acid (PFHpA)	**0.000718**	ND (0.000494)	ND (0.000493)	ND (0.000495)	**0.000838**	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro hexane sulfonic acid (PFHxS)	ND (0.000490)	ND (0.000494)	**0.000611**	ND (0.000495)	**0.00121**	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	**0.13 (n)**	**1.6 (n)**
Perfluoro octanoic acid (PFOA)	**0.000737**	**0.000503**	**0.00189**	**0.00117**	**0.00205**	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	**0.019 (n)**	**0.25 (n)**
Perfluoro nonanoic acid (PFNA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	**0.019 (n)**	**0.25 (n)**
Perfluoro heptane sulfonic acid (PFHpS)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro octane sulfonic acid (PFOS)	**0.0113**	**0.0113**	**0.0184**	**0.0157**	**0.0274**	**0.00507**	**0.00136**	**0.00305**	**0.00162**	**0.00202**	**0.013 (n)**	**0.16 (n)**
Perfluoro decanoic acid (PFDA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro nonane sulfonic acid	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
NMeFOSAA	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
NEtFOSAA	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro undecanoic acid (PFUnA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro decane sulfonic acid (PFDS)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro dodecanoic acid (PFDoA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro tridecanoic acid (PFTrDA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluoro tetradecanoic acid (PFTeDA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluorooctane sulfonamide (PFOSA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
Perfluorobutane sulfonamide (FBSA)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
HFPO-DA	**0.0111**	ND (0.000988)	**0.00118**	**0.00128**	**0.0013**	ND (0.000998)	ND (0.000994)	**0.0034**	**0.0139**	**0.00102**	**0.023 (n)**	**0.35 (n)**
ADONA	ND (0.000980)	ND (0.000988)	ND (0.000986)	ND (0.000990)	ND (0.001)	ND (0.000998)	ND (0.000994)	ND (0.000998)	ND (0.000986)	ND (0.000984)	--	--
Perfluorohexanesulfonamide (FHxSA)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
9-Cl-PF3ONS (9-Cl-PF3ONS)	ND (0.000980)	ND (0.000988)	ND (0.000986)	ND (0.000990)	ND (0.001)	ND (0.000998)	ND (0.000994)	ND (0.000998)	ND (0.000986)	ND (0.000984)	--	--
11-Cl-PF3OUdS (11-Cl-PF3OUdS)	ND (0.000980)	ND (0.000988)	ND (0.000986)	ND (0.000990)	ND (0.001)	ND (0.000998)	ND (0.000994)	ND (0.000998)	ND (0.000986)	ND (0.000984)	--	--
N-Ethyl perfluorooctane sufonamide (NEtFOSA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--
N-Methyl perfluorooctane sulfonamide (NMeFOSA)	ND (0.000490)	ND (0.000494)	ND (0.000493)	ND (0.000495)	ND (0.0005)	ND (0.000494)	ND (0.000497)	ND (0.000499)	ND (0.000493)	ND (0.000492)	--	--

Criteria: U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2023). **When multiple PFAS are encountered at a site, a 0.1 Target Hazard Quotient (THQ) is applied to the screening level when it is based on noncarcinogenic endpoints.**
(n): noncarcinogenic

Blue = value indicate results exceed Residential RSL

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-5. PFAS: Geotechnical Borings, B-19 to B-24

Analytes \ Sample ID [Sampling g Depth (ft bgs)]	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)												EPA RSL, THQ=0.1 (mg/kg)	
	B-19-1.5-3 [1.5-3]	B-19-47-48.5 [47-48.5]	B-20-1.5-3 [1.5-3]	B-20-47-48.5 [47-48.5]	B-21-1.5-3 [1.5-3]	B-21-47-48.5 [47-48.5]	B-22-1.5-3 [1.5-3]	B-22-47-48.5 [47-48.5]	B-23-1.5-3 [1.5-3]	B-23-47-48.5 [47-48.5]	B-24-1.5-3 [1.5-3]	B-24-47-48.5 [47-48.5]	Residential	Industrial
4-2 Fluorotelomer sulfonic acid (4:2FTS)	ND (0.00198)	ND (0.002)	ND (0.00199)	ND (0.00199)	ND (0.00196)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.002)	ND (0.00196)	ND (0.00198)	ND (0.00198)	--	--
6-2 Fluorotelomer sulfonic acid (6:2FTS)	ND (0.00198)	ND (0.002)	ND (0.00199)	ND (0.00199)	ND (0.00196)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.002)	ND (0.00196)	ND (0.00198)	ND (0.00198)	--	--
8-2 Fluorotelomer sulfonic acid (8:2FTS)	ND (0.00198)	ND (0.002)	ND (0.00199)	ND (0.00199)	ND (0.00196)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.002)	ND (0.00196)	ND (0.00198)	ND (0.00198)	--	--
10:2 Fluorotelomer sulfonic acid (10:2FTS)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
Perfluoro butanoic acid (PFBA)	ND (0.00198)	ND (0.002)	ND (0.00199)	ND (0.00199)	ND (0.00196)	ND (0.00198)	ND (0.00199)	ND (0.002)	ND (0.002)	ND (0.00196)	ND (0.00198)	ND (0.00198)	**7.8 (n)**	**120 (n)**
Perfluoro pentanoic acid (PFPeA)	ND (0.000992)	ND (0.000998)	ND (0.000994)	ND (0.000996)	ND (0.000982)	ND (0.00099)	ND (0.000994)	ND (0.001)	ND (0.000998)	ND (0.000982)	ND (0.000992)	ND (0.000992)	--	--
Perfluoro butane sulfonic acid (PFBS)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	**1.9 (n)**	**25 (n)**
Perfluoro hexanoic acid (PFHxA)	**0.00106**	ND (0.000499)	**0.000609**	ND (0.000498)	**0.00122**	ND (0.000495)	ND (0.000497)	ND (0.0005)	**0.00118**	ND (0.000491)	**0.00103**	ND (0.000496)	**3.2 (n)**	**41 (n)**
Perfluoro pentane sulfonoic acid (PFPeS)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro heptanoic acid (PFHpA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro hexane sulfonic acid (PFHxS)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	**0.00262**	ND (0.000495)	**0.000792**	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	**0.13 (n)**	**1.6 (n)**
Perfluoro octanoic acid (PFOA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	**0.000491**	ND (0.000495)	ND (0.000497)	ND (0.0005)	**0.000638**	ND (0.000491)	**0.00104**	ND (0.000496)	**0.019 (n)**	**0.25 (n)**
Perfluoro nonanoic acid (PFNA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	**0.019 (n)**	**0.25 (n)**
Perfluoro heptane sulfonic acid (PFHpS)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro octane sulfonic acid (PFOS)	**0.0039**	ND (0.000499)	**0.0026**	ND (0.000498)	**0.00152**	ND (0.000495)	**0.000909**	ND (0.0005)	**0.00255**	ND (0.000491)	**0.0016**	ND (0.000496)	**0.013 (n)**	**0.16 (n)**
Perfluoro decanoic acid (PFDA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro nonane sulfonic acid	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
NMeFOSAA	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
NEtFOSAA	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro undecanoic acid (PFUnDA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro decane sulfonic acid (PFDS)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro dodecanoic acid (PFDoDA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro tridecanoic acid (PFTrDA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluoro tetradecanoic acid (PFTeDA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluorooctane sulfonamide (PFOSA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000497)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
Perfluorobutane sulfonamide (FBSA)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
HFPO-DA	ND (0.000992)	ND (0.000998)	ND (0.000994)	ND (0.000996)	ND (0.000982)	ND (0.00099)	ND (0.000994)	ND (0.001)	ND (0.000998)	ND (0.000982)	ND (0.000992)	ND (0.000992)	**0.023 (n)**	**0.35 (n)**
ADONA	ND (0.000992)	ND (0.000998)	ND (0.000994)	ND (0.000996)	ND (0.000982)	ND (0.00099)	ND (0.000994)	ND (0.001)	ND (0.000998)	ND (0.000982)	ND (0.000992)	ND (0.000992)	--	--
Perfluorohexanesulfonamide (FHxSA)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
9-Cl-PF3ONS (9-Cl-PF3ONS)	ND (0.000992)	ND (0.000998)	ND (0.000994)	ND (0.000996)	ND (0.000982)	ND (0.00099)	ND (0.000994)	ND (0.001)	ND (0.000998)	ND (0.000982)	ND (0.000992)	ND (0.000992)	--	--
11-Cl-PF3OUdS (11-Cl-PF3OUdS)	ND (0.000992)	ND (0.000998)	ND (0.000994)	ND (0.000996)	ND (0.000982)	ND (0.00099)	ND (0.000994)	ND (0.001)	ND (0.000998)	ND (0.000982)	ND (0.000992)	ND (0.000992)	--	--
N-Ethyl perfluorooctane sufonamide (NEtFOSA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000994)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--
N-Methyl perfluorooctane sulfonamide (NMeFOSA)	ND (0.000496)	ND (0.000499)	ND (0.000497)	ND (0.000498)	ND (0.000491)	ND (0.000495)	ND (0.000994)	ND (0.0005)	ND (0.000499)	ND (0.000491)	ND (0.000496)	ND (0.000496)	--	--

Criteria: U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2023). **When multiple PFAS are encountered at a site, a 0.1 Target Hazard Quotient (THQ) is applied to the screening level when it is based on noncarcinogenic endpoints.**
(n): noncarcinogenic

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-6. PFAS: Geotechnical Borings, B-27 to B-33

Analytes / Sample ID [Sampling g Depth (ft bgs)]	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)										EPA RSL, THQ=0.1 (mg/kg)	
	B-27-1.5-2.5 [1.5-2.5]	B-27-8.5-9.5 [8.5-9.5]	B-28-1.5-2.5 [1.5-2.5]	B-28-8.5-9.5 [8.5-9.5]	B-30-1.5-2.5 [1.5-2.5]	B-30 -28.5-29.5 [28.5-29.5]	B-33-1.5-2.5 [1.5-2.5]	B-33-28.5-29.5 [28.5-29.5]	N-B1-0-1 [0-1]	Q-B2-0-1 [0-1]	Residential	Industrial
4-2 Fluorotelomer sulfonic acid (4:2FTS)	ND (0.00197)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00495)	ND (0.002)	ND (0.00197)	ND (0.000747)	ND (0.000746)	--	--
6-2 Fluorotelomer sulfonic acid (6:2FTS)	ND (0.00197)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00495)	ND (0.002)	ND (0.00197)	ND (0.000756)	ND (0.000755)	--	--
8-2 Fluorotelomer sulfonic acid (8:2FTS)	ND (0.00197)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00495)	ND (0.002)	ND (0.00197)	ND (0.000765)	ND (0.000764)	--	--
10:2 Fluorotelomer sulfonic acid (10:2FTS)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
Perfluoro butanoic acid (PFBA)	ND (0.00197)	ND (0.00197)	ND (0.00198)	ND (0.002)	ND (0.00198)	ND (0.00495)	ND (0.002)	ND (0.00197)	**0.00191**	**0.00251**	**7.8 (n)**	**120 (n)**
Perfluoro pentanoic acid (PFPeA)	ND (0.000984)	ND (0.000986)	ND (0.000988)	ND (0.000998)	ND (0.00099)	ND (0.00248)	ND (0.001)	ND (0.000984)	0.000443	0.00159	--	--
Perfluoro butane sulfonic acid (PFBS)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000176)	ND (0.000176)	**1.9 (n)**	**25 (n)**
Perfluoro hexanoic acid (PFHxA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	**0.000506**	ND (0.00124)	**0.000629**	ND (0.000492)	0.000455	0.00137	**3.2 (n)**	**41 (n)**
Perfluoro pentane sulfonoic acid (PFPeS)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000187)	ND (0.000187)	--	--
Perfluoro heptanoic acid (PFHpA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	**0.000508**	**0.00113**	--	--
Perfluoro hexane sulfonic acid (PFHxS)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	**0.00105**	ND (0.000492)	**0.000590**	**0.00161**	**0.13 (n)**	**1.6 (n)**
Perfluoro octanoic acid (PFOA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	**0.000570**	ND (0.000492)	**0.000752**	**0.00147**	**0.019 (n)**	**0.25 (n)**
Perfluoro nonanoic acid (PFNA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	**0.000366**	**0.000402**	**0.019 (n)**	**0.25 (n)**
Perfluoro heptane sulfonic acid (PFHpS)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000189)	ND (0.000189)	--	--
Perfluoro octane sulfonic acid (PFOS)	ND (0.000492)	**0.000702**	ND (0.000494)	ND (0.000499)	**0.00159**	ND (0.00124)	**0.00306**	ND (0.000492)	**0.00394**	**0.00645**	**0.013 (n)**	**0.16 (n)**
Perfluoro decanoic acid (PFDA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
Perfluoro nonane sulfonic acid (PFNS)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000191)	ND (0.000191)	--	--
NMeFOSAA	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
NEtFOSAA	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
Perfluoro undecanoic acid (PFUnDA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
Perfluoro decane sulfonic acid (PFDS)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000192)	ND (0.000192)	--	--
Perfluoro dodecanoic acid (PFDoDA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	Not Analyzed)	Not Analyzed	--	--
Perfluoro tridecanoic acid (PFTrDA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
Perfluoro tetradecanoic acid (PFTeDA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
Perfluorooctane sulfonamide (PFOSA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
Perfluorobutane sulfonamide (FBSA)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed)	Not Analyzed	--	--
HFPO-DA	ND (0.000984)	ND (0.000986)	ND (0.000988)	ND (0.000998)	ND (0.00099)	ND (0.00248)	ND (0.001)	ND (0.000984)	ND (0.000832)	ND (0.000831)	**0.023 (n)**	**0.35 (n)**
ADONA	ND (0.000984)	ND (0.000986)	ND (0.000988)	ND (0.000998)	ND (0.00099)	ND (0.00248)	ND (0.001)	ND (0.000984)	ND (0.000787)	ND (0.000786)	--	--
Perfluorohexanesulfonamide (FHxSA)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	--	--
9-Cl-PF3ONS (9-Cl-PF3ONS)	ND (0.000984)	ND (0.000986)	ND (0.000988)	ND (0.000998)	ND (0.00099)	ND (0.00248)	ND (0.001)	ND (0.000984)	Not Analyzed	Not Analyzed	--	--
11-Cl-PF3OUdS (11-Cl-PF3OUdS)	ND (0.000984)	ND (0.000986)	ND (0.000988)	ND (0.000998)	ND (0.00099)	ND (0.00248)	ND (0.001)	ND (0.000984)	ND (0.000787)	ND (0.000786)	--	--
N-Ethyl perfluorooctane sufonamide (NEtFOSA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--
N-Methyl perfluorooctane sulfonamide (NMeFOSA)	ND (0.000492)	ND (0.000493)	ND (0.000494)	ND (0.000499)	ND (0.000495)	ND (0.00124)	ND (0.0005)	ND (0.000492)	ND (0.000199)	ND (0.000199)	--	--

Criteria: U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2023). **When multiple PFAS are encountered at a site, a 0.1 Target Hazard Quotient (THQ) is applied to the screening level when it is based on noncarcinogenic endpoints.**
(n): noncarcinogenic

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-7. PFAS: Site 26 FTA and Building 2641

Sample ID [Sampling Depth (ft bgs)] / Analytes	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)						EPA RSL, THQ=0.1 (mg/kg)	
	Site 26 FTA			Building 2641				
	S-26-01 [0-1]	S26-02 [0-1]	S26-03 [0-1]	B2641-01 [0-1]	B2641-02 [0-1]	B2641-03 [0-1]	Residential	Industrial
4-2 Fluorotelomer sulfonic acid (4:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
6-2 Fluorotelomer sulfonic acid (6:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
8-2 Fluorotelomer sulfonic acid (8:2FTS)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
10:2 Fluorotelomer sulfonic acid (10:2FTS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro butanoic acid (PFBA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**7.8 (n)**	**120 (n)**
Perfluoro pentanoic acid (PFPeA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro butane sulfonic acid (PFBS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**1.9 (n)**	**25 (n)**
Perfluoro hexanoic acid (PFHxA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**3.2 (n)**	**41 (n)**
Perfluoro pentane sulfonoic acid (PFPeS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro heptanoic acid (PFHpA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro hexane sulfonic acid (PFHxS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.13 (n)**	**1.6 (n)**
Perfluoro octanoic acid (PFOA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro nonanoic acid (PFNA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	**0.019 (n)**	**0.25 (n)**
Perfluoro heptane sulfonic acid (PFHpS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro octane sulfonic acid (PFOS)	ND (0.0025)	**0.00437**	**0.00717**	**0.00863**	ND (0.0025)	**0.004735**	**0.013 (n)**	**0.16 (n)**
Perfluoro decanoic acid (PFDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro nonane sulfonic acid	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
NMeFOSAA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
NEtFOSAA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro undecanoic acid (PFUnA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--

Sample ID [Sampling Depth (ft bgs)] / Analytes	PFAS Analytical Results (EPA Draft Method 1633, mg/kg)						EPA RSL, THQ=0.1 (mg/kg)	
	Site 26 FTA			Building 2641				
	S-26-01 [0-1]	S26-02 [0-1]	S26-03 [0-1]	B2641-01 [0-1]	B2641-02 [0-1]	B2641-03 [0-1]	Residential	Industrial
Perfluoro decane sulfonic acid (PFDS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro dodecanoic acid (PFDoDA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluoro tridecanoic acid (PFTrDA)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluoro tetradecanoic acid (PFTeDA)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--
Perfluorooctane sulfonamide (PFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorobutane sulfonamide (FBSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
HFPO-DA	**0.0199**	**0.0418**	**0.0202**	ND (0.005)	ND (0.005)	**0.0134**	**0.023 (n)**	**0.35 (n)**
ADONA	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
Perfluorohexanesulfonamide (FHxSA)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	--	--
9-Cl-PF3ONS (9-Cl-PF3ONS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
11-Cl-PF3OUdS (11-Cl-PF3OUdS)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Ethyl perfluorooctane sufonamide (NEtFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--
N-Methyl perfluorooctane sulfonamide (NMeFOSA)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)	--	--

Criteria: U.S. EPA, Regional Screening Levels (RSL) for chemical contaminants at superfund sites (November 2023). **When multiple PFAS are encountered at a site, a 0.1 Target Hazard Quotient (THQ) is applied to the screening level when it is based on noncarcinogenic endpoints.**
(n): noncarcinogenic

Blue = value indicate results exceed Residential RSL

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-8. Other Contaminants: IRP Compound

Sample ID/ [Sampling Depth (ft bgs)] Analytes	Analytical Results							TPESL	
	IRP-A [0-1]	IRP-B-1.5-2.5 [1.5-2.5]	B2550/B2551-0-1 [0-1]	B2552-0-1 [0-1]	B2552-1-2 [1-2]	XFMR-0-1 [0-1]	XFMR-1-2 [1-2]	Unrestricted: Shallow soil (<9.8 ft bgs)	Restricted: Shallow soil (<3.3 ft bgs)
Polycyclic Aromatic Hydrocarbons (EPA 8270C-SIM, mg/kg)									
Naphthalene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	3.1	3.1
1-Methylnaphthalene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	0.89	0.89
2-Methylnaphthalene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	1.9	1.9
Acenaphthylene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	5.5	5.5
Acenaphthene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	40	40
Fluorene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	31	31
Phenanthrene	**0.0048**	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.012**	Not Analyzed	23	23
Anthracene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	1.4	1.4
Fluoranthene	**0.0075**	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.043**	Not Analyzed	29	29
Pyrene	**0.0073**	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.037**	Not Analyzed	41	41
Benzo(a) anthracene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.024**	Not Analyzed	3.3	3.3
Chrysene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.025**	Not Analyzed	30	30
Benzo(b) fluoranthene	**0.0045**	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.038**	Not Analyzed	11	21
Benzo(k) fluoranthene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.015**	Not Analyzed	39	39
Benzo(a)pyrene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.026**	Not Analyzed	3.6	5.9
Indeno(1,2,3-cd) pyrene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.025**	Not Analyzed	11	31
Dibenzo(a,h) anthracene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	ND (0.010)	Not Analyzed	1.1	9.6
Benzo(g,h,i) perylene	ND (0.0045)	ND (0.0078)	ND (5.0)	ND (0.010)	Not Analyzed	**0.026**	Not Analyzed	35	35
Total Petroleum Hydrocarbons (EPA 8015, mg/kg)									
TPH-DRO	Not Analyzed	**48**	ND (50)	**14**	Not Analyzed	**32**	Not Analyzed	220	500
TPH-RRO	Not Analyzed	ND (47)	ND (99)	ND (20)	Not Analyzed	ND (20)	Not Analyzed	500	2,500
Polychlorinated Biphenyls (EPA 8082, mg/kg)									
Arochlor-1016	ND (0.1)	ND (0.017)	ND (0.099)	ND (0.098)	Not Analyzed	ND (0.099)	Not Analyzed	1.2 (ESL for Total PCB)	9.7 (ESL for Total PCB
Arochlor-1221	ND (0.1)	ND (0.017)	ND (0.099)	ND (0.098)	Not Analyzed	ND (0.099)	Not Analyzed		
Arochlor-1232	ND (0.1)	ND (0.017)	ND (0.099)	ND (0.098)	Not Analyzed	ND (0.099)	Not Analyzed		
Arochlor-1242	ND (0.1)	ND (0.017)	ND (0.099)	ND (0.098)	Not Analyzed	ND (0.099)	Not Analyzed		
Arochlor-1248	ND (0.1)	ND (0.017)	ND (0.099)	ND (0.098)	Not Analyzed	ND (0.099)	Not Analyzed		
Arochlor-1254	ND (0.1)	ND (0.017)	ND (0.099)	ND (0.098)	Not Analyzed	ND (0.099)	Not Analyzed		
Arochlor-1260	ND (0.1)	ND (0.017)	ND (0.099)	ND (0.098)	Not Analyzed	ND (0.099)	Not Analyzed		
Target Analyte List Metals or RCRA 8 Metals (EPA 6020/7471A, mg/kg)									
Arsenic	**5.83**	**2.1**	**16**	**3.2**	Not Analyzed	**28**	Not Analyzed	24	95
Barium	**10.2**	**5.0**	**69**	**17**	Not Analyzed	**21**	Not Analyzed	1,000	2,500
Beryllium	ND (2.4)	ND (0.25)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	31	150
Cadmium	ND (2.4)	**0.66**	**3.2**	**2.3**	Not Analyzed	**2.3**	Not Analyzed	14	74
Chromium	**212**	**87**	**200**	**120**	Not Analyzed	**210**	Not Analyzed	1,100	1,100
Cobalt	**3.78**	**1.9**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	80	80

Sample ID/ [Sampling Depth (ft bgs)] / Analytes	Analytical Results							TPESL	
	IRP-A [0-1]	IRP-B-1.5-2.5 [1.5-2.5]	B2550/B2551-0-1 [0-1]	B2552-0-1 [0-1]	B2552-1-2 [1-2]	XFMR-0-1 [0-1]	XFMR-1-2 [1-2]	Unrestricted: Shallow soil (<9.8 ft bgs)	Restricted: Shallow soil (<3.3 ft bgs)
Copper	**6.59**	**2.0**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	630	2500
Lead	**26.1**	**7.1**	**310**	110	Not Analyzed	**49**	Not Analyzed	200	800
Mercury	**0.061 J**	ND (0.19)	0.28	1.2	Not Analyzed	ND (0.14)	Not Analyzed	4.7	70
Nickel	**17.0**	**7.5**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	410	750
Selenium	ND (2.4)	ND (1.5)	ND (6.0)	ND (6.0)	Not Analyzed	ND (5.8)	Not Analyzed	78	1,200
Silver	ND (0.49)	ND (0.25)	ND (1.0)	ND (1.0)	Not Analyzed	ND (0.96)	Not Analyzed	78	1,200
Thallium	ND (2.4)	ND (1.5)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.78	12
Vanadium	**27.3**	**9.5**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	770	770
Zinc	**20.3**	**4.0**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1000	2500
Calcium	ND (24)	**360,000**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Magnesium	**1,810**	**1,600**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Manganese	**563**	**300**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Potassium	ND (24)	ND (25)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Sodium	ND (150)	**44**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Aluminum	**37,000**	**13,000**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Iron	**20,600**	**8,000**	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
TCLP RCRA 8 Metals (mg/L)									
Arsenic	ND (0.4)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Barium	ND (0.2)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Cadmium	ND (0.2)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Chromium	ND (0.2)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Lead	ND (0.2)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Selenium	ND (0.2)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Silver	ND (0.2)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Mercury	ND (0.02)	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Pesticides (EPA 8081A, mg/kg)									
alpha-BHC	ND (0.1)	**0.007**	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	0.029[1]	0.029[1]
beta-BHC	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
gamma-BHC	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
delta-BHC	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
Heptachlor	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	1.4	6.3
Aldrin	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	2.8	2.8
Heptachlor epoxide	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	0.2	3
Endosulfan I	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	4.4[2]	4.4[2]
Endosulfan II	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
Endosulfan sulfate	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
Dieldrin	**0.0172 J**	ND (0.0033)	ND (0.025)	**0.730**	Not Analyzed	ND (0.025)	Not Analyzed	2.5	7.9
4,4'-DDD	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	2.3	9.6
4,4'-DDE	0.0111 J	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	2	9.3
4,4'-DDT	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	1.9	1.9

Sample ID/ [Sampling Depth (ft bgs)] / Analytes	Analytical Results							TPESL	
	IRP-A [0-1]	IRP-B-1.5-2.5 [1.5-2.5]	B2550/B2551-0-1 [0-1]	B2552-0-1 [0-1]	B2552-1-2 [1-2]	XFMR-0-1 [0-1]	XFMR-1-2 [1-2]	Unrestricted: Shallow soil (<9.8 ft bgs)	Restricted: Shallow soil (<3.3 ft bgs)
Endrin	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed	3.8[3]	10
Endrin aldehyde	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
Chlordane (technical)	ND (1.0)	ND (0.033)	**1.6**	ND (0.25)	Not Analyzed	ND (0.25)	Not Analyzed	7.6	7.6
alpha-Chlordane	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
gamma-Chlordane	ND (0.1)	ND (0.0033)	ND (0.025)	ND (0.025)	Not Analyzed	ND (0.025)	Not Analyzed		
Methoxychlor	ND (0.1)	ND (0.013)	ND (0.049)	ND (0.049)	Not Analyzed	ND (0.05)	Not Analyzed	5.4	5.4
Toxaphene	ND (2.5)	ND (0.067)	ND (0.490)	ND (0.490)	Not Analyzed	ND (0.5)	Not Analyzed	0.49	2.1

Criteria: Tropical Pacific Soil Tier 1 ESL with unrestricted (residential) and restricted (commercial/industrial) land uses above a drinking water resource and shallow depth of impacted soil (State of Hawaii, Department of Health, Fall 2017).

Notes: [1] EAL is for Hexachlorocyclohexane ("BHC" as Lindane) = Alpha- + Beta- + Gamma- + Delta-BHC
[2] EAL is for Endosulfan = Endosulfan I + Endosulfan II + Endosulfan sulfate
[3] EAL is for Endrin = Endrin + Endrin aldehyde + Endrin ketone

Laboratory flag: J indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather than quantitative.

Blue = value indicate results exceed Residential (Unrestricted) TPESL

Abbreviations/Acronyms:

--- not analyzed
mg/kg milligrams per kilogram ND (00) not detected (laboratory reporting limit)

Table B-9. Other Contaminants: Site 78A FTA-3

Sample ID [Sampling Depth (ft bgs)] / Analytes	Analytical Results					TPESL	
	S78A-A [0-1]	**S78A-B [0-1]**	**S78A-C-1.5-3 [1.5-3.0]**	**DA-04-A [0-1]**	**DA-05-A [0-1]**	**Unrestricted: Shallow soil (<9.8 ft bgs)**	**Restricted: Shallow soil (<3.3 ft bgs)**
Polycyclic Aromatic Hydrocarbons (EPA 8270C-SIM, mg/kg)							
Naphthalene	**0.0012 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	3.1	3.1
1-Methylnaphthalene	**0.0015 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	0.89	0.89
2-Methylnaphthalene	**0.00054 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	1.9	1.9
Acenaphthylene	**0.00049 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	5.5	5.5
Acenaphthene	ND (0.0079)	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	40	40
Fluorene	**0.00055 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	31	31
Phenanthrene	**0.0027 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	23	23
Anthracene	**0.0012 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	1.4	1.4
Fluoranthene	**0.0041 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	29	29
Pyrene	**0.0044 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	41	41
Benzo(a) anthracene	**0.0052 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	3.3	3.3
Chrysene	**0.0039 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	30	30
Benzo(b) fluoranthene	**0.0052 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	11	21
Benzo(k) fluoranthene	**0.0021 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	39	39
Benzo(a)pyrene	**0.0036 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	3.6	5.9
Indeno(1,2,3-cd) pyrene	**0.0045 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	11	31
Dibenzo(a,h) anthracene	**0.0017 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	1.1	9.6
Benzo(g,h,i) perylene	**0.0072 J**	ND (0.0044)	ND (0.0082)	ND (0.038)	ND (0.037)	35	35
Total Petroleum Hydrocarbons (EPA 8015, mg/kg)							
TPH-DRO	Not Analyzed	Not Analyzed	Not Analyzed	ND (28)	ND (27)	220	500
TPH-RRO	Not Analyzed	Not Analyzed	Not Analyzed	ND (57)	ND (55)	500	2,500
Polychlorinated Biphenyls (EPA 8082, mg/kg)							
Arochlor-1016	ND (0.1)	ND (0.1)	ND (0.017)	ND (0.017)	ND (0.017)	1.2 (ESL for Total PCB)	9.7 (ESL for Total PCB
Arochlor-1221	ND (0.1)	ND (0.1)	ND (0.017)	ND (0.017)	ND (0.017)		
Arochlor-1232	ND (0.1)	ND (0.1)	ND (0.017)	ND (0.017)	ND (0.017)		
Arochlor-1242	ND (0.1)	ND (0.1)	ND (0.017)	ND (0.017)	ND (0.017)		
Arochlor-1248	ND (0.1)	ND (0.1)	ND (0.017)	ND (0.017)	ND (0.017)		
Arochlor-1254	ND (0.1)	ND (0.1)	ND (0.017)	ND (0.017)	ND (0.017)		
Arochlor-1260	ND (0.1)	ND (0.1)	ND (0.017)	ND (0.017)	ND (0.017)		
Target Analyte List Metals (EPA 6020/7471A, mg/kg)							
Arsenic	**5.47**	**6.37**	**5.6**	**7.8**	ND (5.0)	24	95
Barium	**32.0**	**13.8**	**19**	**30**	**17**	1,000	2,500
Beryllium	ND (2.5)	ND (2.5)	ND (0.25)	Not Analyzed	Not Analyzed	31	150
Cadmium	**3.42**	ND (2.5)	**1.5**	**5.4**	**3.4**	14	74
Chromium	**245**	**187**	**210**	**710**	**550**	1,100	1,100
Cobalt	**5.34**	**3.43**	**3.9**	Not Analyzed	Not Analyzed	80	80
Copper	**313**	**5.20**	**9.4**	Not Analyzed	Not Analyzed	630	2500
Lead	**94.3**	**22.4**	**68**	**66**	**70**	200	800

Sample ID [Sampling Depth (ft bgs)] / Analytes	Analytical Results					TPESL	
	S78A-A [0-1]	**S78A-B [0-1]**	**S78A-C-1.5-3 [1.5-3.0]**	**DA-04-A [0-1]**	**DA-05-A [0-1]**	**Unrestricted: Shallow soil (<9.8 ft bgs)**	**Restricted: Shallow soil (<3.3 ft bgs)**
Mercury	ND (0.02)	ND (0.33)	ND (0.19)	**0.35**	**0.38**	4.7	70
Nickel	**21.4**	**13.8**	**18**	Not Analyzed	Not Analyzed	410	750
Selenium	ND (2.5)	ND (2.5)	ND (1.5)	ND (15)	ND (15)	78	1,200
Silver	ND (0.49)	ND (0.5)	ND (0.25)	ND (2.5)	ND (2.5)	78	1,200
Thallium	ND (2.5)	ND (2.5)	ND (1.5)	Not Analyzed	Not Analyzed	0.78	12
Vanadium	**32.0**	**22.9**	**25**	Not Analyzed	Not Analyzed	770	770
Zinc	**65.3**	**10.1**	**16**	Not Analyzed	Not Analyzed	1000	2500
Calcium	ND (25)	ND (25)	**300,000**	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Magnesium	**2,560**	**2,840**	**2,100**	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Manganese	**1,080**	**602**	**1,000**	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Potassium	**57.6**	**30.8**	**46**	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Sodium	ND (150)	ND (150)	**45**	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Aluminum	**46,300**	**31,700**	**40,000**	Not Analyzed	Not Analyzed	Not Provided	Not Provided
Iron	**23,200**	**17,700**	**32,000**	Not Analyzed	Not Analyzed	Not Provided	Not Provided
TCLP RCRA 8 Metals (mg/L)							
Arsenic	ND (0.4)	ND (0.4)	Not Analyzed	---	---		
Barium	ND (0.2)	ND (0.2)	Not Analyzed	---	---		
Cadmium	ND (0.2)	ND (0.2)	Not Analyzed	---	---		
Chromium	ND (0.2)	ND (0.2)	Not Analyzed	---	---		
Lead	ND (0.2)	ND (0.2)	Not Analyzed	---	---		
Selenium	ND (0.2)	ND (0.2)	Not Analyzed	---	---		
Silver	ND (0.2)	ND (0.2)	Not Analyzed	---	---		
Mercury	ND (0.02)	ND (0.02)	Not Analyzed	---	---		
Pesticides (EPA 8081A, mg/kg)							
alpha-BHC	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	0.029[1]	0.029[1]
beta-BHC	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		
gamma-BHC	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		
delta-BHC	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		
Heptachlor	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	1.4	6.3
Aldrin	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	2.8	2.8
Heptachlor epoxide	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	0.2	3
Endosulfan I	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	4.4[2]	4.4[2]
Endosulfan II	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		
Endosulfan sulfate	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		
Dieldrin	**0.148**	**0.0322 J**	ND (0.0017)	ND (0.0017)	ND (0.0017)	2.5	7.9
4,4'-DDD	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	2.3	9.6
4,4'-DDE	ND (0.1)	0.0177 J	ND (0.0017)	ND (0.0017)	ND (0.0017)	2	9.3
4,4'-DDT	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	1.9	1.9
Endrin	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)	3.8[3]	10
Endrin aldehyde	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		

Sample ID [Sampling Depth (ft bgs)] / Analytes	Analytical Results					TPESL	
	S78A-A [0-1]	S78A-B [0-1]	S78A-C-1.5-3 [1.5-3.0]	DA-04-A [0-1]	DA-05-A [0-1]	Unrestricted: Shallow soil (<9.8 ft bgs)	Restricted: Shallow soil (<3.3 ft bgs)
Chlordane (technical)	ND (1.0)	ND (1.0)	ND (0.017)	ND (0.017)	ND (0.017)	7.6	7.6
alpha-Chlordane	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		
gamma-Chlordane	ND (0.1)	ND (0.1)	ND (0.0017)	ND (0.0017)	ND (0.0017)		
Methoxychlor	ND (0.1)	ND (0.1)	ND (0.0033)	ND (0.0033)	ND (0.0033)	5.4	5.4
Toxaphene	ND (2.5)	ND (2.5)	ND (0.033)	ND (0.033)	ND (0.033)	0.49	2.1

Criteria: Tropical Pacific Soil Tier 1 ESL with unrestricted (residential) and restricted (commercial/industrial) land uses above a drinking water resource and shallow depth of impacted soil (State of Hawaii, Department of Health, Fall 2017).

Notes: [1] EAL is for Hexachlorocyclohexane ("BHC" as Lindane) = Alpha- + Beta- + Gamma- + Delta-BHC
[2] EAL is for Endosulfan = Endosulfan I + Endosulfan II + Endosulfan sulfate
[3] EAL is for Endrin = Endrin + Endrin aldehyde + Endrin ketone

Laboratory flag: J indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather than quantitative.

Abbreviations/Acronyms:
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

Table B-10. Other Contaminants: Existing Dirt Road Areas and Perimeter Road

Sample ID [Sampling Depth (ft bgs)] / Analytes	Analytical Results (mg/kg)						TPESL (mg/kg)	
	GR1-0-1 [0-1]	GR1-1.5-2.5 [1.5-2.5]	GR2-0-1 [0-1]	GR2-1.5-2.5 [1.5-2.5]	PR-0-1 [0-1]	PR-1.5-2.5 [1.5-2.5]	Unrestricted: Shallow soil (<9.8 ft bgs)	Restricted: Shallow soil (<3.3 ft bgs)
Polycyclic Aromatic Hydrocarbons (EPA 8270C-SIM)								
Naphthalene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	3.1	3.1
1-Methylnaphthalene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	0.89	0.89
2-Methylnaphthalene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	1.9	1.9
Acenaphthylene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	5.5	5.5
Acenaphthene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	40	40
Fluorene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	31	31
Phenanthrene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	23	23
Anthracene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	1.4	1.4
Fluoranthene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	**0.0095**	29	29
Pyrene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	**0.0089**	41	41
Benzo(a) anthracene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	3.3	3.3
Chrysene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	30	30
Benzo(b) fluoranthene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	**0.0085**	11	21
Benzo(k) fluoranthene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	39	39
Benzo(a)pyrene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	3.6	5.9
Indeno(1,2,3-cd) pyrene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	11	31
Dibenzo(a,h) anthracene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	1.1	9.6
Benzo(g,h,i) perylene	ND (0.017)	ND (0.0084)	ND (0.0081)	ND (0.0084)	ND (0.260)	ND (0.0081)	35	35
Total Petroleum Hydrocarbons (EPA 8015)								
TPH-DRO	ND (26)	**51**	ND (24)	**120**	ND (26)	**60**	220	500
TPH-RRO	ND (51)	ND (50)	ND (49)	ND (50)	ND (52)	ND (48)	500	2,500
Polychlorinated Biphenyls (EPA 8082)								
Arochlor-1016	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.033)	ND (0.017)	1.2 (ESL for Total PCB)	9.7 (ESL for Total PCB
Arochlor-1221	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.033)	ND (0.017)		
Arochlor-1232	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.033)	ND (0.017)		
Arochlor-1242	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.033)	ND (0.017)		
Arochlor-1248	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.033)	ND (0.017)		
Arochlor-1254	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.033)	ND (0.017)		
Arochlor-1260	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.017)	ND (0.033)	ND (0.017)		
Target Analyte List Metals (EPA 6020/7471A)								
Arsenic	**12**	**6.4**	**4.2**	**11**	**5.8**	**7.1**	24	95
Barium	**23**	**14**	**9.6**	**7.1**	**80**	**6.8**	1,000	2,500
Beryllium	**1.1**	ND (0.25)	**0.74**	**0.40**	ND (0.25)	ND (0.25)	31	150
Cadmium	**1.8**	**1.2**	**1.0**	**0.95**	**0.73**	**1.1**	14	74
Chromium	**400**	**250**	**240**	**240**	**150**	**230**	1,100	1,100
Cobalt	**6.3**	**3.3**	**4.5**	**3.4**	4.4	**2.7**	80	80
Copper	**8.8**	**5.2**	**5.1**	**4.0**	**17**	**4.1**	630	2500
Lead	**39**	**120**	**29**	**21**	**35**	**19**	200	800

Sample ID [Sampling Depth (ft bgs)] / Analytes	Analytical Results (mg/kg)						TPESL (mg/kg)	
	GR1-0-1 [0-1]	**GR1-1.5-2.5 [1.5-2.5]**	**GR2-0-1 [0-1]**	**GR2-1.5-2.5 [1.5-2.5]**	**PR-0-1 [0-1]**	**PR-1.5-2.5 [1.5-2.5]**	**Unrestricted: Shallow soil (<9.8 ft bgs)**	**Restricted: Shallow soil (<3.3 ft bgs)**
Mercury	ND (0.21)	ND (0.19)	ND (0.20)	ND (0.1)	ND (0.21)	ND (0.17)	4.7	70
Nickel	**34**	**18**	**22**	**14**	**14**	**13**	410	750
Selenium	**1.6**	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)	78	1,200
Silver	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	78	1,200
Thallium	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)	ND (1.5)	0.78	12
Vanadium	**48**	**25**	**25**	**23**	**32**	**22**	770	770
Zinc	**18**	**11**	**10**	**5.4**	**56**	**6.6**	1000	2500
Calcium	**170,000**	**300,000**	**230,000**	**300,000**	**270,000**	**310,000**	Not Provided	Not Provided
Magnesium	**1,200**	**1,800**	**1,800**	**2,200**	**2,300**	**2,000**	Not Provided	Not Provided
Manganese	**1,300**	**1,000**	**1,500**	**1,300**	**580**	**430**	Not Provided	Not Provided
Potassium	**75**	**47**	**55**	**52**	**200**	**48**	Not Provided	Not Provided
Sodium	**47**	**42**	**49**	**38**	**93**	**53**	Not Provided	Not Provided
Aluminum	**100,000**	**43,000**	**78,000**	**47,000**	**35,000**	**34,000**	Not Provided	Not Provided
Iron	**58,000**	**33,000**	**51,00**	**38,000**	**24,000**	**27,000**	Not Provided	Not Provided
Pesticides (EPA 8081A)								
alpha-BHC	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	0.029[1]	0.029[1]
beta-BHC	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
gamma-BHC	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
delta-BHC	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
Heptachlor	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	1.4	6.3
Aldrin	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	2.8	2.8
Heptachlor epoxide	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	0.2	3
Endosulfan I	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	4.4[2]	4.4[2]
Endosulfan II	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
Endosulfan sulfate	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
Dieldrin	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	2.5	7.9
4,4'-DDD	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	2.3	9.6
4,4'-DDE	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	2	9.3
4,4'-DDT	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	1.9	1.9
Endrin	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)	3.8[3]	10
Endrin aldehyde	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
Chlordane (technical)	ND (0.033)	ND (0.017)	ND (0.033)	ND (0.017)	ND (0.083)	ND (0.017)	7.6	7.6
alpha-Chlordane	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
gamma-Chlordane	ND (0.0033)	ND (0.0017)	ND (0.0033)	ND (0.0017)	ND (0.0083)	ND (0.0017)		
Methoxychlor	ND (0.013)	ND (0.0033)	ND (0.013)	ND (0.0033)	ND (0.033)	ND (0.0033)	5.4	5.4
Toxaphene	ND (0.067)	ND (0.033)	ND (0.067)	ND (0.033)	ND (0.170)	ND (0.033)	0.49	2.1

Criteria: Tropical Pacific Soil Tier 1 ESL with unrestricted (residential) and restricted (commercial/industrial) land uses above a drinking water resource and shallow depth of impacted soil (State of Hawaii, Department of Health, Fall 2017).

Laboratory flag: J indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather than quantitative.

Abbreviations/Acronyms: mg/kg milligrams per kilogram ND (00) not detected (laboratory reporting limit)

Table B-11. Other Contaminants: S26 and B2641 Areas

Sample ID [Sampling Depth (ft bgs)] / Analytes	Analytical Results (mg/kg)					TPESL (mg/kg)	
	S26-A [0-1]	B2641-A [0-1]	Reserved	Reserved	Reserved	Unrestricted: Shallow soil (<3 m bgs)	Restricted: Shallow soil (<1 m bgs)
Polycyclic Aromatic Hydrocarbons (EPA 8270C-SIM)							
Naphthalene	ND (0.02)	ND (0.02)				3.1	3.1
1-Methylnaphthalene	ND (0.02)	ND (0.02)				0.89	0.89
2-Methylnaphthalene	ND (0.02)	ND (0.02)				1.9	1.9
Acenaphthylene	ND (0.02)	ND (0.02)				5.5	5.5
Acenaphthene	ND (0.02)	ND (0.02)				40	40
Fluorene	ND (0.02)	ND (0.02)				31	31
Phenanthrene	**0.0032 J**	**0.0031 J**				23	23
Anthracene	ND (0.02)	**0.0011** J				1.4	1.4
Fluoranthene	**0.0076 J**	**0.01 J**				29	29
Pyrene	**0.0086 J**	**0.011 J**				41	41
Benzo(a) anthracene	**0.0088 J**	**0.01 J**				3.3	3.3
Chrysene	**0.0067 J**	**0.0095 J**				30	30
Benzo(b) fluoranthene	**0.0087 J**	**0.014 J**				11	21
Benzo(k) fluoranthene	**0.0038 J**	**0.005 J**				39	39
Benzo(a)pyrene	**0.0064 J**	**0.0088 J**				3.6	5.9
Indeno(1,2,3-cd) pyrene	**0.0059 J**	**0.008 J**				11	31
Dibenzo(a,h) anthracene	ND (0.02)	ND (0.02)				1.1	9.6
Benzo(g,h,i) perylene	**0.007 J**	**0.0089 J**				35	35
Polychlorinated Biphenyls (EPA 8082)							
Arochlor-1016	ND (0.1)	ND (0.1)				1.2 (ESL for Total PCB)	9.7 (ESL for Total PCB
Arochlor-1221	ND (0.1)	ND (0.1)					
Arochlor-1232	ND (0.1)	ND (0.1)					
Arochlor-1242	ND (0.1)	ND (0.1)					
Arochlor-1248	ND (0.1)	ND (0.1)					
Arochlor-1254	ND (0.1)	ND (0.1)					
Arochlor-1260	ND (0.1)	ND (0.1)					
Target Analyte List Metals (EPA 6020/7471A)							
Arsenic	**2.87**	**7.89**				24	95
Barium	**8.07**	**11.5**				1,000	2,500
Beryllium	ND (2.5)	ND (2.4)				31	150
Cadmium	ND (2.5)	ND (2.4)				14	74
Chromium	**30.2**	**225**				1,100	1,100
Cobalt	ND (2.5)	**5.43**				80	80
Copper	**6.14**	**15.5**				630	2500
Lead	**17.0**	**26.8**				200	800
Mercury	ND (0.29)	ND (0.29)				4.7	70
Nickel	**3.12**	**25.4**				410	750
Selenium	ND (2.5)	ND (2.4)				78	1,200

Sample ID [Sampling Depth (ft bgs)] / Analytes	Analytical Results (mg/kg)					TPESL (mg/kg)	
	S26-A [0-1]	B2641-A [0-1]	Reserved	Reserved	Reserved	Unrestricted: Shallow soil (<3 m bgs)	Restricted: Shallow soil (<1 m bgs)
Silver	ND (0.5)	ND (0.48)				78	1,200
Thallium	ND (2.5)	ND (2.4)				0.78	12
Vanadium	**5.22**	**43.3**				770	770
Zinc	**14.1**	**37.1**				1000	2500
Calcium	ND (25)	ND (24)				Not Provided	Not Provided
Magnesium	**1,790**	**1,950**				Not Provided	Not Provided
Manganese	**108**	**897**				Not Provided	Not Provided
Potassium	ND (25)	**72.5**				Not Provided	Not Provided
Sodium	ND (150)	ND (140)				Not Provided	Not Provided
Aluminum	**5,320**	**40,200**				Not Provided	Not Provided
Iron	**2,820**	**22,400**				Not Provided	Not Provided
Pesticides (EPA 8081A)							
alpha-BHC	ND (0.1)	ND (0.1)				0.029[1]	0.029[1]
beta-BHC	ND (0.1)	ND (0.1)					
gamma-BHC	ND (0.1)	ND (0.1)					
delta-BHC	ND (0.1)	ND (0.1)					
Heptachlor	ND (0.1)	ND (0.1)				1.4	6.3
Aldrin	ND (0.1)	ND (0.1)				2.8	2.8
Heptachlor epoxide	ND (0.1)	ND (0.1)				0.2	3
Endosulfan I	ND (0.1)	ND (0.1)				4.4[2]	4.4[2]
Endosulfan II	ND (0.1)	ND (0.1)					
Endosulfan sulfate	ND (0.1)	ND (0.1)					
Dieldrin	**0.0146 J**	ND (0.1)				2.5	7.9
4,4'-DDD	ND (0.1)	ND (0.1)				2.3	9.6
4,4'-DDE	0.0204 J	0.0115 J				2	9.3
4,4'-DDT	**0.141**	ND (0.1)				1.9	1.9
Endrin	ND (0.1)	ND (0.1)				3.8[3]	10
Endrin aldehyde	ND (0.1)	ND (0.1)					
Chlordane (technical)	ND (1.0)	ND (1.0)				7.6	7.6
alpha-Chlordane	ND (0.1)	ND (0.1)					
gamma-Chlordane	ND (0.1)	ND (0.1)					
Methoxychlor	ND (0.1)	ND (0.1)				5.4	5.4
Toxaphene	ND (2.5)	ND (2.5)				0.49	2.1

Criteria: Tropical Pacific Soil Tier 1 ESL with unrestricted (residential) and restricted (commercial/industrial) land uses above a drinking water resource and shallow depth of impacted soil (State of Hawaii, Department of Health, Fall 2017).

Notes: [1] EAL is for Hexachlorocyclohexane ("BHC" as Lindane) = Alpha- + Beta- + Gamma- + Delta-BHC

[2] EAL is for Endosulfan = Endosulfan I + Endosulfan II + Endosulfan sulfate

[3] EAL is for Endrin = Endrin + Endrin aldehyde + Endrin ketone

Laboratory flag: Jindicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather than quantitative.

Abbreviations/Acronyms: mg/kg milligrams per kilogram ND (00) not detected (laboratory reporting limit)

Table B-12. Stockpile Analytical Results

Sample ID/ [Sampling Depth (ft bgs)] Analytes	Stockpile Analytical Results (Refer to Appendix C for Stockpile Photographs and Locations)								TPESL	
	Stockpile 6-2	Stockpile 6-4	Stockpile 7-1	Stockpile 7-3	Stockpile 8-6	Stockpile 8-10	Stockpile 13-1	Stockpile 13-3	Unrestricted: Shallow soil (<9.8 ft bgs)	Restricted: Shallow soil (<3.3 ft bgs)
RCRA 8 Metals (EPA 6020/7471A, mg/kg)										
Arsenic	**15**	**13**	**14**	**14**	**3.1**	**4.0**	**10**	**10**	24	95
Barium	**22**	**26**	**28**	**24**	**11**	**7.2**	**13**	**66**	1,000	2,500
Cadmium	**3.4**	**3.0**	**3.2**	**3.1**	**0.9**	**1.2**	**1.7**	**21**	14	74
Chromium	**370**	**360**	**430**	**420**	**95**	**110**	**230**	**370**	1,100	1,100
Lead	**34**	**32**	**39**	**30**	**36**	**22**	**22**	**430**	200	800
Mercury	0.19	0.22	ND (0.16)	ND (0.16)	ND (0.15)	ND (0.15)	ND (0.14)	ND (0.16)	4.7	70
Selenium	ND (3.0)	ND (2.9)	ND (3.0)	ND (3.0)	ND (2.9)	ND (2.9)	ND (2.9)	ND (2.9)	78	1,200
Silver	ND (0.5)	ND (0.49)	ND (0.5)	ND (0.5)	ND (0.49)	ND (0.49)	ND (0.49)	1.5	78	1,200
Pesticides (EPA 8081A, mg/kg)										
alpha-BHC	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	0.029[1]	0.029[1]
beta-BHC	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)		
gamma-BHC	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)		
delta-BHC	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)		
Heptachlor	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	1.4	6.3
Aldrin	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	2.8	2.8
Heptachlor epoxide	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	0.2	3
Endosulfan I	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	4.4[2]	4.4[2]
Endosulfan II	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)		
Endosulfan sulfate	ND (0.0053)	ND (0.0053)	ND (0.0053)	ND (0.0052)	ND (0.0053)	ND (0.0053)	ND (0.0053)	ND (0.0053)		
Dieldrin	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	2.5	7.9
4,4'-DDD	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	2.3	9.6
4,4'-DDE	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	2	9.3
4,4'-DDT	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	1.9	1.9
Endrin	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)	3.8[3]	10
Endrin aldehyde	ND (0.005)	ND (0.0051)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0051)	ND (0.005)		
Chlordane (technical)	ND (0.05)	ND (0.051)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.051)	ND (0.05)	7.6	7.6
Methoxychlor	ND (0.01)	ND (0.01)	ND (0.0099)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	5.4	5.4
Toxaphene	ND (0.1)	ND (0.1)	ND (0.099)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	0.49	2.1

Criteria: Tropical Pacific Soil Tier 1 ESL with unrestricted (residential) and restricted (commercial/industrial) land uses above a drinking water resource and shallow depth of impacted soil (State of Hawaii, Department of Health, Fall 2017).

Notes: [1] EAL is for Hexachlorocyclohexane ("BHC" as Lindane) = Alpha- + Beta- + Gamma- + Delta-BHC
[2] EAL is for Endosulfan = Endosulfan I + Endosulfan II + Endosulfan sulfate
[3] EAL is for Endrin = Endrin + Endrin aldehyde + Endrin ketone

Blue = value indicate results exceed Residential (Unrestricted) TPESL

Abbreviations/Acronyms:

--- not analyzed
mg/kg milligrams per kilogram ND (00) not detected (laboratory reporting limit)

APPENDIX C VISUAL STOCKPILE OBSERVATION

APPENDIX C. VISUAL STOCKPILE OBSERVATION

Limitations

MNA conducted a visual assessment for the stockpiles located in the P-012 Project Site. The assessment was limited to the surface level. Subsurface assessment or observation was not performed. Hazardous materials can be found during stockpile disturbances. If suspected materials are identified, the Contractor must collect and test samples for the suspected material. If not tested, the Contractor must assume the material as hazardous material.

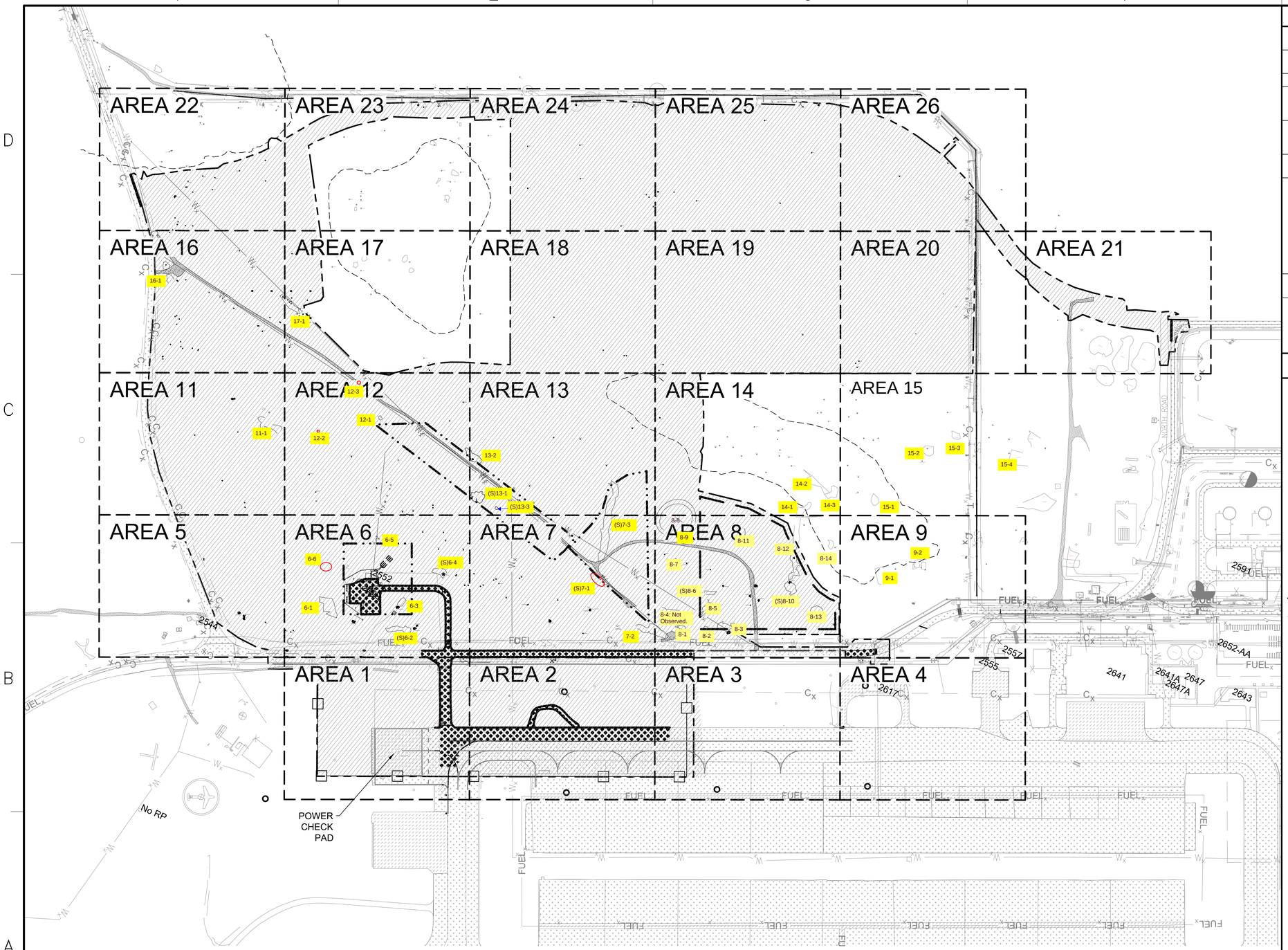
Table of Contents

Area 6 5
6-1: Rock and Concrete Debris (Electrical) 6
(S) 6-2: Dirt Pile 7
6-3: Rock and Waste Debris (Concrete, Metal, etc.) 8
(S) 6-4: Dirt, Concrete, Asphalt, and Waste Debris 9
6-5: Waste Debris (HM ID: 49) 10
6-6: Concrete and Rock Debris 11
Area 7 12
(S) 7-1: Dirt, Rock, Concrete Pile 13
7-2: Rock Pile 14
(S) 7-3: Drit, Concrete, Rocks, Various Waste Debris 15
Area 8 17
8-1: Rock Pile 18
8-2: Rock and Waste (HM ID: 69, Asbestos) 19
8-3: Dirt Pile 20
8-4: Not Observed (Unable to Find during the Site Visit). 20
8-5: Concrete and Rock Debris 21
(S) 8-6: Dirt Pile 22
8-7: Waste Debris (HM ID 65: Asbestos) 23
8-8 and 8-9, Soil Mound (Former Fire Training Pit) 24
(S) 8-10: Dirt and Rock Pile 25
8-11: Waste Debris 26
8-12: Waste Debris (Electrical) 27
8-13: Waste Debris (HM ID: 52) 28
8-14: No Site Access due to Thick Vegetation 28
Area 9 29
9-1: Concrete, Rocks, Metal Debris and Asbestos Cement Pipes 30

9-2: Not Observed (Unable to Find during the site visit)....30
Area 11....31
11-1: Rock, Dirt, Waste Debris....32
Area 12....34
12-1: Rock and Waste Debris....35
12-2: Waste Debris-Roofing Material....36
12-3: Concrete Manhole Structure....37
Area 13....38
(S) 13-1: Waste Concrete (HM ID 63 & 64, Asbestos)....39
13-2: Rock Pile....42
(S) 13-3: Dirt, Rock, Waste Mixed Debris....43
Area 14: No Site Access due to Heavy Vegetation....44
Area 15: No Site Access due to Heavy Vegetation....45
Area 16....46
16-1: Rock and Waste Debris....47
Area 17....48
17-1: Rock, Concrete, and Waste Debris....49

Figures

Figure 1. Stockpile Locations....4

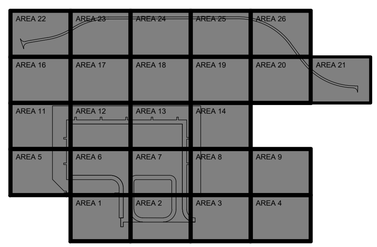


GENERAL NOTES

A	ALL EXISTING IMPROVEMENTS NOT SHOWN REMOVED ON DEMOLITION PLAN SHEETS MUST BE PROTECTED IN PLACE.
B	SAWCUT A STRAIGHT EDGE ALONG EXISTING ASPHALT PAVEMENT FOR INSTALLATION OF NEW PAVEMENT.
C	PROTECT EXISTING EDGES OF PAVEMENT TO REMAIN.
D	EXISTING SECURITY FENCE MUST REMAIN IN PLACE UNTIL TEMPORARY OR PERMANENT FENCING IS INSTALLED AND ACCEPTED. THE AIRFIELD MUST BE SECURE AT ALL TIMES.
E	COMPLY WITH ENVIRONMENTAL REQUIREMENTS AND REGULATIONS. REFER TO DIVISIONS 01 AND 02 SPECIFICATIONS.
F	CLEAR AND GRUB AND REMOVE ALL WEEDS, STUMPS, ROOTS, ROCKS, CONCRETE DEBRIS AND TRASH.
G	ALL GREEN WASTE GENERATED FROM CLEARING AND GRUBBING TASKS AND CONSTRUCTION ACTIVITIES MUST BE MANAGED, PROCESSED AND REUSED ON SITE. PREPARE A GREEN WASTE MANAGEMENT PLAN THAT WILL BE INCLUDED IN THEIR OVERALL WASTE MANAGEMENT PLAN. MONITOR GREEN WASTE PILES WEEKLY FOR CRB INFESTATION. IF THERE IS AN INFESTATION, THE PILES MUST GO THROUGH A GRINDER/SHREDDER PRIOR TO RESUMING COMPOST ACTIVITIES.
H	OBTAIN ANY NECESSARY DIG PERMITS 15 CALENDAR DAYS PRIOR TO THE START OF EXCAVATION.

LEGEND

- REMOVE ASPHALT PAVEMENT
- REMOVE DIRT ROAD
- EXISTING CONCRETE PAVEMENT TO REMAIN
- EXISTING ASPHALT PAVEMENT TO REMAIN
- LIMITS OF CLEARING AND GRUBBING
- LIMITS OF DISTURBANCE
- PFAS EXCAVATION AREA
- PFAS RELOCATION AREA
- TEMPORARY FENCE (FREE ZONE BOUNDARY), RE: A1/CS508
- EXISTING SINKHOLE
- W_x REMOVE EXISTING WATERLINE
- W_x EXISTING WATERLINE
- E_x EXISTING UNDERGROUND ELECTRIC
- C_x EXISTING UNDERGROUND COMM.
- $FUEL_x$ EXISTING UNDERGROUND MAIN FUEL PIPE
- SS_x EXISTING SANITARY SEWER



OVERALL KEY PLAN

GRAPHIC SCALE

0 100' 200' 400'

SCALE: 1"=200'

NORTH ARROW

TRUE N

A1 OVERALL DEMOLITION PLAN
SCALE: 1" = 200'

(S) Notation: Soil Sampling was conducted.

Figure 1. Stockpile Locations

PRELIMINARY FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

ANDREW T. MCCOY
Name
TX 96627 18 AUG 2025
Registration Number # Date
TEXAS REGISTERED ENGINEERING FIRM F-2966 SEAL

Jacobs / BURNS MCDONNELL
JACOBS/B&M, A JOINT VENTURE
1100 NORTH GLEBE ROAD
SUITE 500
ARLINGTON, VA 22201

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0315
JEG NO. 034306G3 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	JMH	DRW:	SMC	REV:	ATM
PM/DM					GAM
BRANCH MANAGER					SMK
CHIEF ENG/ARCH					SMK
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND - PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP REVISION

OVERALL DEMOLITION PLAN

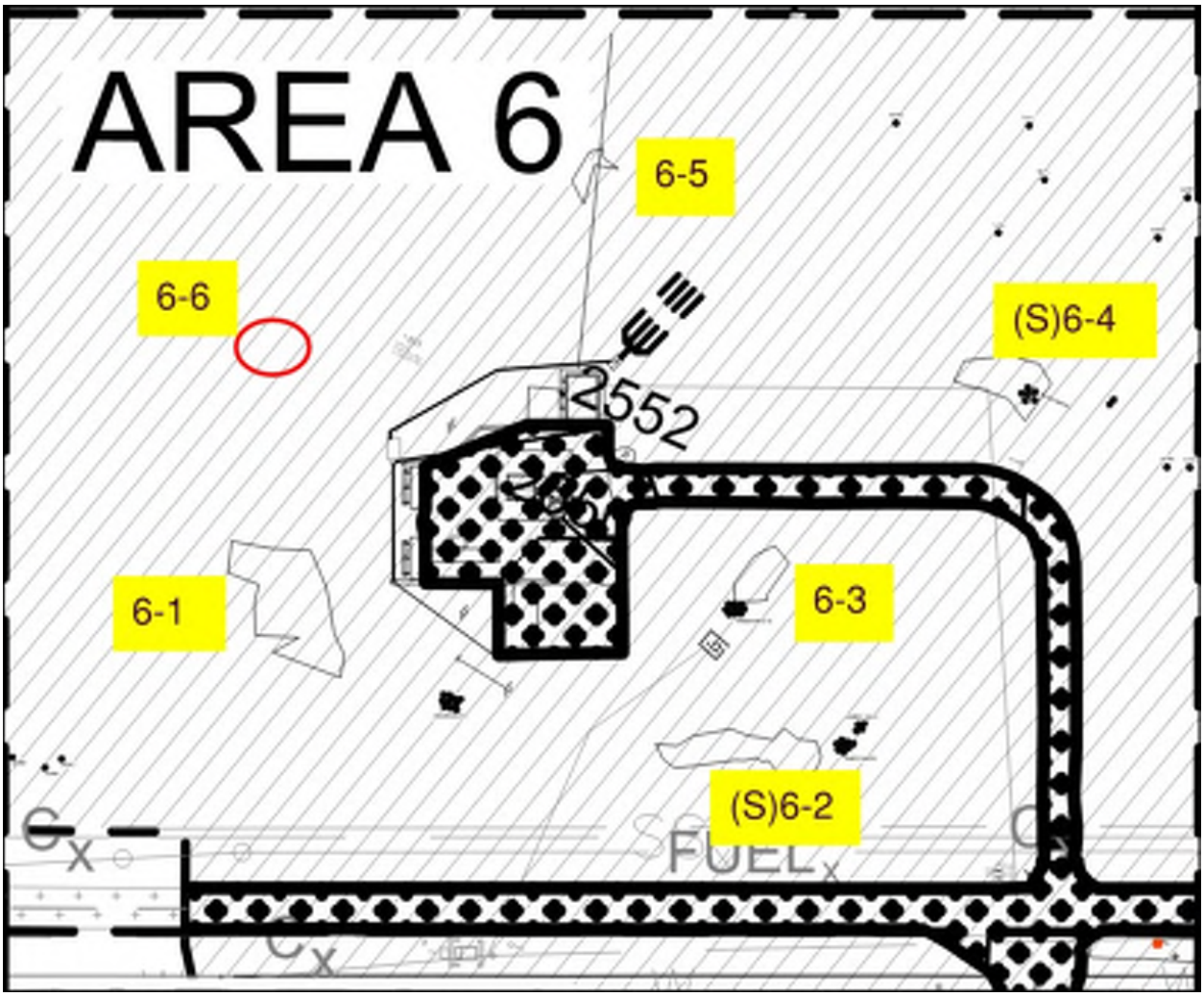
SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF
CD101

65% DESIGN SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: C:\Users\local_FERGUSD\Temp\AcPublish_21888\P012_1665555_CD101.dwg
LAYOUT NAME: OVERALL DEMOLITION PLAN
PLOTTED: 08/15/2025 10:04am
USER: FERGUSD

Area 6

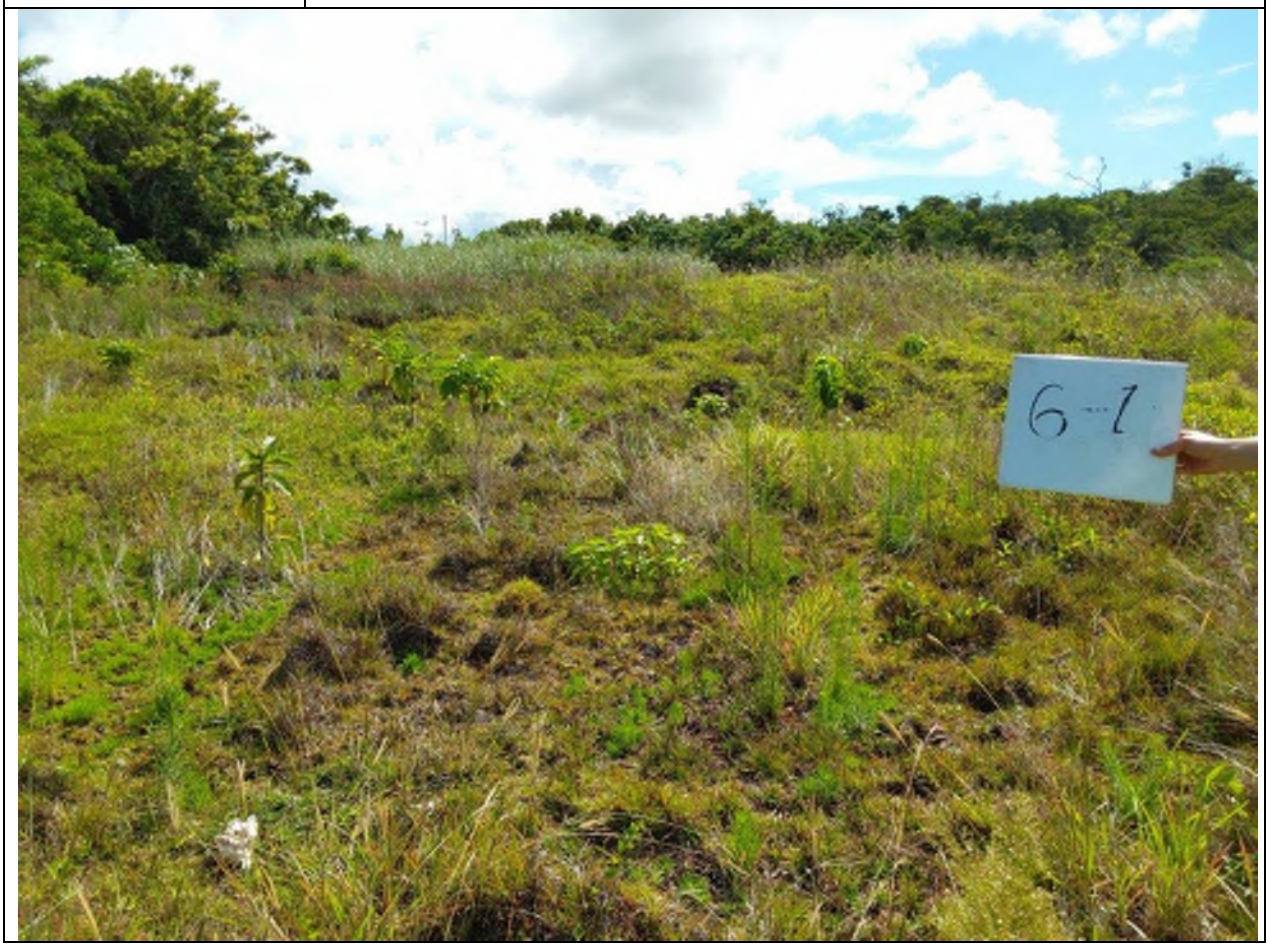


XXX: Stockpile Number for Inspection

(S) notation: A soil sample was collected from the respective stockpile.

6-1: Rock and Concrete Debris (Electrical)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	6-1
Contents:	Rock and Concrete Debris		



(S) 6-2: Dirt Pile

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	6-2
Contents:	Electrical waste		

Observation: Dirt Pile
A soil sample (Sample ID Stockpile 6-2) was collected and analyzed for RCRA 8 metals and pesticides. Results were below the TPESL for unrestricted (residential land use). Refer to Appendix B, Table B-12 for the summary of analytical results.

6-3: Rock and Waste Debris (Concrete, Metal, etc.)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	6-3
Contents:	Rock, Concrete, metal, treated wood debris.		

Observation: Rock and waste debris.

(S) 6-4: Dirt, Concrete, Asphalt, and Waste Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	6-4
Contents:	Dirt, Concrete, Asphalt and Waste Debris		

Observation: Dirt, Concrete, Asphalt and Waste debris
A soil sample (Sample ID Stockpile 6-4) was collected and analyzed for RCRA 8 metals and pesticides. Results were below the TPESL for unrestricted (residential land use). Refer to Appendix B, Table B-12 for the summary of analytical results.

6-5: Waste Debris (HM ID: 49)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	6-5
Contents:	Concrete blocks, metal, various waste debris		

Observations: Various debris was scattered throughout the area including:

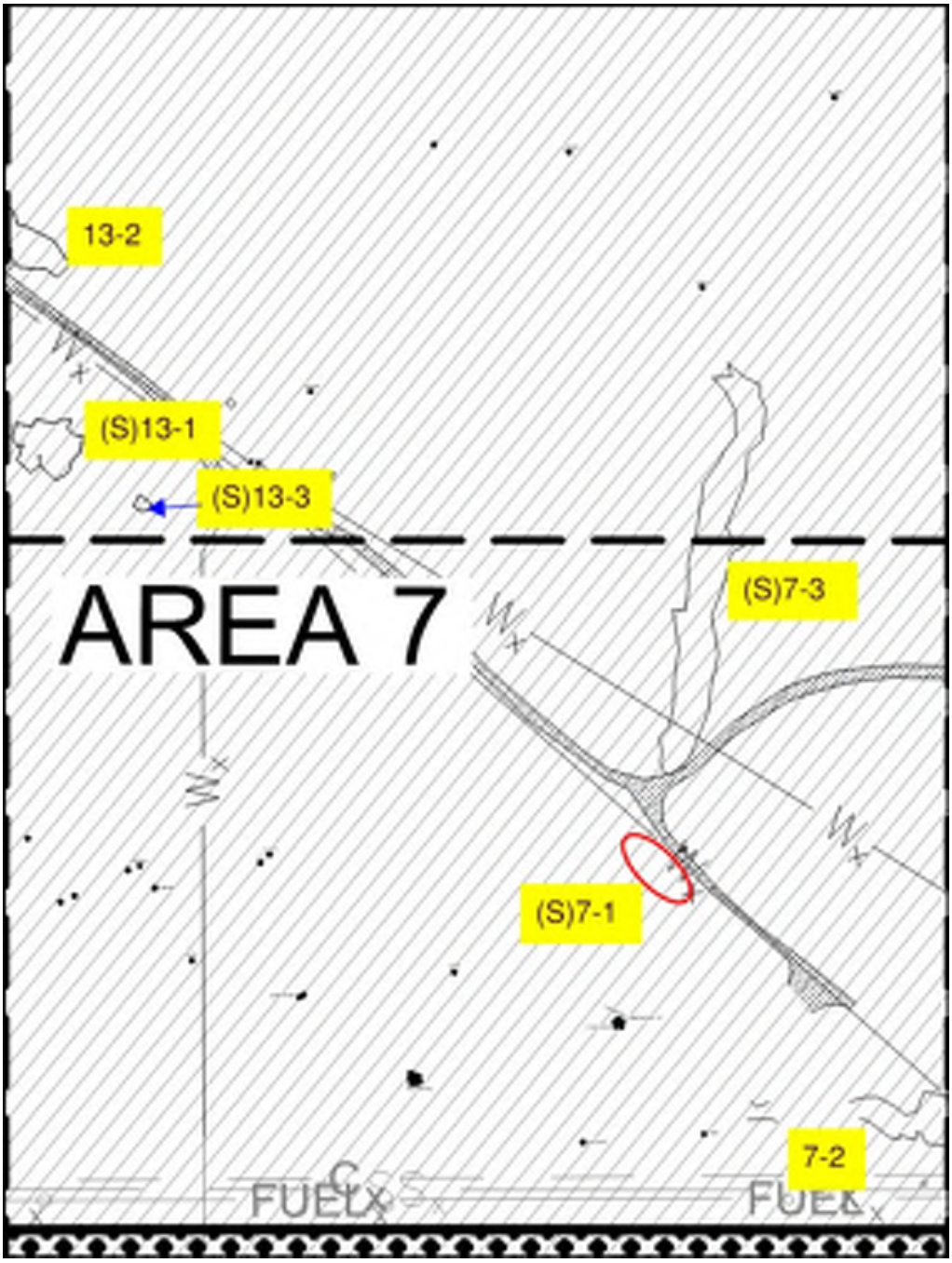
- Concrete box with rusted metal and yellow paint (approximately 5 ft by 5 ft by 5ft)
- Vehicle tires
- Wooden pallet
- Trash (Styrofoam, metal sheets, etc)
- A gun shooting target with holes

Refer to the HAZMAT Survey, HM ID: 49. Lead-Based Paint (Yellow Paint on Metal Debris)

6-6: Concrete and Rock Debris

Inspection Date:	07/29/2024	Stockpile No.	6-6
Contents:	Concrete and rock debris in a heavy vegetation area.		

Area 7



XXX: Stockpile Number for Inspection

(S) notation: A soil sample was collected from the respective stockpile.

(S) 7-1: Dirt, Rock, Concrete Pile

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	7-1
Contents:	Dirt, Rock, Concrete mixed pile		

Observation: Dirt, Rock, Concrete mixed pile
A soil sample (Sample ID Stockpile 7-1) was collected and analyzed for RCRA 8 metals and pesticides. Results were below the TPESL for unrestricted (residential land use). Refer to Appendix B, Table B-12 for the summary of analytical results.

7-2: Rock Pile

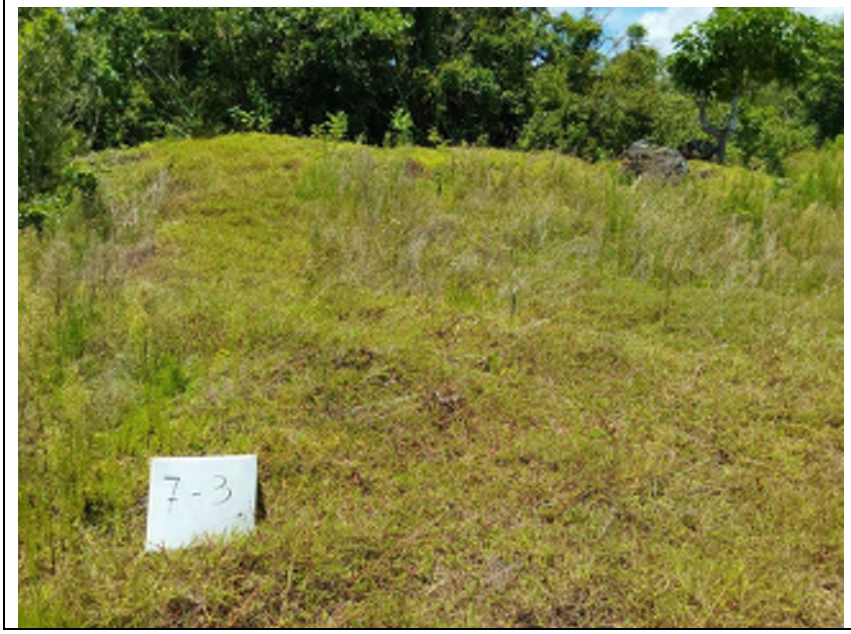
Inspection Date:	07/29/2024	Stockpile No.	7-2
Contents:	Rocks		

(S) 7-3: Drit, Concrete, Rocks, Various Waste Debris

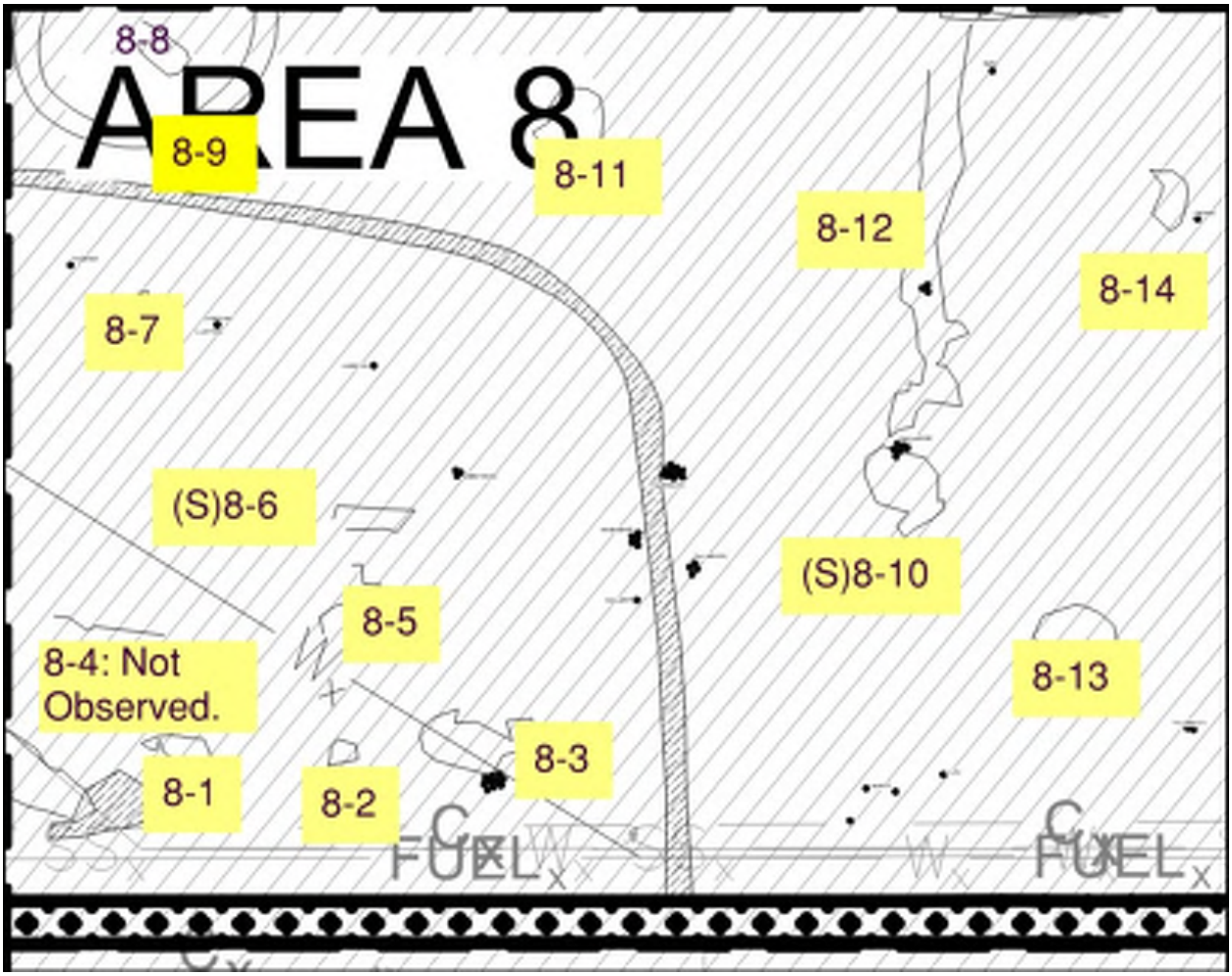
Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	7-3
Contents:	Various Waste Debris		

Observations: Scattered waste debris including

- Dirt pile [A soil sample (Sample ID Stockpile 7-3) was collected and analyzed for RCRA 8 metals and pesticides. Results were below the TPESL for unrestricted (residential land use). Refer to Appendix B, Table B-12 for the summary of analytical results. A soil sample was collected and analyzed for RCRA 8 metals and pesticides.]
- Metals, plastic sheeting, wires etc.
- Rusted vehicle metal frame, tiers,
- Electrical wires and parts


7-3

Area 8



XXX: Stockpile Number for Inspection

(S) notation: A soil sample was collected from the respective stockpile.

8-1: Rock Pile

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-1
Contents:	Rocks		

8-2: Rock and Waste (HM ID: 69, Asbestos)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-2
Contents:	Concrete, asphalt, metal mixed waste		
Sample Collected?	Yes – **Confirmed Asbestos**		
Observations: A rusted pipe was found in this area (approximately 12 ft length). Refer to the HAZMAT Survey, HM ID 69.			

HM ID: 69, Asbestos: 20% Chrysotile

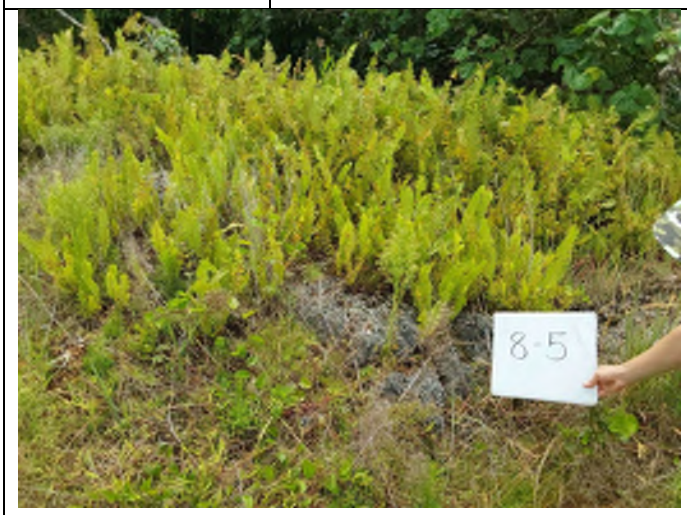
8-3: Dirt Pile

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-3
Contents:	Dirt		

8-4: Not Observed (Unable to Find during the Site Visit).

8-5: Concrete and Rock Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-5
Contents:	Concrete and Rock Debris		



(S) 8-6: Dirt Pile

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-6
Contents:	Dirt Pile		

A soil sample (Sample ID Stockpile 8-6) was collected and analyzed for RCRA 8 metals and pesticides. Results were below the TPESL for unrestricted (residential land use). Refer to Appendix B, Table B-12 for the summary of analytical results.

8-7: Waste Debris (HM ID 65: Asbestos)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-7
Contents:	Metal, concrete, etc.		
Sample Collected?	Yes - Asbestos		
Analytes:			
Concerns/Notes: Heavy metal, Asbestos			

Observations: Various debris was scattered throughout the area.

- Rusted standing metal frame (18 ft in height and 12 ft in wide)
- Rusted Round metal container with cover (3.8 ft in height and 4.5 ft diameter)
- Concrete pile (1 ft height and 3ft wide)
- Black plastic sheets
- Gravel pile

Refer to the HAZMAT Survey Report, HM ID: 65. The material contains asbestos (10% Chrysotile).

8-8 and 8-9, Soil Mound (Former Fire Training Pit)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-8 and 8-9
Contents:	Soil Mound: **PFAS-Impacted Soil**		

(S) 8-10: Dirt and Rock Pile

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-10
Contents:	Dir and rocks		

A soil sample (Sample ID Stockpile 8-10) was collected and analyzed for RCRA 8 metals and pesticides. Results were below the TPESL for unrestricted (residential land use). Refer to Appendix B, Table B-12 for the summary of analytical results.

8-11: Waste Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-11
Contents:	Metal, plastic, other waste debris		

8-12: Waste Debris (Electrical)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-12
Contents:	Metal Debris		

Observations:
Metal debris including electrical waste.

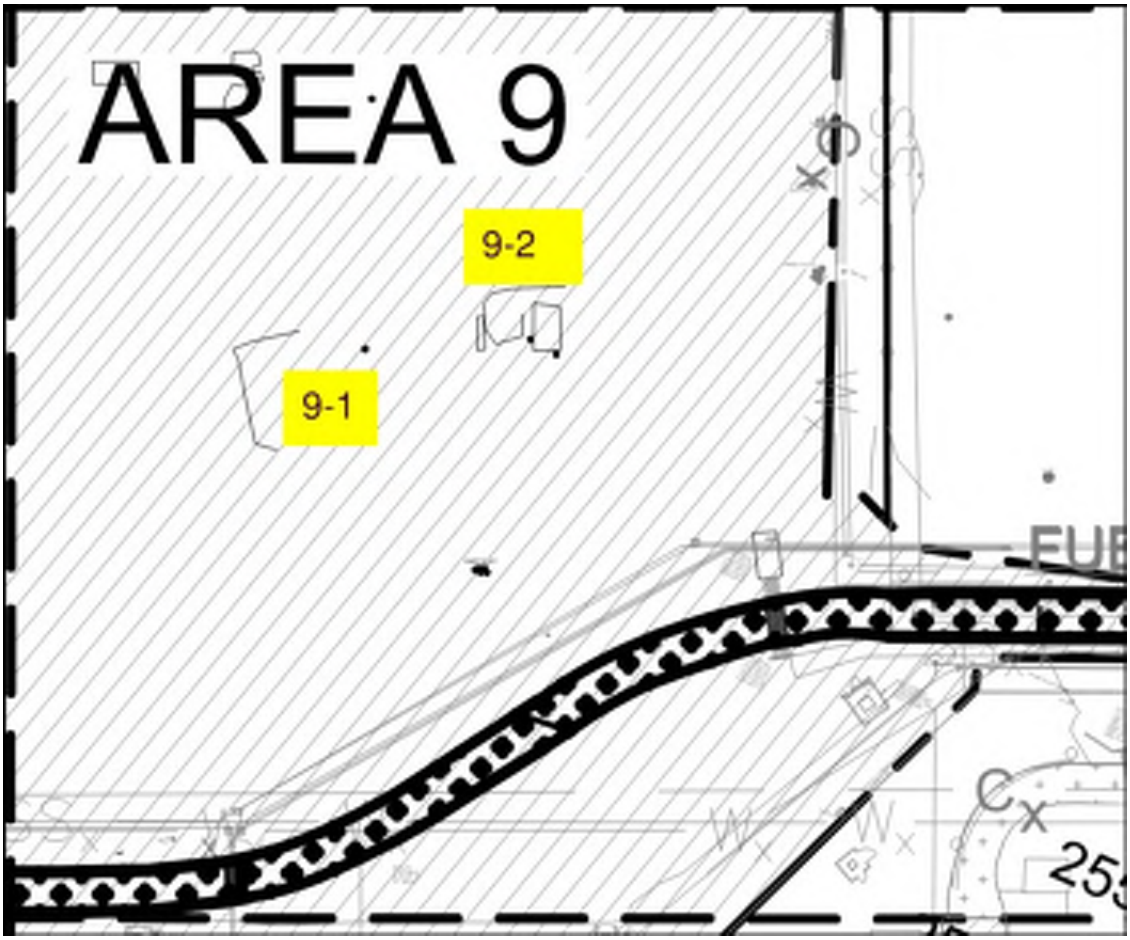
8-13: Waste Debris (HM ID: 52)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	8-13
Contents:	Metals, plastic, electrical, other waste debris		

Refer to HM ID: 52 (LBP, Chromium)

8-14: No Site Access due to Thick Vegetation

Area 9



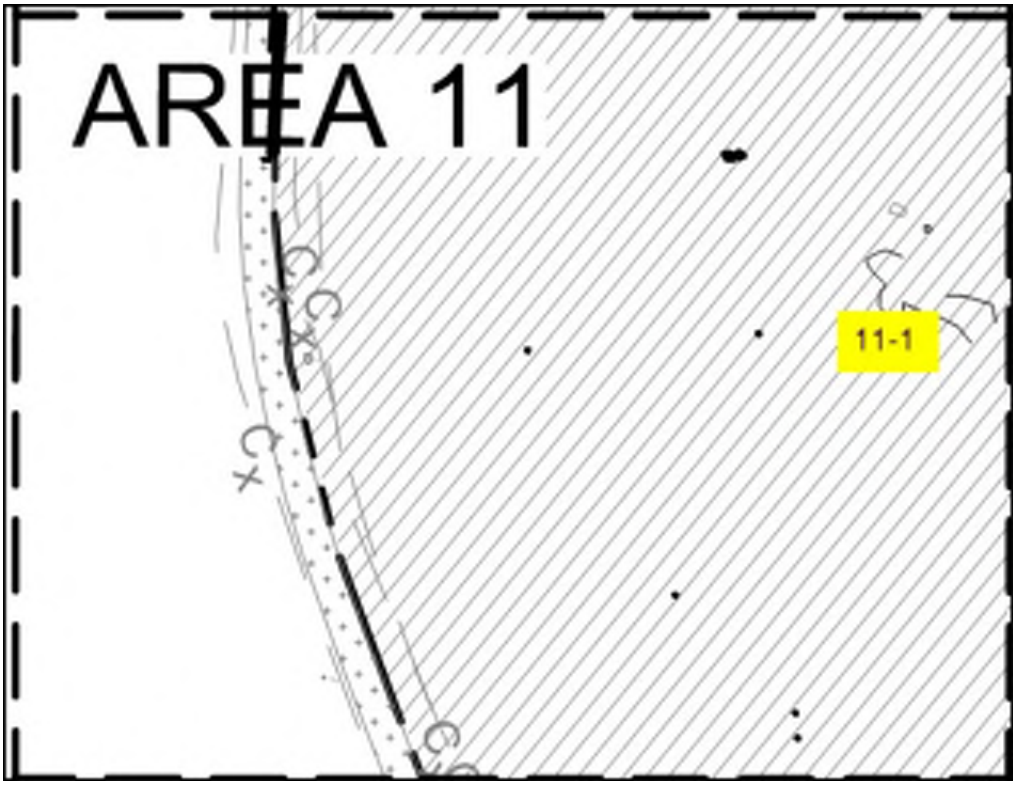
XXX: Stockpile Number for Inspection

9-1: Concrete, Rocks, Metal Debris and Asbestos Cement Pipes

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	9-2
Contents:	Waste debris includes concrete, metals, etc. Asbestos cement pipes Plastic liners		

9-2: Not Observed (Unable to Find during the site visit)

Area 11



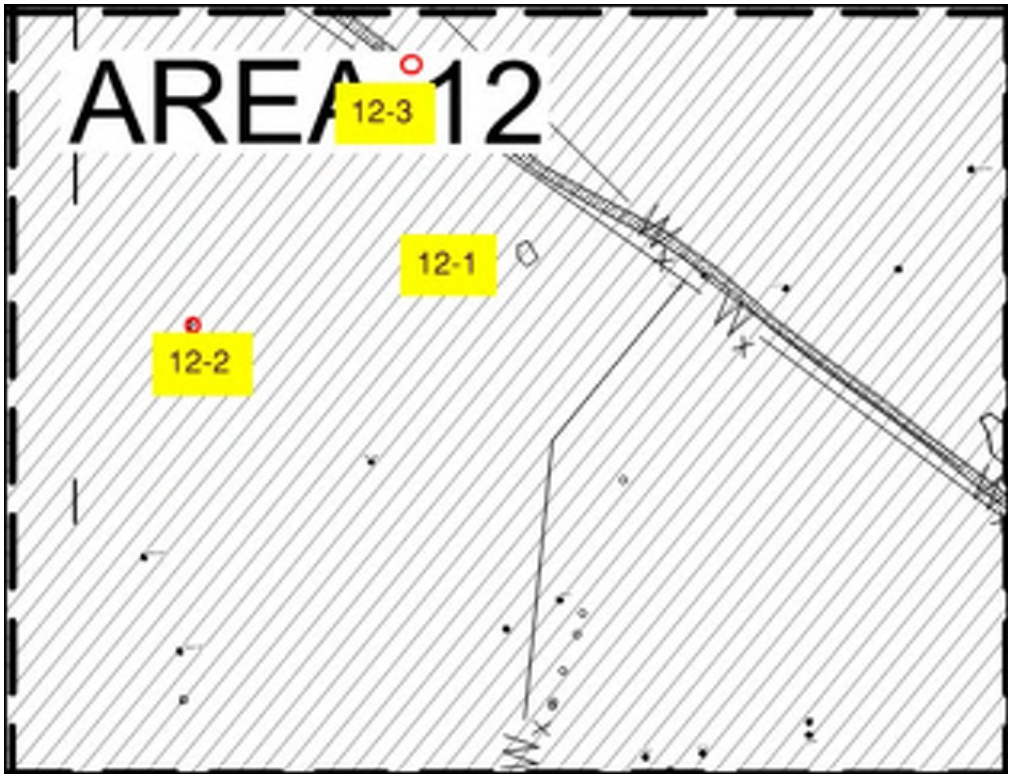
XXX: Stockpile Number for Inspection

11-1: Rock, Dirt, Waste Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	11-1
Contents:	Metal, rubber, various waste debris		

Observations: Various waste debris was scattered throughout the area, including old tires, a rusted metal cabinet, metal plates, metal pipes, old electrical wire/electrical components, rubber debris, etc.

Area 12



XXX: Stockpile Number for Inspection

12-1: Rock and Waste Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	12-1
Contents:	Rubber, metal, other waste debris		

Observations:
Debris including scattered black rubber pieces, rusted steel rebar, and broken black tire.

12-2: Waste Debris-Roofing Material

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	12-2
Contents:	Roofing material		

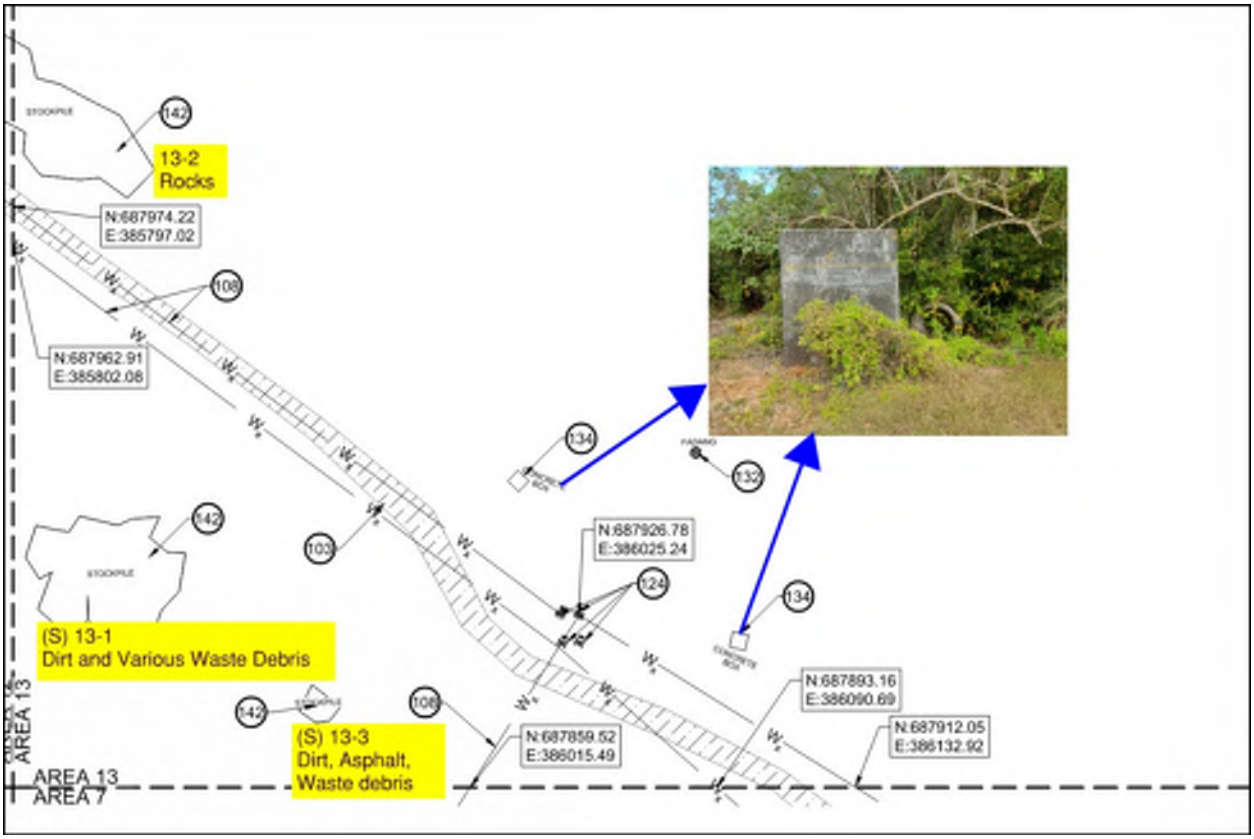
Observations: Roofing material

12-3: Concrete Manhole Structure

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	12-3
Contents:	Concrete manhole		

Observations: Concrete manhole structure

Area 13



XXX: Stockpile Number for Inspection

(S) notation: A soil sample was collected from the respective stockpile.

(S) 13-1: Waste Concrete (HM ID 63 & 64, Asbestos)

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	13-1
Contents:	Various waste debris including utility lines, concrete, metal, other waste debris		
Sample Collected?	Yes for Asbestos analysis Yes for soil stockpile analysis		

Observations:

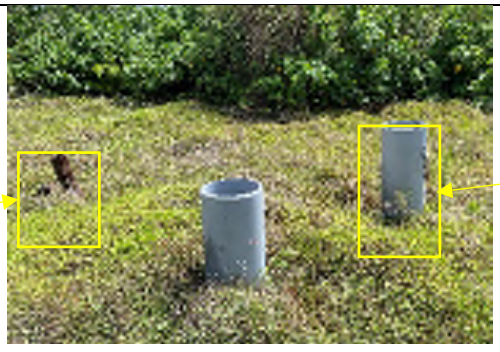
Various debris was scattered throughout the area, including bur are not limited to:

- Soil stockpile [A soil sample (Sample ID Stockpile 13-1) was collected and analyzed for RCRA 8 metals and pesticides. Results were below the TPESL for unrestricted (residential land use). Refer to Appendix B, Table B-12 for the summary of analytical results.]
- Concrete debris: Two utility vaults (5ft W x 5ft L x 7 ft H).
  One of the utility vaults has a rusted steel plate on the top. Two 8-inch concrete pipes, and a round concrete slab tunnel, demolished concrete chunk with water utility line and metal pole.
- Rusted metal pipes, plates and PVC pipes with rusted steel rebar, along with an underground water utility.
- Asphalt stockpile (approx. 9 ft x 9ft x 3ft H)
- Presence of asbestos cement pipes

Collected a soil sample from the stockpile.

HM ID 63
BARE CONCRETE
NO ASBESTOS

HM ID 64 (ASBESTOS)
8" LIGHT GRAY TRANSITE PIPE
15% CHRYSOTILE / 5% CROCIDOLITE
100 FT



13-2: Rock Pile

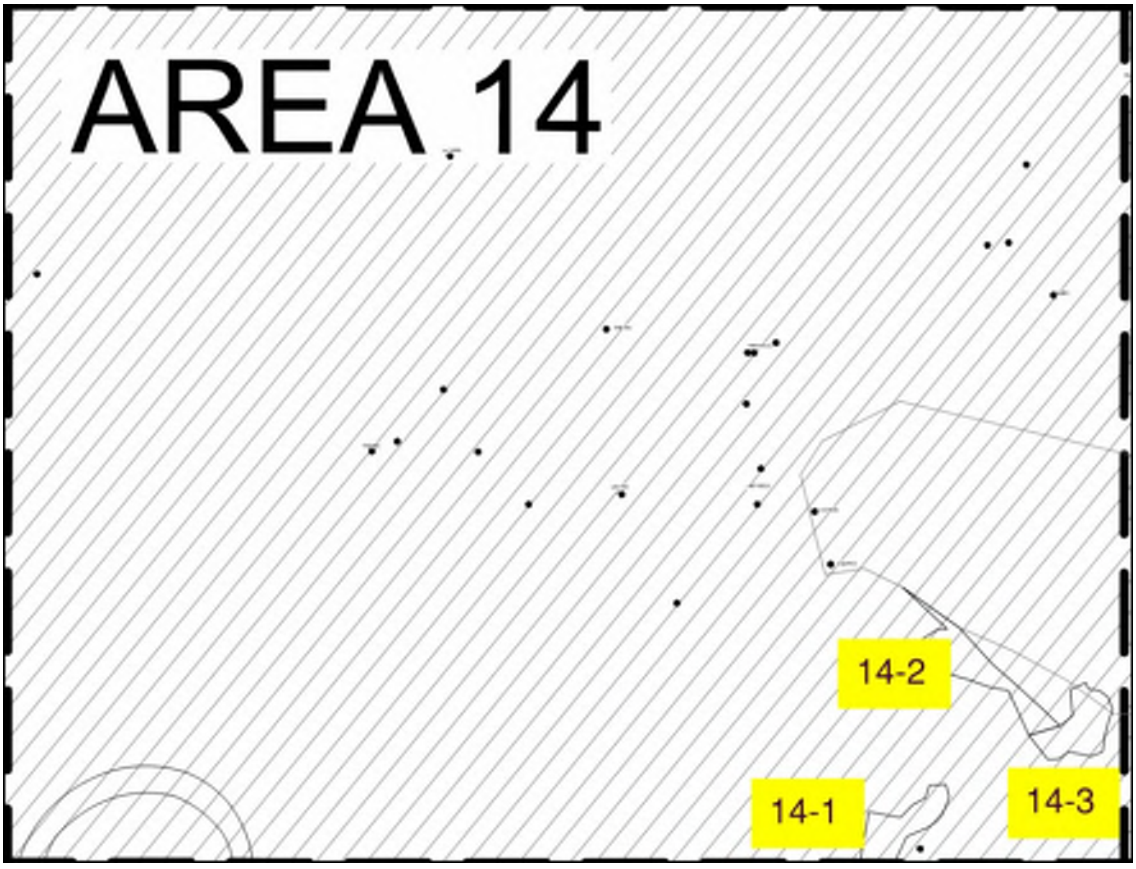
Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	13-2
Contents:	Rock pile		
Observations: Rock pile			

(S) 13-3: Dirt, Rock, Waste Mixed Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	13-3
Contents:	Dirt, Rock, Waste Mixed Debris		

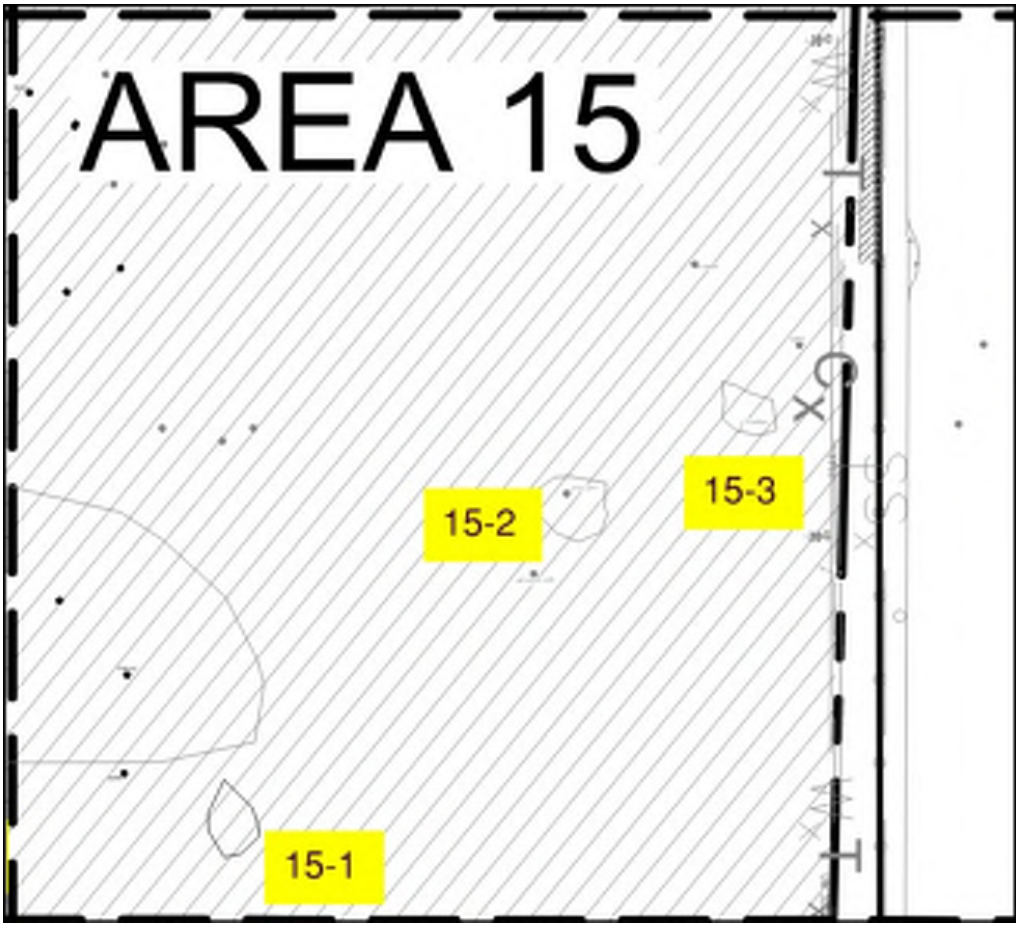
Observations: Dirt, asphalt, and demolition debris
A soil sample (Sample ID Stockpile 13-3) was collected and analyzed for RCRA 8 metals and pesticides. **Results were above the TPESL for unrestricted (residential land use) for lead and cadmium**. Refer to Appendix B, Table B-12 for the summary of analytical results.

Area 14: No Site Access due to Heavy Vegetation



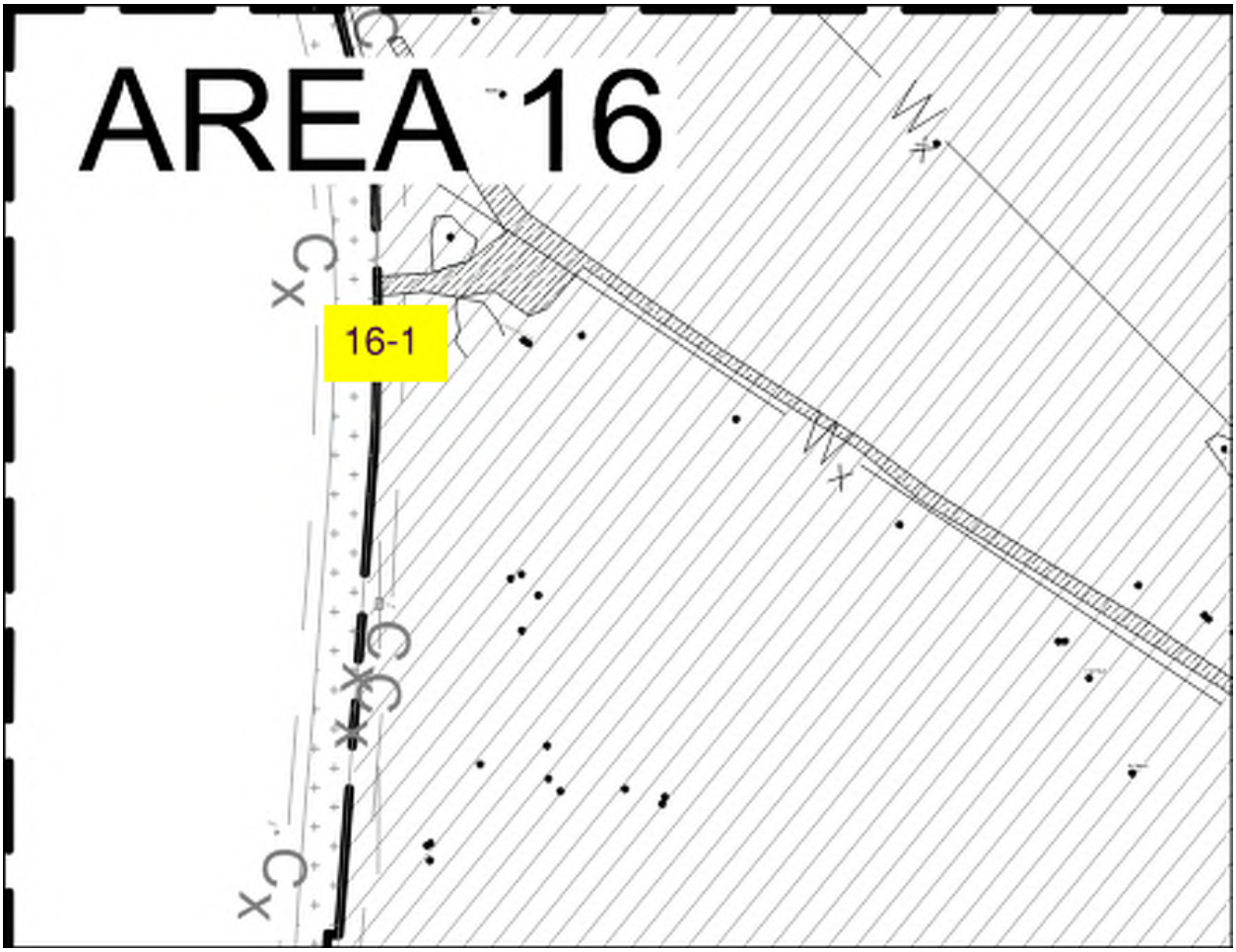
XXX: Stockpile Number for Inspection

Area 15: No Site Access due to Heavy Vegetation



XXX: Stockpile Number for Inspection

Area 16



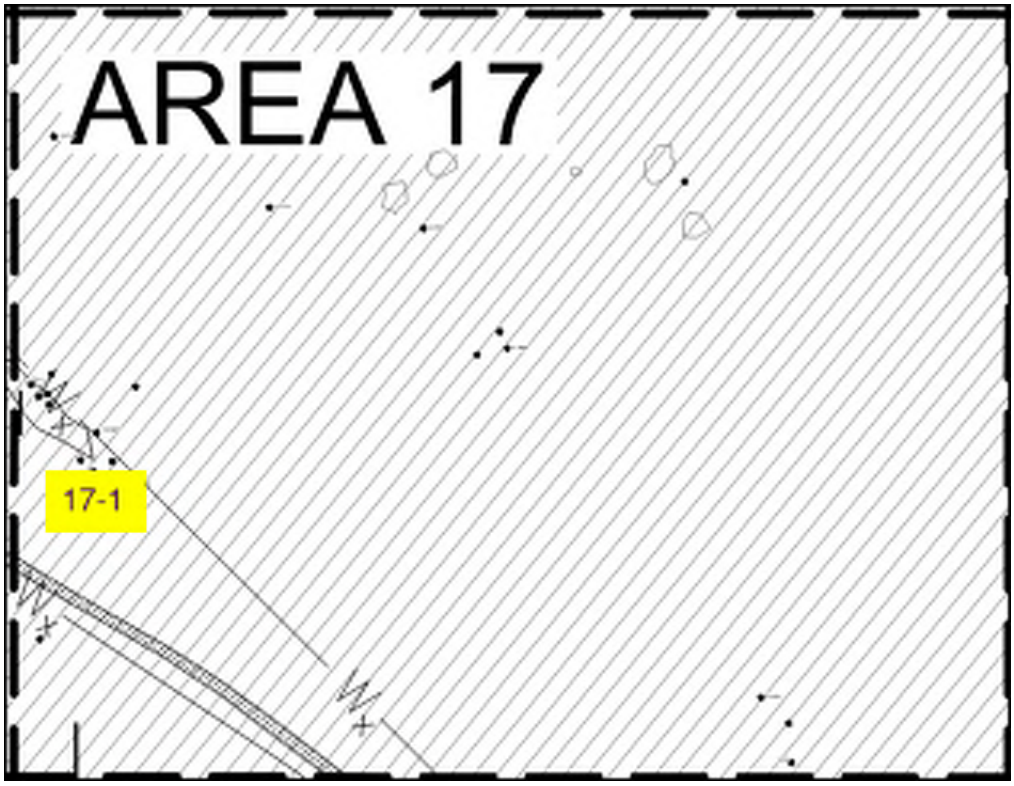
XXX: Stockpile Number for Inspection

16-1: Rock and Waste Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	16-1
Contents:	Rock and waste debris		

Observations:
Rocks and waste debris including metal pipes

Area 17



XXX: Stockpile Number for Inspection

17-1: Rock, Concrete, and Waste Debris

Inspection Date:	06/27/2024, 07/29/2024	Stockpile No.	17-1
Contents:	Rock, concrete, metal, waste debris		

Observations:
Waste debris including rocks, concrete debris, metal pipes, rusted empty drums, etc.

SECTION 02 81 00

TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS
08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)

IATA DGR	(2025) Dangerous Goods Regulations - Edition 66

INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)

IMDG DGR	(2024) Dangerous Goods Regulations - 42nd Amendment

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 415-1-266	(2000) Construction -- Resident Engineer Management Guide (REMG) for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

DOT 4500.9R	Defense Transportation Regulation, Part 2, Cargo Movement, Chapter 204, Hazardous Material

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 175	Carriage by Aircraft
49 CFR 176	Carriage by Vessel
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Hazardous Material

A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated pursuant to the Hazardous Materials Transportation Act, 49 U.S.C. Appendix Section 5101 et seq. The term includes materials designated as hazardous materials under the provisions of 49 CFR 172, Sections .101 and .102 and materials which meet the defining criteria for hazard classes and divisions in 49 CFR 173. EPA designated hazardous wastes are also hazardous materials.

1.2.2 Hazardous Waste

A waste which meets criteria established in Resource Conservation and Recovery Act (RCRA) or specified by the EPA in 40 CFR 261 or which has been designated as hazardous by a RCRA authorized state program.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Packaging Notifications

Hazardous Waste Management Plan; G

Onsite Hazardous Waste Management; G

Notices of Non-Compliance and Notices of Violation

SD-06 Test Reports

Recordkeeping; G

Exception Report; G

Spill Response

SD-07 Certificates

Transportation and Disposal Coordinator; G

Training; G

Pipeline Hazardous Materials Safety Administration Certification

Shipping Documents and Packagings Certification; G

Security Plan

Certificates of Disposal

Waste Minimization

1.4 QUALITY ASSURANCE

1.4.1 Transportation and Disposal Coordinator

Designate, by position and title, one person to act as the Transportation and Disposal Coordinator (TDC) for this contract. The TDC serves as the single point of contact for all environmental regulatory matters and has overall responsibility for total environmental compliance at the site including, but not limited to, accurate identification and classification of hazardous waste and hazardous materials; determination of proper shipping names; identification of marking, labeling, packaging and placarding requirements; completion of waste profiles, hazardous waste manifests, asbestos waste shipment records, PCB manifests, bill of ladings, exception and discrepancy reports; and all other environmental documentation in security of hazardous waste and hazardous materials. The TDC must have, at a minimum, one year of specialized experience in the management and transportation of hazardous waste and have been Department

of Transportation certified under 49 CFR 172, Subpart H, IATA Certification for shipments via air, and IMDG Certification for shipments via vessel.

1.4.2 Training

Hazardous materials/waste employees must be trained, tested, and certified to safely and effectively carry out their assigned duties in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES. Employees transporting hazardous materials or preparing hazardous materials for transportation, including samples, must be trained, tested, and certified in accordance with 49 CFR 172, Subpart H, including security awareness and any applicable security plans. Hazardous material employees must also be trained in accordance with IATA DGR when shipping hazardous materials by air and IMDG DGR when shipping hazardous materials by water. Employees must be trained, tested, and certified in accordance with 49 CFR 172, Subpart H to determine that shipments do not constitute DOT regulated hazardous materials. Provide certifications for training in accordance with requirements provided in DOT 4500.9R.

1.4.3 Pipeline Hazardous Materials Safety Administration Certification

The hazardous materials transporter and offeror must possess a current certificate of registration issued by the Pipeline Hazardous Materials Safety Administration, when required by 49 CFR 107, Subpart G and unless an exemption applies. Submit copies of the certificates or written statements certifying exemption from these requirements.

1.4.4 Laws and Regulations Requirements

Comply with Federal, state, and local laws and regulations which are applicable. These requirements are amended frequently and compliance with amendments is required as they become effective. Notify the Contracting Officer immediately if compliance exceeds the scope of work or conflicts with specific requirements of the contract.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all the materials required for the packaging, labeling, marking, placarding and transportation of hazardous wastes and hazardous materials in conformance with Department of Transportation standards, IATA DGR, IMDG DGR, and EP 415-1-266. Details must not be construed as establishing the limits of the Contractor's responsibility.

2.1.1 Packagings

Provide bulk and non-bulk containers for packaging hazardous materials/wastes consistent with the authorizations referenced in the Hazardous Materials Table in 49 CFR 172, Section 101, Column 8. Bulk and non-bulk packaging must meet the corresponding specifications in 49 CFR 173 referenced in the Hazardous Materials Table, 49 CFR 172, Section 101. Packaging must conform to the general packaging requirements of Subpart B of 49 CFR 173, to the requirements of 49 CFR 178 at the specified packing group performance level, to the requirements of special provisions of column 7 of the Hazardous Materials Table in 49 CFR 172, Section 101, and

be compatible with the material to be packaged as required by 49 CFR 173. Also provide other packaging related materials such as materials used to cushion or fill voids in overpacked containers. The hazardous materials being packaged must not react dangerously with, decompose or ignite the sorbent packaging materials. Additionally, sorbents used to treat free liquids to be disposed of in landfills must be non-biodegradable as specified in 40 CFR 264, Section 314. In addition, packaging notifications must be provided to the Government in accordance with 49 CFR 172, Section 178.2(c) regarding type and dimensions of closures, including gaskets, needed to satisfy performance test requirements.

2.1.2 Markings

Provide markings for each hazardous material/waste package, freight container, and transport vehicle consistent with the requirements of 49 CFR 172, Subpart D; 40 CFR 262, Section 32 (for hazardous waste); 49 CFR 175 (for transport by aircraft); and IATA DGR Section 7; 49 CFR 176 for transport by vessel; IMDG DGR Part 5, Chapters 5.2; 40 CFR 761, Section 45 (for PCBs); 40 CFR 61, Section 149(d) (for asbestos); and EP 415-1-266 (for FUSRAP radionuclides). Markings must withstand a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation, without deterioration or substantial color change.

2.1.3 Labeling

Provide primary and subsidiary labels for hazardous materials/wastes consistent with the requirements in the Hazardous Materials Table in 49 CFR 172, Section 101, Column 6. Provide labels meeting design specifications required by 49 CFR 172, Subpart E including size, shape, color, printing, and symbol requirements. Labeling must meet 49 CFR 175 (for transport by aircraft) and IATA DGR Section 7, 49 CFR 176 for transport by vessel and IMDG DGR Section 5.3. Labels must be durable weather resistant and withstanding a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation, without deterioration or substantial color change.

2.1.4 Placards

For each offsite shipment of hazardous material/waste, provide primary and subsidiary placards consistent with the requirements of 49 CFR 172, Subpart F and IMDG DGR Section 5.3. Provide placards for each side and each end of bulk packaging, freight containers, transport vehicles, and rail cars requiring such placarding. Placards may be plastic, metal, or other material capable of withstanding, without deterioration, a 30 day exposure to open weather conditions and must meet design requirements specified in 49 CFR 172, Subpart F and IMDG DGR Section 5.3.

2.1.5 Spill Response Materials

Provide spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials must be available at all times when hazardous materials/wastes are being handled or transported, must be compatible with the type of material being handled, and must include a sufficient volume of materials to contain the contents of the spill.

2.2 EQUIPMENT AND TOOLS

Provide appropriate equipment and tools necessary to handle hazardous materials and hazardous wastes in a safe and environmentally sound manner.

PART 3 EXECUTION

3.1 HAZARDOUS WASTE MANAGEMENT PLAN

Prepare a Hazardous Waste Management Plan detailing the manner in which hazardous wastes must be managed and describing the types and volumes of hazardous wastes anticipated to be managed. The Hazardous Waste Management Plan must be consistent with identified environmental controls described in 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS and 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Address both onsite and offsite hazardous waste management. Describe the methods to be used to ensure accurate piece counts or weights of shipments; describe waste minimization methods; identify and describe facilities to be used for treatment, storage, and disposal (TSD); identify areas onsite where hazardous wastes are to be handled; and identify whether transfer facilities are to be used; and if so, how the wastes must be tracked to ultimate disposal. Submit the plan to the Contracting Officer for approval prior to start of work. Provide waste inspections as required by federal, state and local hazardous waste regulations. Submit written documentation of weekly hazardous waste inspections on a monthly basis.

3.2 ONSITE HAZARDOUS WASTE MANAGEMENT

Coordinate the onsite management of all hazardous materials and waste with the installation environmental function and the Contracting Officer. These paragraphs apply to Government owned waste only. Ensure compliance with Federal, state, and local hazardous waste laws and regulations and verifying those requirements when preparing reports, waste shipment records, hazardous waste manifests, or other documents. Identify hazardous wastes using criteria set forth in 40 CFR 261 or applicable state and local laws, regulations, and ordinances. Comply with generator requirements in 40 CFR 262 and applicable state or local law or regulations when accumulating hazardous waste onsite. Separate hazardous or otherwise regulated wastes from materials that are eligible for recycling or reclamation to the greatest extent practicable in accordance with Section 01 74 19 CONSTRUCTION WASTE MANGEMENT AND DISPOSAL.

Restrict onsite accumulation times to applicable time frames referenced in 40 CFR 262, Section 16, 17 and 18 based upon waste generator status, and applicable Guam or local law or regulation. Accumulation start dates commence when waste is placed into the container, unless accumulating in a Satellite Accumulation Area (SAA); then requirements of 40 CFR 262, Section 15 and state and local regulations must be followed. For waste accumulated in an SAA, the accumulation start date commences when the container exceeds the SAA volume limits and is moved to a Central Accumulation Area. Only use containers in good condition and compatible with the waste to be stored. Ensure containers are closed except when adding or removing waste, or temporary venting is necessary to support equipment operation or prevent hazardous pressure buildup. Immediately mark all hazardous waste containers with the words "hazardous waste" and other information required by 40 CFR 262, Section 32 and applicable state or local law or regulation as soon as the waste is containerized. Place additional markings on containers of "unknowns" designating the date sampled, and the suspected hazard. Inspect containers for signs of

deterioration and for responding to any spills or leaks. Inspect all hazardous waste areas weekly and provide written documentation of the inspection. For hazardous waste tank systems, perform daily inspections in accordance with 40 CFR 265 and provide written documentation of the inspections. Include date and time of inspection, name of individual conducting the inspection, problems noted, and corrective actions taken on the inspection logs.

3.2.1 Hazardous Waste Classification

Identify, in consultation with the Contracting Officer, all federal and Guam waste codes applicable to each hazardous waste stream based on requirements in 40 CFR 261 or applicable state or local law or regulation. Also identify applicable treatment standards in 40 CFR 268 and land disposal restrictions and make a determination as to whether or not the waste meets or exceeds the standards. Submit waste profiles, analyses, classification and treatment standards information to Contracting Officer for review and approval.

3.2.2 Packaging, Labeling, and Marking

Package, label, and mark hazardous materials/wastes using the specified materials and in accordance with the referenced authorizations. Mark each container of hazardous waste of 110 gallons or less with the following:

"HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal.
If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.

1) Generator's name: _____
2) Manifest Document Number (or applicable labels required by RCRA authorized state programs): _____".
3) RCRA characterization (toxic, reactive, corrosive, ignitable): _____
4) DOT shipping name and Emergency Response Guide (ERG)#: _____

3.3 OFFSITE HAZARDOUS WASTE MANAGEMENT

Coordinate the off-site transfer of all hazardous materials and waste with the installation environmental function and the Contracting Officer. Use RCRA Subtitle C permitted facilities which meet the requirements of 40 CFR 264 or facilities operating under interim status which meet the requirements of 40 CFR 265 or 40 CFR 300 Section 440 for CERCLA sites. Do not use offsite treatment, storage, and disposal facilities with significant RCRA violations or compliance problems (such as facilities known to be releasing hazardous constituents into ground water, surface water, soil, or air). Submit Notices of Non-Compliance and Notices of Violation by a Federal, state, or local regulatory agency issued to the Contractor in relation to any work performed under this contract. Immediately provide copies of such notices to the Contracting Officer. Also furnish relevant documents regarding the incident and any information requested by the Contracting Officer, and coordinate its response to the notice with the Contracting Officer or the designated representative prior to submission to the notifying authority. Also furnish a copy to the Contracting Officer of all documents submitted to the regulatory authority, including the final reply to the notice, and all other materials, until the matter is resolved.

3.3.1 Treatment, Storage, and Disposal Facility and Transporter

Provide the Contracting Officer with EPA ID numbers, names, locations, and telephone numbers of TSD facilities and transporters. This information must be contained in the Hazardous Waste Management Plan and be approved by the Contracting Officer prior to waste disposal.

3.3.2 Facility Status Information

Facilities receiving hazardous waste must be permitted in accordance with 40 CFR 270 or operating under interim status in accordance with 40 CFR 265 requirements, or permitted by a state authorized by the Environmental Protection Agency to administer the RCRA permit program. Additionally, for waste generated at CERCLA sites, prior to using a TSD Facility, contact the EPA Regional Offsite Coordinator in accordance with 40 CFR 300, Section 440, to determine the facility's status, and document all information necessary to satisfy the requirements of the EPA Offsite policy and submit this information to the Contracting Officer in the Hazardous Waste Management Plan.

3.3.3 Shipping Documents and Packagings Certification

Prior to shipment of any hazardous material offsite and a minimum of 14 days prior to anticipated pickup, provide for review written certification to the Contracting Officer that hazardous materials have been properly packaged, labeled, and marked in accordance with Department of Transportation, IATA, IMDG, and EPA or authorized state requirements. Furnish designated receiving facility packaging assurances not later than 35 days after acceptance of the shipment. The Contractor's TDC must also provide written certification regarding waste minimization efforts documenting that efforts have been taken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

3.3.4 Transportation

Prior to conducting hazardous materials activities, the Contractor responsible for pre-transportation activities must either certify to the Government that a Security Plan is in place which meets the requirements of 49 CFR 172, Subpart I IATA DGR Section 1.7, IMDG DGR Section 1.4 or in the event that the types or amounts of hazardous materials are excluded from the security planning requirements, a written statement to that effect detailing the basis for the exception. Use Uniform Hazardous Waste manifests for transporting hazardous wastes as required by 40 CFR 263 or applicable state or local law or regulation. Transportation must comply with all requirements in the Department of Transportation referenced regulations in the 49 CFR series. Prepare uniform hazardous waste manifests for each shipment of hazardous waste shipped offsite. Complete manifests using instructions in 40 CFR 262, Subpart B and applicable state or local law or regulation. Submit manifests and waste profiles to Contracting Officer for review and approval. Prepare land disposal restriction notifications as required by 40 CFR 268 for each shipment of hazardous waste. Submit notifications with the manifest to the Contracting Officer for review and approval. In accordance with DOT 4500.9R, inspect motor vehicles used to transport hazardous materials in accordance the 49 CFR and DOT safety regulations and complete DDForm 626, Motor Vehicle Inspection.

3.3.5 Treatment and Disposal of Hazardous Wastes

Coordinate any off site shipments of hazardous materials or hazardous wastes with the installation environmental function. Initial, or satellite hazardous waste accumulation is limited to 55 gallons (or 1 quart of acutely hazardous waste). Once a waste stream exceeds 55 gallons, it must be transferred to an on-site 90 day (180 day small quantity generator) accumulation area, or 270 days if the designated disposal facility is more than 200 miles away, or a permitted hazardous waste treatment, storage or disposal facility within three days. Ship hazardous wastes only to facilities which are properly permitted to accept the hazardous waste or operating under interim status. Ensure wastes are treated to meet land disposal treatment standards in 40 CFR 268 prior to land disposal. Propose TSD facilities via submission of the Hazardous Waste Management Plan, subject to the approval of the Contracting Officer. Submit Certificates of Disposal documenting the ultimate disposal, destruction or placement of hazardous wastes, CERCLA remediation waste, polychlorinated biphenyls (PCBs), G-RAM/LLRW, and asbestos within 180 days of initial shipment. Receipt of these certificates are required for final payment.

3.4 RADIOACTIVE MATERIALS MANAGEMENT

Consult with the Contracting Officer and RASO, to evaluate, prior to shipment of any material offsite, whether the material is regulated as a hazardous waste or a DOT hazardous material in addition to being regulated as a radioactive material. Management of radioactive materials/wastes must comply with Nuclear Regulatory Commission (NRC), DOT, and federal and state regulations governing management and transport. Perform the evaluation to determine proper shipping descriptions, marking requirements, and other criteria, as described below.

3.4.1 Identification of Proper Shipping Names

Use 49 CFR 172, Section .101 to identify proper shipping names for each hazardous material (including hazardous wastes and radioactive materials) to be shipped offsite. Submit proper shipping names to the Contracting Officer in the form of draft shipping documents for review and approval.

3.4.2 Packaging, Labeling, and Marking

Packaging, labeling and marking of radioactive materials must be in accordance with 49 CFR 172, and all nuclear regulatory commission (NRC) requirements and all state and local regulations.

3.4.3 Shipping Documents

Ensure that each shipment of radioactive and hazardous materials sent offsite is accompanied by properly completed shipping documents. This includes shipments of samples that may potentially meet the definition of a Department of Transportation regulated hazardous material.

3.4.3.1 Other Hazardous Material Shipment Documents

Prepare a bill of lading or dangerous goods declaration for air shipments for each shipment of hazardous material which is not a regulated hazardous waste requiring a hazardous waste manifest which fulfills the shipping paper requirements. Satisfy the requirements of 49 CFR 172, Subpart C, and 40 CFR 279 if shipping used oil and applicable state or local law or

regulation, and submit to the Contracting Officer for review and approval. For laboratory samples and treatability study samples, prepare bills of lading or dangerous goods declaration and other documentation as necessary to satisfy conditions of the sample exclusions in 40 CFR 261, Section 4(d) and (e) and any applicable state or local law or regulation. Bill of ladings or dangerous goods declarations requiring shipper's certifications must be signed by the Contractor.

3.5 SPECIAL REQUIREMENTS FOR ASBESTOS WASTES

If work involves asbestos containing wastes, manage these wastes in accordance with specification Section 02 82 00 ASBESTOS REMEDIATION.

3.5.1 Asbestos Waste Shipment Documents

Prepare waste shipment records, as required by 40 CFR 61, for shipments of asbestos. Submit waste shipment records to the Contracting Officer for review and approval.

3.6 PCB WASTE SHIPMENT DOCUMENTS

Prepare hazardous waste manifests for each shipment of PCB waste shipped offsite. Complete manifests using instructions in 40 CFR 761, Sections 207 and 208 and other applicable requirements. Submit documents to Contracting Officer for review and approval.

3.7 WASTE MINIMIZATION

Minimize the generation of hazardous waste to the maximum extent practicable and take all necessary precautions to avoid mixing clean and contaminated wastes. Identify and evaluate recycling and reclamation options as alternatives to land disposal. Requirements of 40 CFR 266 apply to: hazardous wastes recycled in a manner constituting disposal; hazardous waste burned for energy recovery; lead-acid battery recycling; and hazardous wastes with economically recoverable precious metals. Submit written certification that waste minimization efforts have been undertaken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment. Exclude hazardous waste (whether recycled, reclaimed, or sent to landfill) from waste reduction calculations in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.8 RECORDKEEPING

Maintain adequate records to support information provided to the Contracting Officer regarding exception reports, annual reports, and biennial reports; maintain hazardous waste, PCB waste and asbestos waste shipment records for a minimum of 3 years from the date of shipment or any longer period required by applicable law or regulation or other provision of this contract; and maintain bill of ladings for a minimum of 2 years from the date of shipment or longer period required by applicable law or regulation or other provision of this contract. Submit information necessary to file state annual or EPA biennial reports for hazardous waste transported, treated, stored, or disposed of under this contract and in accordance with federal and state regulatory requirements. Do not forward these data directly to the regulatory agency but to the Contracting Officer at the specified time. Submit the information necessary for filing of the formal reports in the form and format required by the

governing Federal or state regulatory agency. A cover letter must accompany the data to include the contract number, Contractor name, and project location. In the event that a manifest copy documenting receipt of hazardous waste at the treatment storage and disposal facility is not received within 45 to 60 days days of shipment initiation based on the generator status, or that a manifest copy documenting receipt of PCB waste at the designated facility is not received within 35 days of shipment initiation, prepare and submit an exception report to the Contracting Officer within 60 days of shipment initiation. Exception reports must also comply with applicable state regulations.

3.9 SPILL RESPONSE

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), or pollutant or contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), notify the Contracting Officer immediately. Direction from the Contracting Officer concerning a spill or release is not considered a change under the contract. If the spill exceeds a reporting threshold, follow the pre-established procedures for immediate reporting to the Contracting Officer. Comply with applicable requirements of Federal, state, or local laws or regulations regarding any spill incident. Transporters must comply with 49 CFR 171 Section 15 for reporting of spills and releases during tranport.

3.10 EMERGENCY CONTACTS

Comply with the emergency contact provisions in 49 CFR 172, Section 604. When shipping hazardous materials, provide a 24 hr emergency response contact and phone number of a person knowledgeable about the hazardous materials being shipped and who has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information. Monitor the phone on a 24 hour basis at all times when the hazardous materials are in transportation, including during storage incidental to transportation. Ensure that information regarding this emergency contact and phone number are placed on all hazardous material shipping documents. Designate an emergency coordinator and post the following information at areas in which hazardous wastes are managed:

a. The name of the emergency coordinator.

b. Phone number through which the emergency coordinator can be contacted on a 24 hour basis.

c. The telephone number of the local fire department.

d. The location of fire extinguishers and spill control materials.

Attachment A SAMPLE OFF-SITE POLICY CERTIFICATION MEMO	
Project/Contract #:	
Waste Stream:	
Primary TSD Facility, EPA ID # and Location:	
Alter. TSD Facility, EPA ID # and Location:	
EPA Region	Contact
I	888-372-7341 or (617) 918-1111
II	(212) 637-3660
III	800-438-2474 or 215-814-5000
IV	800-241-1754 or 404-562-9900
V	(800) 621-8431 or 312-353-2000
VI	800-887-6063 or 214-665-2210
VII	800-223-0425 or (913) 551-7003
VIII	(800) 227-8917 or (303) 312-6312
IX	(866) EPA-WEST or (415) 947-8000
X	800-424-4372 or (206) 553-1200
EPA representative contacted:	
EPA representative phone number:	
Date contacted:	
Comment:	
The above EPA representative was contacted on _____. As of that date the above sites were considered acceptable in accordance with the Off-Site Policy in 40 CFR 300 Section 440.	
Date:	Signature:
Phone number:	

-- End of Section --

SECTION 02 82 00

ASBESTOS REMEDIATION
08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2	(2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM D4397	(2016; R 2023) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E1368	(2023) Standard Practice for Visual Inspection of Asbestos Abatement Projects

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7	(2019) Standard for Compressed Air for Human Respiration; 6th Edition

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2023; ERTA 1 2023) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH NMAM	(2020; 5th Ed) NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90-018	(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

EPA 560/5-85-024	(1985) Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1926.51	Sanitation
29 CFR 1926.59	Hazard Communication
29 CFR 1926.103	Respiratory Protection
29 CFR 1926.200	Accident Prevention Signs and Tags
29 CFR 1926.1101	Asbestos
40 CFR 61-SUBPART A	General Provisions
40 CFR 61-SUBPART M	National Emission Standard for Asbestos
40 CFR 763	Asbestos
42 CFR 84	Approval of Respiratory Protective Devices
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 174	Carriage by Rail

U.S. NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND (NAVFAC)

NAVFAC P-502	(2017) Asbestos Program Management
ND OPNAV M-5100.23	(2020; Rev G) Navy Safety and Occupational Health Manual

UL SOLUTIONS (UL)

UL 586	(2009; Reprint Sep 2022) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 Amended Water

Water containing a wetting agent or surfactant with a maximum surface tension of 0.00042 psi.

1.2.2 Area Sampling

Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.2.3 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite and any of these minerals that have been chemically treated or altered.

1.2.4 Asbestos Containing Material (ACM)

Any material which contains greater than 1 percent asbestos.

1.2.5 Asbestos Containing Construction Material (ACCM)

Any manufactured construction material which contains more than 1/10th of 1 percent asbestos by weight.

1.2.6 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

1.2.7 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.2.8 Asbestos Permissible Exposure Limit

0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.

1.2.9 Authorized Person

Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

1.2.10 Background

The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

1.2.11 Competent Person (CP)

A person meeting the requirements for competent person as specified in 29 CFR 1926.1101 including a person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, and is specifically trained in a training course which meet the criteria of EPA's Model Accreditation Plan (40 CFR 763) for project designer or supervisor, or its equivalent. The competent person must have a current asbestos contractors or supervisors license.

1.2.12 Contractor

The Contractor is that individual, or entity under contract to perform the herein listed work.

1.2.13 Disposal Bag

A 6 mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101 or applicable state regulations, used for transporting asbestos waste from containment to disposal site.

1.2.14 Disturbance

Activities that disrupt the matrix of ACM or ACCM, crumble or pulverize ACM or ACCM, or generate visible debris from ACM or ACCM. Disturbance includes cutting away small amounts of ACM or ACCM, no greater than the amount which can be contained in one standard sized glovebag or waste bag, not larger than 60 inches in length and width or as required by state or local regulations in order to access a building component.

1.2.15 Encapsulation

The abatement of an asbestos hazard through the appropriate use of a physical barrier or chemical encapsulants.

1.2.16 Encapsulants

Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.

a. Removal Encapsulant (can be used as a wetting agent)

b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)

c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)

d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).

1.2.17 Friable Asbestos Material

A term defined in 40 CFR 61-SUBPART M and EPA 340/1-90-018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

1.2.18 Glovebag Technique

Those asbestos removal and control techniques put forth in 29 CFR 1926.1101.

1.2.19 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters must retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

1.2.20 Model Accreditation Plan (MAP)

USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763.

1.2.21 Negative Pressure Enclosure (NPE)

That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101 or applicable state regulations.

1.2.22 NESHAP

National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61-SUBPART M. Requirements associated with demolition and renovation activities are found in Section 61.145 of the NESHAP while requirements associated with waste disposal are found in Section 61.150.

1.2.23 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos fibers are not normally released during appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, removal, or mishap.

1.2.24 Permissible Exposure Limits (PELs)

1.2.24.1 PEL-Time Weighted Average(TWA)

Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8-hour time weighted average (TWA).

1.2.24.2 PEL-Excursion Limit

An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

1.2.25 Personal Sampling

Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

1.2.26 Presumed ACM

Any material which cannot be sampled at the time of the initial inspection due to inaccessibility, structural or safety concerns (such as charged electrical components), or could void active warranties (such as roofing materials). Presumed ACM must be managed as ACM unless proven to not be ACM through testing by a qualified and certified asbestos professional.

1.2.27 Private Qualified Person (PQP)

A Registered Architect, Professional Engineer, Certified Industrial Hygienist, consultant or other qualified person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan as described in 40 CFR 763 as a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer. The PQP that collects samples and elects to analyze samples on site must successfully complete the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent, and must participate in the American Industrial Hygiene Association (AIHA) Asbestos Analysis Registry (AAR). The PQP must be appropriately licensed accordance with the USEPA authorized State (or local) certification and accreditation program.

1.2.28 TEM

Refers to Transmission Electron Microscopy.

1.2.29 Thermal System Insulation

Thermal system insulation (TSIACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain.

1.2.30 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

1.2.31 Transite

A generic name for asbestos cement wallboard and pipe.

1.2.32 Wetting Agent

A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 0.00042 psi.

1.2.33 Worker

Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required

by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation, if required by the OSHA Class of work to be performed or by the state where the work is to be performed. The worker must be appropriately licensed accordance with the USEPA authorized State (or local) certification and accreditation program.

1.3 REQUIREMENTS

1.3.1 Description of Work

A hazardous material survey report is attached at the end of this section. The approximate locations and amounts are presented in the hazardous material survey report. The following table provides a summary of ACM and estimated quantities.

Location	Asbestos Containing Materials	Estimated Quantities*	Remarks
B2550, B2551, and B2552	Vinyl floor tiles, mastic, floor coating materials, roof paint/skim coat, caulking, etc.	Refer to HAZMAT Survey Report. Table 2 and Drawings C-1 to C-7 for the Estimated Quantities and Locations.	None
IRP Field Office Drainage Pipes -Concrete Cement Pipe	Assumed Asbestos Cement Pipes (ACP)	400 linear ft. Refer to HAZMAT Survey Report, Table 2 and Figure 3 for the information.	No asbestos sampling was conducted during the HAZMAT Survey.
Areas to be cleared/grubbed	Abandoned ACP	390 linear ft. Refer to HAZMAT Survey Report, Table 2 and Figure C-8 for the information.	The 130 of 390 ft abandoned ACP (HM ID 66, 67, and 68) are located in the Bid Option Area (Area 9). However, the removal of 130-ft ACP must be included in the base bid.
Areas to be cleared/grubbed	Abandoned black coating metal debris	40 square ft. Refer to HAZMAT Survey Report, Table 2 and Figure C-8 for the information.	None

Location	Asbestos Containing Materials	Estimated Quantities*	Remarks
Existing waterlines to be removed	ACP	6,700 linear ft. Assume ACP for all existing waterlines to be removed in accordance with CD-Series, Demolition Plan.	None

*Estimated Quantities: The Contractor must verify, prior to bidding, the location and volumes of hazardous materials and determine the appropriate hazard control measures based on the area and material to be disturbed. The estimated quantities of materials provided in this section and the survey report are based on visual approximations during the survey or available drawings/references and must not be used for bidding purposes.

The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures must be outlined in the Asbestos Hazard Abatement Plan called for elsewhere. The asbestos work includes the demolition and removal which is governed by 40 CFR 763 and NAVFAC P-502. Under normal conditions non-friable or chemically bound materials containing asbestos would not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal and therefore must be handled in accordance with the removal and disposal procedures as specified herein. Provide negative pressure enclosure or wet removal techniques as outlined. The building or work area must be evacuated during the asbestos abatement work. A competent person must supervise asbestos removal work as specified herein.

1.3.2 Unexpected Discovery of Asbestos

Notify the Contracting Officer if any previously untested building components suspected to contain asbestos are impacted by the work.

The project site includes multiple waste debris/stockpiles as shown in the Demolition Plan. Collect up to 50 suspected asbestos materials at no additional cost to the Government, to characterize unforeseen suspect ACM that were previously not tested or to be assumed to contain asbestos. Use a triplicate sampling method (i.e. collect 3 samples from a suspected asbestos material). Submit the Asbestos Sampling and Analytical Report.

1.3.3 Medical Requirements

Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.

1.3.3.1 Medical Examinations

Contractor must submit documentation of workers who perform activities potentially impacted ACM or ACCM including the name of each employee, type of exam received, and date of the exam. The documentation must also

include a signed statement that the medical examination was reviewed by the contractor's Safety Manager and Industrial Hygienist stating that the listed personnel have received the required medical examination in accordance with 29 CFR 1926.1101 and the exam results are saved. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination must be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."

1.3.3.2 Medical Records

Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of indefinite time after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.

1.3.4 Employee Training

Submit certificates, prior to the start of work but after the main abatement submittal, signed by each employee indicating that the employee has received training in the proper handling of materials and wastes that contain asbestos in accordance with 40 CFR 763; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in 29 CFR 1926.1101 on an initial and annual basis. Organize certificates by individual worker, not grouped by type of certification. Make training requirement records readily available in accordance with 40 CFR 763. Train personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. Document the training by providing: dates of training, training entity, course outline, names of instructors, and qualifications of instructors upon request by the Contracting Officer. Furnish each employee with respirator training and fit testing administered by the PQP as required by 29 CFR 1926.1101 and 29 CFR 1926.103. Fully cover engineering and other hazard control techniques and procedures. Asbestos workers must have a current in accordance with the USEPA authorized State (or local) certification and accreditation program.

1.3.5 Permits, Licenses, and Notifications

Prior to the start of work, obtain necessary permits and licenses in conjunction with asbestos removal, encapsulation, hauling, and disposition, and furnish notification of such actions required by Federal, State, regional, and local authorities. Notify the GEPA air pollution control district/agency and the Contracting Officer in writing 30 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M and applicable GEPA requirements. Notify the Contracting Officer and other appropriate Government agencies in writing 20 working days prior to the start of asbestos work as indicated in applicable laws, ordinances,

criteria, rules, and regulations. Submit copies of all Notifications to the Contracting Officer.

1.3.6 Environment, Safety and Health Compliance

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of EM 385-1-1, 29 CFR 1926.1101, 40 CFR 61-SUBPART A, 40 CFR 61-SUBPART M, 40 CFR 763 and ND OPNAV M-5100.23. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Government apply. The following laws, ordinances, criteria, rules and regulations regarding removal, handling, storing, transporting and disposing of asbestos materials apply:

a. (2020 or most current) Installation Hazardous Materials Management Plan

1.3.7 Respiratory Protection Program

Establish and implement a respirator program as required by 29 CFR 1926.1101, and 29 CFR 1926.103 and applicable state and local regulations. Submit a written description of the program to the Contracting Officer. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.

1.3.7.1 Respirator Program Records

Submit records of the respirator program as required by 29 CFR 1926.103, and 29 CFR 1926.1101.

1.3.7.2 Respirator Fit Testing

The Contractor's PQP must conduct a qualitative or quantitative fit test conforming to 29 CFR 1926.103 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test must be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that affects the fit, a new fit test must be performed. Functional fit checks must be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.3.7.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by 29 CFR 1926.1101 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators must be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter must be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type must be made by the Contractor's Designated IH based on the measured

or anticipated airborne asbestos fiber concentrations to be encountered.

1.3.8 Asbestos Hazard Control Supervisor

The Contractor must be represented on site by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

1.3.9 Hazard Communication

Adhere to all parts of 29 CFR 1926.59 and provide the Contracting Officer with a copy of the Safety Data Sheets (SDS) for all materials brought to the site.

1.3.10 Asbestos Hazard Abatement Plan

Submit a detailed plan of the safety precautions such as lockout, tagout, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the removal and demolition of materials containing asbestos. The plan, not to be combined with other hazard abatement plans, must be prepared, signed, and sealed by the PQP. Provide a Table of Contents for each abatement submittal, which follows the sequence of requirements in the contract. The plan must include but not be limited to the precise personal protective equipment to be used including, but not limited to, respiratory protection, type of whole-body protection and if reusable coveralls are to be employed, an outer disposable layer such as disposable whole body cover must be employed over the top of the coveralls, the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan must also include (both fire and medical emergency) response plans and an Activity Hazard Analyses (AHAs) in accordance with EM 385-1-1. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work. The Contractor, Asbestos Hazard Control Supervisor, CP and PQP must meet with the Contracting Officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan must be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to starting work.

1.3.11 Testing Laboratory

Submit the name, address, telephone number, and appliable laboratory certification(s) of each testing laboratory selected for the sampling, analysis, and reporting of airborne concentrations of asbestos fibers along with evidence that each laboratory selected holds the appropriate State license and permits and certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is

accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis. The testing laboratory firm must be independent of the asbestos contractor and must have no employee or employer relationship which could constitute a conflict of interest.

1.3.12 Landfill Approval

Submit written evidence that the landfill is approved for asbestos disposal by the U.S. Environmental Protection Agency and GEPA. Within three working days after delivery, submit detailed delivery tickets, prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the waste shipment records within one day of the shipment leaving the project site.

1.3.13 Transporter Certification

Submit written evidence that the transporter is approved to transport asbestos waste in accordance with the DOT requirements of 49 CFR 171, 49 CFR 172, 49 CFR 173, 49 CFR 174, IMDG DGR for water transportation, as well as registration requirements of 49 CFR 107 and all other State and local regulatory agency requirements.

1.3.14 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work but after the main abatement submittal.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Asbestos Sampling And Analytical Report; G

SD-03 Product Data

Amended Water; G

Safety Data Sheets (SDS) for All Materials; G

Respirators; G

Local Exhaust Equipment; G

Pressure Differential Automatic Recording Instrument; G

Vacuums; G

Glovebags; G

SD-06 Test Reports

Air Sampling Results; G

Pressure Differential Recordings for Local Exhaust System; G

Clearance Sampling; G

Asbestos Disposal Quantity Report; G

SD-07 Certificates

Employee Training; G

Notifications; G

Respiratory Protection Program; G

Asbestos Hazard Abatement Plan; G

Testing Laboratory; G

Landfill Approval; G

Delivery Tickets; G

Waste Shipment Records; G

Transporter Certification; G

Medical Certification; G

Private Qualified Person Documentation; G

Designated Competent Person; G

Worker's License; G

Contractor's License; G

Federal, State or Local Citations on Previous Projects; G

Equipment Used to Contain Airborne Asbestos Fibers; G

Water Filtration Equipment; G

Vacuums; G

Ventilation Systems; G

SD-11 Closeout Submittals

Permits and Licenses; G

Notifications; G

Respirator Program Records; G

Rental Equipment; G

1.5 QUALITY ASSURANCE

1.5.1 Private Qualified Person Documentation

Submit the name, address, and telephone number of the PQP selected to prepare the Asbestos Hazard Abatement Plan, direct monitoring and training, and documented evidence that the PQP has successfully completed training in and is accredited and where required is certified as, a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer as described by 40 CFR 763 . The PQP must be appropriately licensed by the USEPA authorized State (or local) certification and accreditation program as a Project Monitor. The PQP and the asbestos contractor must not have an employee/employer relationship or financial relationship which could constitute a conflict of interest. The PQP must be a first tier subcontractor.

1.5.2 Designated Competent Person Documentation

The Designated Competent Person must be experienced in the administration and supervision of asbestos abatement projects including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite. The Designated Competent Person must be on-site at all times when asbestos abatement activities are underway.Submit training certification and a current USEPA authorized State or local Asbestos Contractor's and Supervisor's License. Submit evidence that the Designated Competent Person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA designated competent person requirements. The Designated Competent Person must be a first tier subcontractor.

1.5.3 Worker's License

Submit documentation that workers meet the requirements of 29 CFR 1926.1101, 40 CFR 61-SUBPART M and have a current USEPA authorized State (or local) Asbestos Workers License.

1.5.4 Contractor's License

Submit a copy of the asbestos contractor's license issued by the USEPA authorized State (or local). Submit the following certification along with the license: "I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61-SUBPART MEM 385-1-1, and the Federal, State and local requirements for those asbestos abatement activities that they will be involved in." This certification statement must be signed by the Company's President or Chief Executive.

1.5.5 Air Sampling Results

Complete fiber counting and provide results to the PQP for review within 16 hours of the "time off" of the sample pump. Notify the Contracting Officer immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Contracting Officer

and the affected Contractor employees where required by law within three working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the PQP. Notify the Contractor and the Contracting Officer immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.01 fibers per cubic centimeter or background whichever is higher. In no circumstance must levels exceed 0.1 fibers per cubic centimeter.

1.5.6 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.02 inches of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the asbestos control area is removed. Submit pressure differential recordings for each work day to the PQP for review and to the Contracting Officer within 24-hours from the end of each work day.

1.5.7 Federal, State or Local Citations on Previous Projects

Submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities within the last 5 years (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company must be provided and this must be applicable for the Contractor and all Subcontractors.

1.5.8 Preconstruction Conference

Conduct a safety preconstruction conference to discuss the details of the Asbestos Hazard Abatement Plan, Accident Prevention Plan (APP) including the AHAs required in specification Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. The safety preconstruction conference must include the Contractor and their Designated Competent Person, Designated IH and Project Supervisor and the Contracting Officer. Deficiencies in the APP must be discussed. Onsite work must not begin until the APP has been accepted.

1.6 SECURITY

Site security must be provided for each regulated area. A log book must be kept documenting entry into and out of the regulated area. Entry into regulated areas must only be by personnel authorized by the Contractor and the Contracting Officer. Personnel authorized to enter regulated areas must be trained, medically evaluated, and wear the required personal protective equipment.

1.7 EQUIPMENT

1.7.1 Rental Equipment

Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

PART 2 PRODUCTS

2.1 DUCT TAPE

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container.

2.2 DISPOSAL CONTAINERS

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers must be provided for ACM wastes, and presumed ACM wastes, as required by 29 CFR 1926.1101 and state and local regulatory requirements. Disposal containers can be in the form of:

a. Disposal Bags

b. Fiberboard Drums

c. Cardboard Boxes

2.3 SHEET PLASTIC

Sheet plastic must be polyethylene of 6 mil minimum thickness and must be provided in the largest sheet size necessary to minimize seams. Film must be clear, frosted, or black and conform to ASTM D4397, except as specified below

2.3.1 Reinforced

Reinforced sheets must be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock must consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film must meet flame resistant standards of NFPA 701.

2.4 MASTIC REMOVING SOLVENT

Mastic removing solvent must be nonflammable and must not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite must have a flash point greater than 140 degrees F.

Prior to approving the use of mastic removing solvent for renovation projects where a new material is placed on the treated surface, the treated surface with mastic removing solvent must be completely removed. Remaining mastic removing solvent may react with glues and mastic of the new product.

2.5 LEAK-TIGHT WRAPPING

Two layers of 6 mil minimum thick polyethylene sheet stock must be used for the containment of removed asbestos-containing components or materials such as large tanks, boilers, insulated pipe segments and other materials. Upon placement of the ACM component or material, each layer must be individually leak-tight sealed with duct tape.

2.6 VIEWING INSPECTION WINDOW

Where feasible, a minimum of one clear, 1/8 inch thick, acrylic sheet, 18

by 24 inches, must be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows must be sealed leak-tight with industrial grade duct tape.

2.7 WETTING AGENTS

Removal encapsulant (a penetrating encapsulant) must be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant must be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS above.

PART 3 EXECUTION

3.1 EQUIPMENT

Provide manufacturer's certificate of compliance for all equipment used to contain airborne asbestos fibers.

3.1.1 Air Monitoring Equipment

The Contractor's PQP must approve air monitoring equipment. The equipment must include, but must not be limited to:

a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute.

b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps must also be equipped with an automatic flow control unit which must maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.

d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands when conducting environmental area sampling using NIOSH NMAM Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).

e. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

3.1.2 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

3.1.2.1 Respirators for Handling Asbestos

Provide personnel engaged in pre-cleaning, cleanup, handling, removal or demolition of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101 and 29 CFR 1926.103. Breathing air must comply with CGA G-7.

3.1.3 Exterior Whole Body Protection

3.1.3.1 Outer Protective Clothing

Provide personnel exposed to asbestos with disposable "non-breathable," whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but must not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape.

3.1.3.2 Personal Decontamination Unit

Provide a temporary, negative pressure unit with a separate decontamination locker room and clean locker room with a shower that complies with 29 CFR 1926.51(f)(4)(ii) through (V) in between for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Wastewater filters must be installed in series with the first stage pore size 20 microns and the second stage pore size of 5 microns. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste. Keep the floor of the decontamination unit's clean room dry and clean at all times. Proper housekeeping and hygiene requirements must be maintained. Provide soap and towels for showering, washing and drying. Cloth towels provided must be disposed of as ACM waste. Physically attach the decontamination units to the asbestos control area. Construct both a personnel decontamination unit and an equipment decontamination unit onto and integral with each asbestos control area.

3.1.3.3 Eye Protection

Provide eye protection that complies with ANSI/ISEA Z87.1 when operations present a potential eye injury hazard. Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.

3.1.4 Regulated Areas

All Class I, II, and III asbestos work must be conducted within regulated areas. The regulated area must be demarcated to minimize the number of

persons within the area and to protect persons outside the area from exposure to airborne asbestos. Control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

3.1.5 Load-out Unit

Provide a temporary load-out unit that is adjacent and connected to the regulated area. Attach the load-out unit in a leak-tight manner to each regulated area.

3.1.6 Warning Signs and Labels

Provide warning signs printed in English at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to the requirements are acceptable

3.1.6.1 Warning Sign

Provide vertical format conforming to 29 CFR 1926.200 and 29 CFR 1926.1101 minimum 20 by 14 inches displaying the following legend in the lower panel:

Legend	Notation
DANGER	one inch Sans Serif Gothic or Block
ASBESTOS	one inch Sans Serif Gothic or Block
MAY CAUSE CANCER	one inch Sans Serif Gothic or Block
CAUSES DAMAGE TO LUNGS	1/4 inch Sans Serif Gothic or Block
AUTHORIZED PERSONNEL ONLY	1/4 inch Sans Serif Gothic or Block
WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA	1/4 inch Sans Serif Gothic or Block

Spacing between lines must be at least equal to the height of the upper of any two lines.

3.1.6.2 Warning Labels

Provide labels conforming to Guam regulations and 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST AVOID CREATING DUST

3.1.7 Local Exhaust System

Provide a local exhaust system in the asbestos control area in accordance with ASSP Z9.2 and 29 CFR 1926.1101 that provides at least four air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the asbestos control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the control area of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. The building ventilation system must not be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment must conform to ASSP Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

3.1.8 Tools

Vacuums must be leak proof to the filter and equipped with HEPA filters. Filters on vacuums must conform to ASSP Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse. Reusable tools must be thoroughly decontaminated prior to being removed from the regulated areas.

3.1.9 Rental Equipment

If rental equipment is to be used, furnish written notification to the rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

3.1.10 Glovebags

Submit written manufacturers proof that glovebags do not break down under expected temperatures and conditions.

3.1.11 Single Stage Decontamination Area

A decontamination area (equipment room/area) must be provided for Class I work involving less than 25 feet or 10 square feet of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment. The equipment room or area must be adjacent to the regulated area for the decontamination of employees, material, and their equipment which could be contaminated with asbestos. The area must be covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and

removing personal protective equipment without spreading contamination beyond the area.

3.1.12 Decontamination Area Exit Procedures

Ensure that the following procedures are followed:

a. Before leaving the regulated area, remove all gross contamination and debris from work clothing using a HEPA vacuum.

b. Employees must remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers for disposal.

c. Employees must not remove their respirators until showering.

d. Employees must shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, ensure that employees engaged in Class I asbestos jobs: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.

3.2 WORK PROCEDURE

Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, NAVFAC P-502, and as specified herein. Use wet or removal procedures as listed in the asbestos hazard abatement plan and/or negative pressure enclosure techniques. Wear and utilize protective clothing and equipment as specified herein. No eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics is permitted in the asbestos work or control areas. Personnel of other trades not engaged in the removal and demolition of asbestos containing material must not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection and training provisions of this specification are complied with by the trade personnel. Seal all roof top penetrations, except plumbing vents, prior to asbestos roofing work. Power to the regulated area must be locked-out and tagged in accordance with 29 CFR 1910.147. Disconnect electrical service when wet removal is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection prior to the use of any water. All electrical work must be performed by a licensed electrician. Stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. Correct the condition to the satisfaction of the Contracting Officer, including visual inspection and air sampling. Work must resume only upon notification by the Contracting Officer. Corrective actions must be documented. If an asbestos fiber release or spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the Contracting Officer including clearance sampling, prior to resumption of work.

3.2.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it must be restored to its original condition or decontaminated by the Contractor as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the PQP work may proceed at the discretion of the Contracting Officer.

3.2.2 Precleaning

Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.

3.2.3 Asbestos Control Area Requirements

3.2.3.1 Negative Pressure Enclosure

Removal of asbestos contaminated acoustical ceiling tiles, spray applied fireproofing, thermal system insulation, gypsum wallboard/joint compound require the use of a negative pressure enclosure. Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area. Negative pressure enclosure development must include protective covering of uncontaminated walls, and ceilings with a continuous membrane of two layers of minimum 6-mil plastic sheet sealed with tape to prevent water or other damage. Provide two layers of 6-mil plastic sheet over floors and extend a minimum of 12 inches up walls. Seal all joints with tape. Provide local exhaust system in the asbestos control area. Openings are allowed in enclosures of asbestos control areas for personnel and equipment entry and exit, the supply and exhaust of air for the local exhaust system and the removal of properly containerized asbestos containing materials. Replace local exhaust system filters as required to maintain the efficiency of the system.

3.2.3.2 Glovebag

If the construction of a negative pressure enclosure is infeasible for the removal, use alternate techniques as indicated in 29 CFR 1926.1101. Establish designated limits for the asbestos regulated area with the use of rope or other continuous barriers, and maintain all other requirements for asbestos control areas. The PQP must conduct personal samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds background or 0.01 fibers per cubic centimeter whichever is greater, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Contracting Officer. This sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those obtained by the Contractor, the Government will determine which results predominate. If adjacent areas are contaminated as determined by the Contracting

Officer, clean the contaminated areas, monitor, and visually inspect the area as specified herein.

3.2.3.3 Regulated Area for Class II Removal

Removal of asbestos containing floor tile/mastic, carpet/mastic, or sealants are Class II removal activities. Establish designated limits for the asbestos regulated work area with the use of red barrier tape; install critical barriers, splash guards and signs, and maintain all other requirements for asbestos control area except local exhaust. Place impermeable dropcloths on surfaces beneath removal activity extending out 3 feet in all directions. A detached decontamination system may be used. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.4 Removal Procedures

Wet asbestos material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water or wetting agent in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Contracting Officer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation, wrap the pipes and insulation in plastic and remove the pipe by sections. Containerize asbestos containing material while wet. Do not allow asbestos material to accumulate or become dry. Lower and otherwise handle asbestos containing material as indicated in 40 CFR 61-SUBPART M.

3.2.4.1 Sealing Contaminated Items Designated for Disposal

Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal by completely coating the items with an asbestos lock-down encapsulant at the demolition site before removing the items from the asbestos control area. These items need not be vacuumed. The asbestos lock-down encapsulant must be tinted a contrasting color and spray-applied by airless method. Thoroughness of sealing operation must be visually gauged by the extent of colored coating on exposed surfaces. Lock-down encapsulants must comply with the performance requirements specified herein.

3.2.4.2 Exposed Pipe Insulation Edges

Contain edges of asbestos insulation to remain that are exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 1/4 inch thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by at least 4 inches. When

insulating cement and cloth is an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the Contracting Officer.

3.2.4.3 Presumed ACM

Presumed ACM must be treated as ACM throughout the abatement and disposal process. Testing can be performed by a trained and certified asbestos professional following applicable local, state, and federal regulations to either confirm the material is ACM or non-ACM. If testing proves asbestos is not present, the material can be managed as non-ACM.

3.2.5 Methods of Compliance

3.2.5.1 Mandated Practices

The specific abatement techniques and items identified must be detailed in the Contractor's Asbestos Hazard Abatement Plan (AHAP). Use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

a. Vacuum cleaners equipped with HEPA filters.

b. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.

c. Prompt clean-up and disposal.

d. Inspection and repair of polyethylene.

e. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

3.2.5.2 Control Methods

Use the following control methods:

a. Local exhaust ventilation equipped with HEPA filter;

b. Enclosure or isolation of processes producing asbestos dust;

c. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, use them to reduce employee exposure to the lowest levels attainable and must supplement them by the use of respiratory protection.

3.2.5.3 Unacceptable Practices

The following work practices must not be used:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

b. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

c. Dry sweeping, shoveling, or other dry clean up.

d. Employee rotation as a means of reducing employee exposure to asbestos.

3.2.6 Class I Work Procedures

In addition to requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

a. A Competent Person must supervise the installation and operation of the control methods.

b. For jobs involving the removal of more than 25 feet or 10 square feet of TSI or surfacing material, place critical barriers over all openings to the regulated area.

c. HVAC systems must be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.

d. Impermeable dropcloths (6 mil or greater thickness) must be placed on surfaces beneath all removal activity.

e. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area must be ventilated with a HEPA unit and employees must use PPE.

3.2.7 Specific Control Methods for Class I Work

Use Class I work procedures, control methods and removal methods for the following ACM:

a. Spray Applied Fireproofing

b. Gypsum Wallboard and Joint Compound

c. Thermal System Insulation and Mudded Pipe Fittings

d. Plaster and Textured Ceilings and Walls

e. Vermiculite insulation

3.2.7.1 Negative Pressure Enclosure (NPE) System

The system must provide at least four air changes per hour inside the containment. The local exhaust unit equipment must be operated 24-hours per day until the containment is removed. The NPE must be smoke tested for leaks at the beginning of each shift and be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential must be monitored continuously, 24-hours per day, with an automatic manometric recording instrument and records must be provided daily on the same day collected to the Contracting Officer. The Contracting Officer must be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system must not be used as the local exhaust system for the regulated area. The NPE must terminate outdoors unless an alternate arrangement is allowed by the Contracting Officer. All filters used must be new at the beginning of the project and must be periodically changed as necessary and disposed of as ACM waste.

3.2.7.2 Glovebag Systems

Glovebags must be used without modification, smoke-tested for leaks, and completely cover the circumference of pipe or other structures where the work is to be done. Glovebags must be used only once and must not be moved. Glovebags must not be used on surfaces that have temperatures exceeding 150 degrees F. Prior to disposal, glovebags must be collapsed using a HEPA vacuum. Before beginning the operation, loose and friable material adjacent to the glovebag operation must be wrapped and sealed in two layers of plastic or otherwise rendered intact. At least two persons must perform glovebag removal. Asbestos regulated work areas must be established for glovebag abatement. Designated boundary limits for the asbestos work must be established with rope or other continuous barriers and all other requirements for asbestos control areas must be maintained, including area signage and boundary warning tape.

a. Attach HEPA vacuum systems to the bag to prevent collapse during removal of ACM.

b. The negative pressure glove boxes must be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or other material which can withstand the weight of the ACM and water used during removal. A negative pressure must be created in the system using a HEPA filtration system. The box must be smoke tested for leaks prior to each use.

3.2.7.3 Mini-Enclosure

Mini-containment (small walk-in enclosure) to accommodate no more than two persons, may be used if the disturbance or removal can be completely contained by the enclosure. The mini-enclosure must be inspected for leaks and smoke tested before each use. Air movement must be directed away from the employee's breathing zone within the mini-enclosure.

3.2.7.4 Wrap and Cut Operation

Prior to cutting pipe, the asbestos-containing insulation must be wrapped with polyethylene and securely sealed with duct tape to prevent asbestos becoming airborne as a result of the cutting process. The following steps must be taken: install glovebag, strip back sections to be cut 6 inches from point of cut, and cut pipe into manageable sections.

3.2.7.5 Class I Removal Method

Class I ACM must be removed using a control method described above. Prepare work area as previously specified. Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area. Spread one layer of 6-mil seamless plastic sheeting on the floor below the work area. Remove asbestos containing spray applied fireproofing using a scraper and wet methods and immediately place into 6-mil thickness disposal bag. After removal of the material use a wire brush to clean the exposed substrate to remove residual material. Continue wet cleaning until surfaces are free of visible debris. Cut manageable sections of gypsum wallboard and joint compound and immediately place into a 6-mil minimum thickness disposal bag or other approved container. Make every effort to keep the material from falling to the floor of the work area. Use a wire brush and wet clean to remove residual

material from studs. Continue wet cleaning until the surface is clean of visible material and encapsulate stud walls. Remove ACM thermal system insulation and mudded pipe fittings using mechanical means and wet methods and immediately place into 6-mil thickness disposal bag. Continue wet cleaning until surfaces are free of visible debris. Remove ACM plaster ceilings or walls using mechanical means and adequately wet methods and immediately place into 6-mil thickness disposal bag. Make every effort to keep the material from falling to the floor of the work area. Continue wet cleaning until surfaces are free of visible debris. Remove ACM textured ceiling finish using a scraper and wet methods and immediately place into 6-mil thickness disposal bag. Floors are considered contaminated from fallen textured ceiling finish. Clean up debris on floor and dispose of carpet as asbestos contaminated material. After removal of the material use a wire brush to clean the exposed concrete ceiling to remove residual material. Continue wet cleaning until surfaces are free of visible debris. Remove ACM vermiculite using mechanical means and adequately wet methods and immediately place into 6-mil thickness disposal bag. Make every effort to keep the material from falling to the floor of the work area. Continue wet cleaning until surfaces are free of visible debris. Bag all asbestos debris which has fallen to the floor as asbestos-containing debris. Place all debris in plastic disposal bags of 6-mil minimum thickness. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duct tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers or the designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work, and immediately correct the situation.

3.2.8 Class II Work Procedures

In addition to the requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

a. A Competent Person must supervise the work.

b. For indoor work, critical barriers must be placed over all openings to the regulated area.

c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

3.2.9 Specific Control Methods for Class II Work

3.2.9.1 Vinyl and Asphaltic Flooring Materials, Carpet and Mastic

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. A detached decontamination system may be used. When removing vinyl floor tile and mastic, carpet and mastic which contains ACM, use the following

practices. Remove floor tile and mastic, carpet and mastic using adequately wet methods. Remove floor tiles, carpet and mastic intact (if possible). Wetting is not required when floor tiles are heated and removed intact. Do not sand flooring or its backing. Scrape residual adhesive and backing using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duct tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.9.2 Sealants and Mastic

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers and signs, and maintain all other requirements for asbestos control area except local exhaust. Spread 6-mil plastic sheeting on the ground around the perimeter of the work area extending out in all directions. Using adequately wet methods, carefully remove the ACM sealants and mastics using a scraper of knife blade. As it is removed place the material into a disposal bag. Make every effort to keep the asbestos material from falling to the ground or work area floor below. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter and disposable dust bag. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duct tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or at designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.9.3 Roofing Materials

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing roofing materials which contain ACM as described in 29 CFR 1926.1101(g)(8)(ii), use the following practices. Roofing material must be removed in an intact state. Wet methods must be used to remove roofing materials that are not intact, or to be rendered not intact during

removal, unless such wet methods are not feasible or create safety hazards. When removing built-up roofs, with asbestos-containing roofing felts and an aggregate surface, using a power roof cutter, all dust resulting from the cutting operations must be collected by a HEPA dust collector, or must be HEPA vacuumed by vacuuming along the cut line. Asbestos-containing roofing material must not be dropped or thrown to the ground, but must be lowered to the ground via covered, dust-tight chute, crane, hoist or other method approved by the Contracting Officer. Any ACM that is not intact must be lowered to the ground as soon as practicable, but not later than the end of the work shift. While the material remains on the roof it must be kept wet or placed in an impermeable waste bag or wrapped in plastic sheeting. Intact ACM must be lowered to the ground as soon as practicable, but not later than the end of the work shift. Unwrapped material must be transferred to a closed receptacle. Critical barriers must be placed over roof level heating and ventilation air intakes. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.9.4 Cementitious Siding and Shingles or Transite Panels

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing cementitious asbestos-containing siding, shingles or Transite panels use the following work practices. Intentionally cutting, abrading or breaking is prohibited. Each panel or shingle must be sprayed with amended water or wetting agent prior to removal. Nails must be cut with flat, sharp instruments. Unwrapped or unbagged panels or shingles must be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duct tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.9.5 Gaskets

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. Gaskets must be thoroughly wetted with amended water or wetting agent prior to removal and immediately placed in a disposal container. If a gasket is visibly deteriorated and unlikely to be removed intact, removal must be undertaken within a glovebag. Any scraping to remove residue must be performed wet. Place debris into a 6-mil minimum thickness disposal bag or other approved

container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duct tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.10 Abatement of Asbestos Contaminated Soil

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. Asbestos contaminated soil must be removed from areas to a minimum depth of 2 inches. Abatement of asbestos contaminated soil must be performed in accordance with all federal, state, and local regulations. Soil must be thoroughly dampened with amended water and then removed by manual shoveling into labeled containers. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duct tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11 Air Sampling

Perform sampling of airborne concentrations of asbestos fibers in accordance with 29 CFR 1926.1101, the Contractor's air monitoring plan, applicable local, state and federal regulations, and as specified herein. Sampling performed in accordance with 29 CFR 1926.1101 must be performed by the PQP. Sampling performed for environmental and quality control reasons must be performed by the PQP. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate. Results of breathing zone samples must be made available to the tested employees and Contracting Officer.. Submit all documentation regarding initial exposure assessments, negative exposure assessments, and air-monitoring results.

3.2.11.1 Sampling Prior to Asbestos Work

Provide area air sampling and establish the baseline one day prior to the masking and sealing operations for each demolition or removal site. Establish the background by performing area sampling in similar but uncontaminated sites in the building.

3.2.11.2 Sampling During Asbestos Work

The PQP must provide personal and area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Breathing zone samples must be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Air sample fiber counting must be completed and results provided within 24-hours (breathing zone samples), and 24 hours (environmental/clearance monitoring) after completion of a sampling period. In addition, provided the same type of work is being performed, provide area sampling at least once every work shift close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately. Where alternate methods are used, perform personal and area air sampling at locations and frequencies that accurately characterize the evolving airborne asbestos levels. The written results must be signed by testing laboratory analyst, testing laboratory principal and the Contractor's PQP. The air sampling results must be documented on a Contractor's daily air monitoring log.

3.2.11.3 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH NMAM Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, must be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) must be confirmed from that same filter using NIOSH NMAM Method 7402 (TEM) at no additional cost to the Government. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning must be repeated at no additional cost to the Government. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria must be done at no additional cost to the Government.

3.2.11.4 Sampling After Final Clean-Up (Clearance Sampling)

Provide area sampling of asbestos fibers using aggressive air sampling techniques as defined in the EPA 560/5-85-024 and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean-up but before removal of the enclosure or the asbestos work control area. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the PQP must perform a visual inspection in accordance with ASTM E1368 to ensure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris. Prepare a written report signed and dated by the PQP documenting that the asbestos control area is free of dust, dirt, and debris and all waste has been removed.

3.2.11.5 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

3.2.12 Lock-Down

Prior to removal of plastic barriers and after pre-clearance clean up of gross contamination, the PQP must conduct a visual inspection of all areas affected by the removal in accordance with ASTM E1368. Inspect for any visible fibers, and to ensure that encapsulants were applied evenly and appropriately. Spray apply a post removal (lock-down) encapsulant to ceiling, walls, floors and other areas exposed in the removal area. The exposed area includes but is not limited to plastic barriers, furnishings and articles to be discarded as well as dirty change room, air locks for bag removal and decontamination chambers.

3.2.13 Site Inspection

While performing asbestos engineering control work, the Contractor must be subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation must be at no additional cost to the Government.

3.3 CLEAN-UP AND DISPOSAL

3.3.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will attest that the area is safe before the signs can be removed. After final clean-up and acceptable airborne concentrations are attained but before the HEPA unit is turned off and the enclosure removed, remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of filters as asbestos contaminated materials. Reestablish HVAC mechanical, and electrical systems in proper working order. The Contracting Officer will visually inspect all surfaces within the enclosure for residual material or accumulated dust or debris. The Contractor must re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer must agree that the area is safe in writing before unrestricted entry is permitted. The Government must have the option to perform monitoring to determine if the areas are safe before entry is permitted.

3.3.2 Title to Materials

All waste materials, except as specified otherwise, become the property of the Contractor and must be disposed of as specified in applicable local, State, and Federal regulations and herein.

3.3.3 Disposal of Asbestos

3.3.3.1 Procedure for Disposal

Coordinate all waste disposal manifests with the Contracting Officer and host installation environmental function. Collect asbestos waste, contaminated waste water filters, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag. Clearly indicate on the outside of each container the name of the waste generator and the location at which the waste was generated. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids must be assigned by the Contracting Officer or his authorized representative. Comply with 40 CFR 61-SUBPART M, State, regional, and local standards for hauling and disposal. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags must remain in the drum and the entire contaminated drum must be buried. Uncontaminated drums may be recycled. All persons handling containers with asbestos containing wastes must comply with applicable federal, state, and local regulations.

3.3.3.2 Asbestos Disposal Quantity Report

Direct the PQP to record and report, to the Contracting Officer, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet and in cubic feet as well as tons for the amount of asbestos containing material released for disposal.

Allow the PQP to inspect, record and report the amount of asbestos containing material removed and released for disposal on a daily basis. Exclude hazardous waste from waste reduction calculations in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

Attachment:

A. Hazardous Material Survey Report for MCAF Project P-012/AJJY183012 North Aircraft Parking Ramp Joint Region Marianas, Andersen Air Force Base, Guam dated 10 November 2023 prepared by MNA Environmental

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

Hazardous Material Survey Report
For
MCAF Project P-012/AJJY183012
North Aircraft Parking Ramp
Joint Region Marianas
Andersen Air Force Base, Guam

Owner Job/Contract # N62742-20-D-0002
MNA Project 3035_1

November 10, 2023

MNA Environmental

Design, Studies, and Consulting Services

98-025 Hekaha Street, Suite 215A, Aiea, Hawaii, USA 96701 • 808.484.9214
16-643 Kipimana Street, Suite 12, Keaau, Hawaii, USA 96749 • 808.769.4221

This page is intentionally left blank.

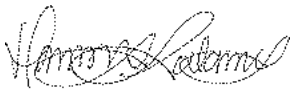
This report is prepared for:

Jacobs/Burns and McDonnell, A Joint Venture
155 North Lake Avenue, Suite 150
Pasadena, California 91101-1891

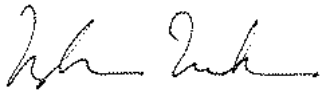
HAZARDOUS MATERIAL SURVEY REPORT
FOR
MCAF PROJECT P-012/AJJY183012
NORTH AIRCRAFT PARKING RAMP
JOINT REGION MARIANAS
ANDERSEN AIR FORCE BASE, GUAM

Owner Job/Contract # N62742-20-D-0002
MNA Project 3035_1

November 10, 2023



Danny Falanug
Environmental Specialist



Myounghee Noh, CIH, CSP
Principal

Myounghee Noh & Associates, L.L.C., dba MNA Environmental
Design, Studies, and Consulting Services

98-025 Hekaha Street, Suite 215A, Aiea, HI 96701
Tel (808) 484-9214
www.mnaenvironmental.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY iv

1.0 INTRODUCTION 1

2.0 SAMPLING AND SURVEY METHODS 2

2.1 Identifying Homogeneous Materials 6

2.2 Building Material Sampling 7

2.3 PCB-Containing Ballast Inspection 7

2.4 Mercury-Containing Light Tube and Switch Inspection 7

3.0 LABORATORY INFORMATION 8

4.0 ASBESTOS RESULTS 8

5.0 LEAD/HEAVY METAL-CONTAINING PAINT RESULTS 11

6.0 TCLP METALS RESULTS 11

7.0 SUSPECT PCB-CONTAINING BALLAST RESULTS 15

8.0 MERCURY RESULTS 15

9.0 OTHER HAZARDS AND MATERIALS 15

9.1 Chemicals and Chemical Storages in IRP Building Compound 15

9.2 Biohazards (Wasps, Rodents, Molds, Snakes, Wildlife) 16

9.3 Treated Wooden Utility Poles 16

10.0 SUMMARY OF SURVEY RESULTS 16

11.0 RECOMMENDATIONS FOR RENOVATION AND CONSTRUCTION WORK 17

11.1 Asbestos-Containing Materials 17

11.2 Lead/Heavy Metal-Containing Paints 18

11.3 Arsenic-Containing Materials 19

11.4 PCB-Containing Ballasts 19

11.5 Mercury-Containing Light Switches 19

11.6 Silica in Concrete 20

12.0 LIMITATIONS 20

TABLES

Table 1. Summary of Sampling and Results 6
Table 2. Asbestos-Containing Material Determination 9
Table 3. Lead/Heavy Metal-Containing Paint Determination 12
Table 4. Summary of TCLP Sampling and Analysis 14

FIGURE

Figure 1. Vicinity Map 3
Figure 2. Project Area and Buildings to be Demolished. 4
Figure 3. IRP Building Compound – Assumed Asbestos Cement Pipes 5

APPENDICES

Appendix A Inspector Certifications
Appendix B Homogeneous Materials Identified and Sample Types Collected
Appendix C Sample and Hazardous Material Location Drawings
Appendix D Photographs
Appendix E Laboratory Analytical Reports

CONTRIBUTORS

Project Manager	Eunjin Kotkovetz
Certified Inspector	Danny Falanug
Data Quality Control	Erik Stum
Report Writer	Danny Falanug
Drafter/Illustrator	Erik Stum / Eunjin Kotkovetz
Technical Editor/QC	Eunjin Kotkovetz
QA Review	Myounghee Noh

EXECUTIVE SUMMARY

In February and June 2023, Myounghee Noh & Associates, L.L.C., dba MNA Environmental (MNA), was retained by Jacobs/Burns and McDonnell, A Joint Venture, to conduct a hazardous material survey for the FY24 MCAF Project P-012/AJJY183012, North Aircraft Parking Ramp, Joint Region Marianas, Andersen Air Force Base, Guam.

The objective of the survey was to identify the presence, extent, and conditions of hazardous materials in the project areas anticipated to be disturbed, so that the information can be incorporated in the design. The project area is approximately 192 acres of undeveloped land (Jungle) except the Installation Restoration Program (IRP) Building Compound. The project will construct an aircraft parking apron with associated taxiways and shoulders, flightline maintenance support facility, utility buildings, airfield fence, and hydrant fueling pits and piping required to accommodate bombers, tankers, and other aircraft.

The IRP Building Compound includes B2550, B2551, B2552, transformer and its concrete enclosure, and the Spill Response Storage. The building compound was constructed in 1971 including an oil-water separator and a septic tank/leaching field system. The oil-water separator was removed in the 1990s. The septic tank/leaching field system is still in place.

As part of the project, the IRP Building Compound and ancillary structures/utilities will be demolished. The project includes site/vegetation clearance and grubbing in the undeveloped areas. There are scattered abandoned debris or waste within the project to be removed and disposed of. A site investigation and hazardous material survey was conducted in support of the planned demolition, site clearance, and waste/ debris removal for areas to be disturbed by the construction. MNA's survey included as-built drawing review, visual inspection, and sampling and analysis of suspect building materials. MNA provides the following summary:

IRP Building Compounds

- B2550
  - Roof paint/skim coat: Asbestos (<1 % Chrysotile)
  - Floor coating: Asbestos (<1 % Chrysotile)
  - Presence of heavy metal containing paints

- B2551
  - Floor coating: Asbestos (<1 % Chrysotile)
  - Vinyl Floor Tile and Mastic: Asbestos (5% Chrysotile, 8% Chrysotile)
  - Presence of heavy metal containing paints
  - Chemicals (methanol, nitric acid, etc.) and used oil: Assume the Installation will dispose of before construction.
  - Biohazards: During the surveys, wasps and rodents were observed inside and outside the building. Mold contamination must be assumed.

- B2552
  - Door frame caulking: Asbestos (2 % Chrysotile)
  - Vinyl Floor Tile and Mastic: Asbestos (<5% Chrysotile and 8% Chrysotile)
  - Presence of heavy metal containing paints
  - Mercury-containing light switch
  - Biohazards: During the surveys, wasps and rodents were observed inside and outside the building. Mold contamination must be assumed.
- Vicinity of IRP Building Compounds
  - Underground concrete pipes: Assumed ACM. The Contractor must test the pipes for asbestos before disturbance and provide analytical results to the Contracting Officer.
  - Presence of heavy metal containing paints
  - Various 55-gallon drums and storages: Assume the Installation will dispose of before construction.
- Toxicity Characteristic Leaching Procedure (TCLP) Test for painted materials of B2550, B2551, B2552: Lead results were in the range of 1.2-4.8 mg/L, approached the TCLP regulatory limit of 5 mg/L. The TCLP Analytical results provided in this report do not meet the requirements for waste characterizations. The Contractor must be required to coordinate with permitted landfills for waste characterization requirements and conduct TCLP testing on actual waste stream.

Undeveloped Project Area (Jungle)

- Scattered Waste Debris
  - Various transite pipes: Asbestos up to 20% Chrysotile
  - Presence of waste debris with heavy metal containing paints
- Most of the project site is an undeveloped jungle area. The Contractor must assume biohazards including wasps, rodents, snakes, and other wildlife.

Based on the sampling and analysis of suspect bulk materials and paints, special hazard control measures are warranted for work involving asbestos, lead-, cadmium-, chromium-, and TCLP for waste stream. These control measures are briefly described in Section 11 Recommendations for Renovation and Construction Work. General dust, respirable crystalline silica, and runoff controls and environmental protection are also required.

Paint samples were analyzed for lead, cadmium, and chromium content only. There is a potential for the presence of other hazardous chemicals in the lead-free or low-lead paint coatings, such as arsenic, zinc, and other metals and chemical substances. Suspect asbestos materials may contain other hazardous substances, such as silica and/or polychlorinated biphenyls (PCB), and other mineral fibers. The contractor must anticipate hazards and take all appropriate measures to prevent exposure to site workers, facility users, base personnel, and the environment.

The contractors must verify, prior to bidding, the location and volumes of potentially hazardous materials and determine the appropriate dust and hazard control measures based on the area and material to be disturbed. The quantities of materials provided in this report are based on visual approximations only during the survey and must not be used for bidding purposes.

Any ACM disturbance is considered a regulated activity. Contractors are required to comply with 29 CFR 1926.1101(k)(3)(i) to identify the presence, location, and quantity of ACM before any work is begun.

Worker protection from exposures to respirable crystalline silica is enforced by the Occupational Safety and Health Administration (29 CFR 1926.1153; 29 CFR 1910.1053). All appropriate engineering controls must be implemented, and personal protective equipment may be considered as added protection.

All appropriate best management practices are required to contain materials and wastes. Runoff or visible emission must not be allowed.

Summary of Hazardous Material Findings

Sampling Areas		Locations	ACM	Paint/Coating				PCB Ballast	Mercury Switch
				LCP	LBP	Cd	Cr		
IRP Building Compound	B550	Exterior	□	◙	◙	◙	◙		
	B2551	Exterior	◙	◙	◙				
		Interior	◙	◙	◙				
	B2552	Exterior		◙	◙	◙	◙		
		Plenum		◙	◙		◙		
		Restroom		◙	◙		◙		◙
		Room 1	◙	◙	◙	◙	◙		◙
		Room 2							◙
		Storage		◙	◙	◙	◙		
	Vicinity	Exterior			◙	◙	◙		
		Underground Concrete Pipes	◙ Assumed ACM						
Undeveloped Project Areas (Jungle)		Scattered Waste Debris	◙ (Transite Pipes)	◙	◙	◙	◙		

Note: ◙ indicates presence of hazardous material □ indicates trace amount of hazardous material

Abbreviations and Acronyms

ACM – Asbestos-Containing Material, 1% or higher
IRP – Installation Restoration Program
LCP – Lead-Containing Paint, <5,000 mg/kg
Cd – Cadmium
LBP – Lead-Based Paint, ≥5,000 mg/kg
PCB – Polychlorinated Biphenyls
Cr – Chromium

1.0 INTRODUCTION

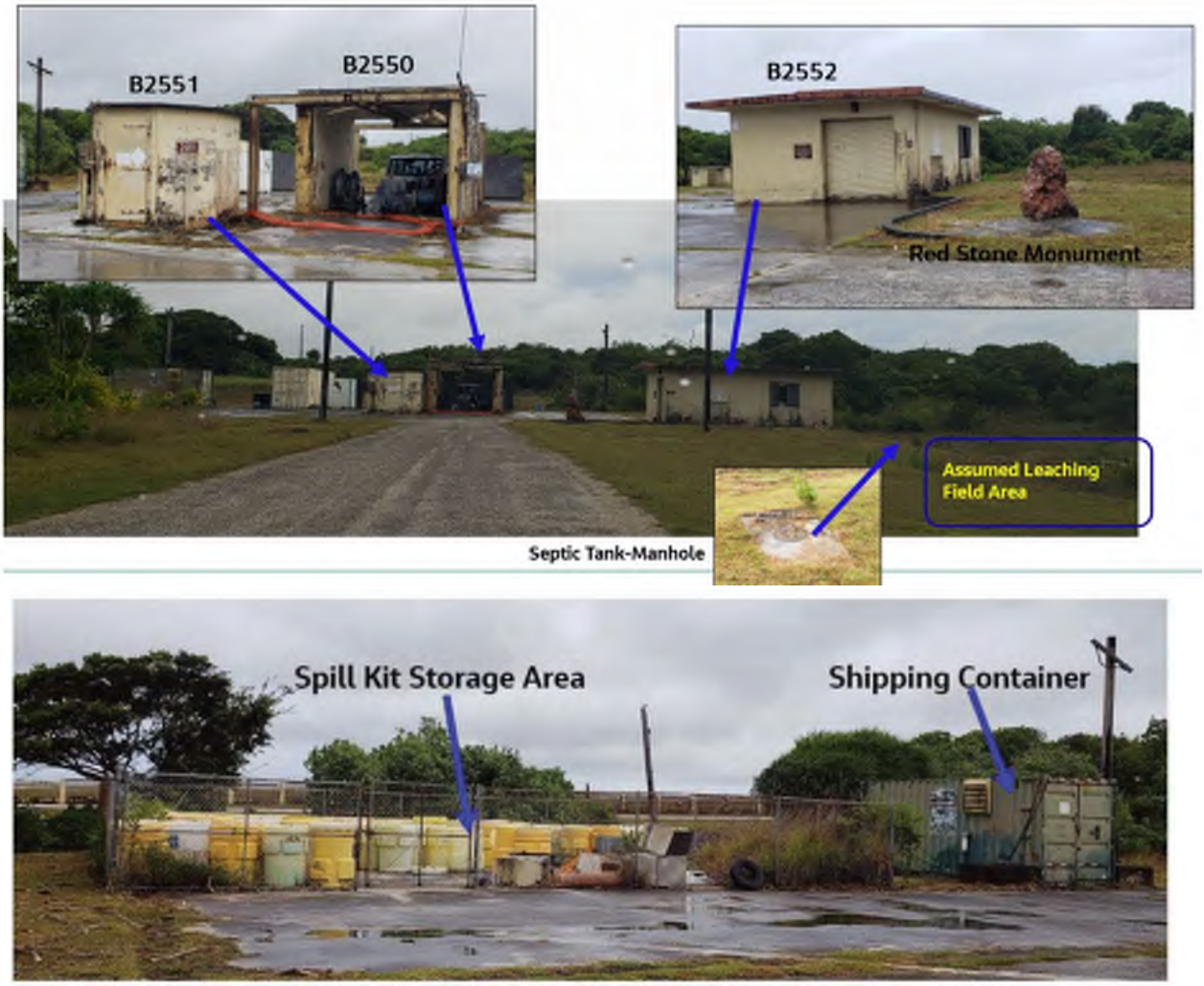
Myounghee Noh & Associates, L.L.C., dba MNA Environmental (MNA), under an agreement with Jacobs/Burns and McDonnell, A Joint Venture, to conduct a hazardous material survey at the proposed North Aircraft Parking Ramp, Joint Reason Marianas (JRM), Andersen Air Force Base, Guam (Figures 1 and 2). The project area is approximately 192 acres of undeveloped land except the Installation Restoration Program (IRP) Building Compound. The project will construct an aircraft parking apron with associated taxiways and shoulders, flightline maintenance support facility, utility buildings, airfield fence, and hydrant fueling pits and piping required to accommodate bombers, tankers, and other aircraft.

The IRP Building Compound includes B2550, B2551, B2552, transformer and its concrete enclosure, and the Spill Response Storage. The Compound was constructed in 1971 including an oil-water separator and a septic tank/leaching field system. The oil-water separator was removed in the 1990s. The septic tank/leaching field system is still in place. As part of the project, the Compound will be demolished.

The project includes site clearing and grubbing. There are scattered abandoned debris or waste within the project that will be removed and disposed of. The survey was conducted in support of the planned demolition, site clearance, and waste/ debris removal for areas to be disturbed by the demolition and construction work, as follows:

- IRP Building Compound (B2550, B2551, B2552 and its ancillary facilities/structures)
    - Review as-built drawing: Identify assumed asbestos containing pipelines (approximately 400 linear feet, Figure 3).
    - Visual inspection
    - Hazardous building materials due to the suspected presence of asbestos
    - Hazardous materials or chemicals
    - Paints/coatings suspected of containing lead, cadmium, and chromium
    - Polychlorinated biphenyls (PCB)-containing light ballasts.
    - Mercury-containing electrical equipment, such as fluorescent light tubes, high-intensity discharge light bulbs, and light switches.
    - Toxicity Characteristic Leaching Procedure (TCLP) for waste characterizations.

- Undeveloped project area to be cleared/disturbed (Figures 3 and 4)
    - Visual inspection
    - Hazardous building materials due to the suspected presence of asbestos
    - Paints/coatings suspected of containing lead, cadmium, and chromium



Photograph 1. IRP Building Compound

2.0 SAMPLING AND SURVEY METHODS

During February and June 2023, a State of Hawaii-certified building inspector, Danny Falanug, conducted the building material survey. The inspector performed a visual assessment of the project site, identified materials suspected of containing asbestos and lead/heavy metals collected samples of these materials. The inspectors also surveyed light ballasts and inventoried light components and switches for the three buildings to be demolished. Inspector certifications are presented in Appendix A.

A1 LOCATION MAP
SCALE: 1" = 600'

GRAPHIC SCALE

0 300' 600' 1200'

SCALE: 1"=600'

NORTH ARROW

TRUE N

NAVFAC

Name DD MM 2023
Registration Number # Date
DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No.: N62742-20-D-0002
A/E Task Order No.: N62742-22-F0015
ZEG NO.: D3400003
A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	DRW:	REV:
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
JOINT REGION MARIANAS (JRM)
NAVFAC PACIFIC
GUAM
ANDERSEN AIR FORCE BASE

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

LOCATION MAP

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 1

IF SHEET IS LESS THAN 22" X 34"
REDUCED PRINT, USE GRAPHIC SCALES

SPILL RESPONSE STORAGE

TRANSFORMER TO BE DEMOLISHED

B2550 (TO BE DEMOLISHED)

B2551 (TO BE DEMOLISHED)

B2552 (TO BE DEMOLISHED)

A1 PROJECT AREA AND BUILDINGS TO BE DEMOLISHED
SCALE: 1" = 300'

GRAPHIC SCALE
0 150' 300' 600'
SCALE: 1"=300'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NAVFAC

Name
DD MM 2023
Registration Number # Date
DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS MCDONNELL
JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N6274221F0315
JCG WO. 2343003
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DRW:	REV:
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND – PACIFIC
JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE
GUAM

FY2024 MCAF P-012/ AJUY183012
NORTH AIRCRAFT PARKING RAMP

PROJECT AREA AND BUILDINGS TO BE DEMOLISHED

SCALE: AS SHOWN
EPROJECTS NO.: 1665555
CONSTR CONTROL NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 2

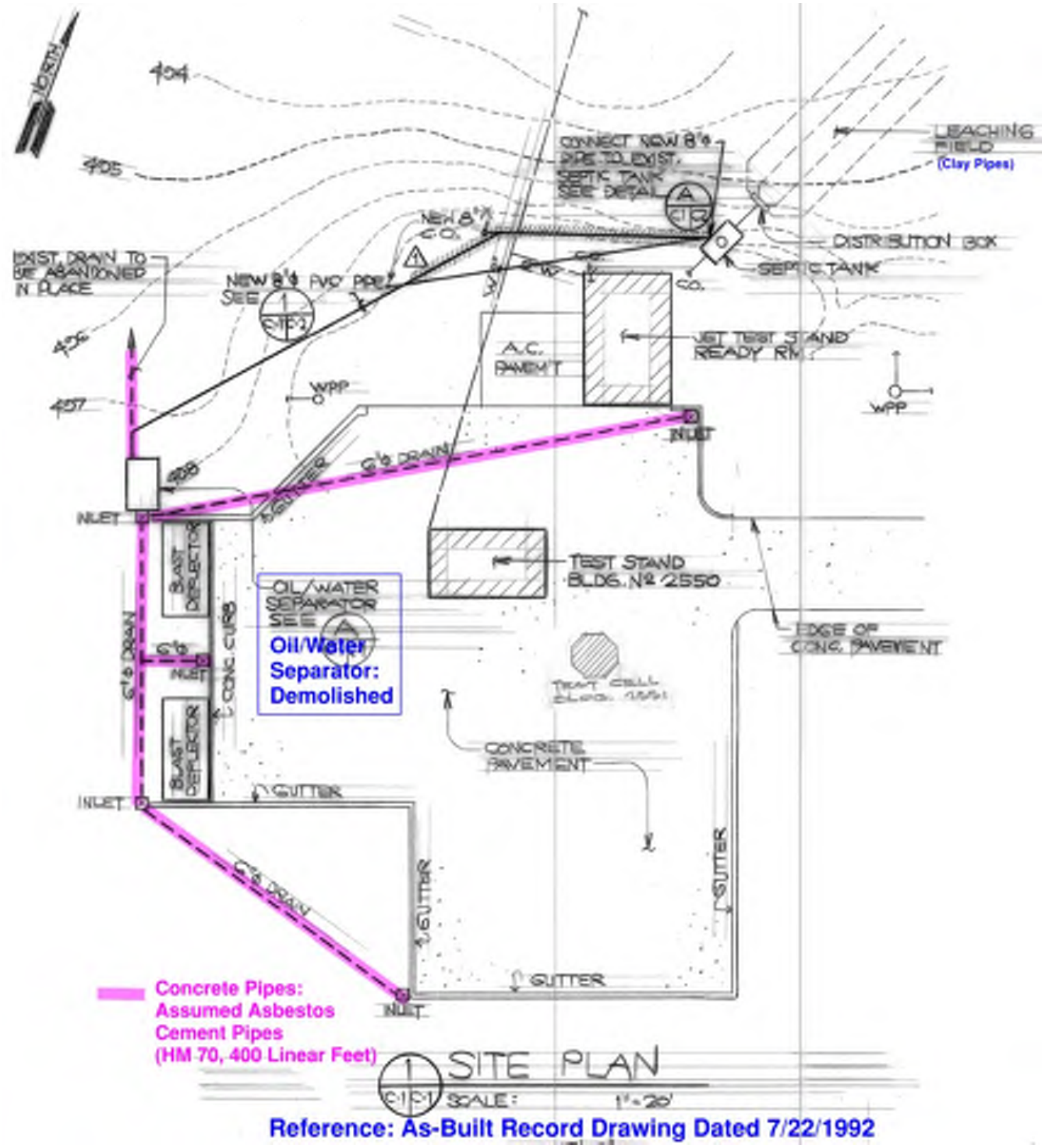


Figure 3. IRP Building Compound – Assumed Asbestos Cement Pipes

2.1 Identifying Homogeneous Materials

The inspector identified building materials with the same appearance, color, and substrate as homogeneous materials. Interior homogeneous materials are considered unique per building and building floor, while exterior building materials are considered unique per area/structure. Building materials with the same characteristics (appearance, color, and substrate), as an identified homogeneous material, must be considered to possess the same hazard characteristics, unless specifically identified as otherwise in the report. As an example, if off-white paint on metal is found to be lead-based paint (LBP), then all identical off-white paint on metal in the survey area must be treated as LBP. Table 1 provides an overview of sampling and a summary of hazardous materials identified in this survey.

Table 1. Summary of Sampling and Results

Materials Sampled	Samples Submitted/ Inspected	Suspect Material Locations	Identified Hazardous Materials
Asbestos in bulk material or paint	105	Roof, floors (VFT, mastic), door frame, waste debris, transite pipes	9 ACM (4 – 20% Chrysotile) 3 Trace ACM (<1% Chrysotile) 1 Assumed ACM (no test): Underground Concrete Pipes, 400 Linear Feet (Figure 3)
Lead in paint	66	Beams, bollards, ceiling, conduit, debris, doors, door frames, eaves, electrical box, fire hydrants, floor, footing, H-beams, ladder, pipes, roll-up door, roll-up door frame, roof, rock monument, transformer, walls, window frames	30 LCP (42 mg/kg – 4,900 mg/kg) including 16 LBP (5,000 mg/kg – 240,000 mg/kg)
Cadmium in paint	33		11 LCP and LBP also contained Cadmium (11 mg/kg – 100 mg/kg)
Chromium in paint			21 LCP and LBP also contained Chromium (96 mg/kg – 56,000 mg/kg)
PCB light ballasts	7	Fluorescent light fixtures (7 fixtures)	None
Mercury light tubes	16	Fluorescent light tubes (16 tubes)	None
Mercury light switches	4	Wall switches (4 switches)	4 Suspect mercury-containing light switches 4 low mercury-containing light switches
TCLP for IRP Building Compound	4	Ceiling, eaves, floor, roof, walls Conduit, H-beams, ladder, window frames, door frames	Passed TCLP Test; however, the lead results, 1.2-4.8 mg/L, approached the TCLP regulatory limit of 5 mg/L.

Abbreviations and Acronyms

ACM – Asbestos-Containing Material
Cd – Cadmium
Cr - Chromium
LBP – Lead-Based Paint, ≥5,000 mg/kg
LCP – Lead-Containing Paint, <5,000 mg/kg
mg/kg – milligrams per kilogram (equivalent to parts per million)
PCB – Polychlorinated biphenyls
TCLP – Toxicity Characteristic Leaching Procedure
VFT – Vinal Floor Tile

2.2 Building Material Sampling

Bulk and paint samples were collected using a decontaminated chisel, razor, or hammer in a manner that minimized airborne dust. The inspector collected triplicate samples for asbestos, duplicate samples for lead, and primary samples for cadmium and chromium. Samples were placed in sealable plastic bags, labeled with a unique identification number, and recorded on a chain-of-custody. For each sample, the date, sample appearance, analyte, and sample location were recorded on a field data form. Asbestos bulk samples were transported under chain-of-custody to LA Testing in South Pasadena, California. The paint samples were delivered under chain-of-custody to Hawaii Analytical Laboratory in Honolulu, Hawaii.

2.3 PCB-Containing Ballast Inspection

Fluorescent light ballasts in the project building were inventoried and inspected for the presence of PCB-containing dielectric fluid. MNA recorded the number of fluorescent light fixtures and selected fixtures to be inspected; 2 of 7 accessible light fixtures were inspected. MNA confirmed that the light switch was off, opened the light fixture, removed the ballast cover plate, and inspected the ballast for a "No PCBs" label and/or the manufactured date. If the "No PCBs" label is not visible and the ballast appear new, the inspector recorded the manufactured date for confirmation purpose. The location of inspected fixtures was recorded, and the light fixtures were reassembled following inspections.

Ballast manufactured between July 1, 1978, and July 1, 1998, that does not contain PCBs must be labeled "No PCBs." Ballast manufactured after 1998 are not required to be labeled. Ballasts without the "No PCBs" label or that are manufactured prior to 1979 are considered suspect PCB-containing in accordance with EPA guidance for PCB. Inaccessible ballasts are assumed to be PCB-containing.

2.4 Mercury-Containing Light Tube and Switch Inspection

MNA visually inspected fluorescent light tubes in project building and identified if they were conventional mercury-containing tubes. According to the EPA guidelines, lamps with green end caps are identified as low-mercury light tubes which may contain 3.5 - 4 milligrams (mg) of mercury, compared to a conventional fluorescent light tube with 8 - 14 mg of mercury (http://www.epa.gov/osw/hazard/wastetypes/universal/lamps/faqs.htm). If a green band is not observed at the end cap, it is considered a conventional mercury-containing tube.

MNA also turned on and off all accessible light switches in the project building. If a switch does not make a clicking sound when turned on and off, it is considered to be suspect mercury-containing. The locations of inspected light tubes and switches were recorded.

3.0 LABORATORY INFORMATION

LA Testing analyzed the asbestos samples by polarized light microscopy using the Environmental Protection Agency (EPA) Method 600/R-93/116 and the arsenic samples by 3050B/6010B. LA Testing, South Pasadena, is certified by:

- National Voluntary Laboratory Accreditation Program (NVLAP), certification 200232-0
- State of Hawaii Department of Health (HDOH), certification L-01-034
- American Industrial Hygienist Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP), certification 102814

Hawaii Analytical Laboratory analyzed the lead samples by flame atomic absorption spectroscopy using the NIOSH Method 7082m and heavy metals samples by EPA Method 3051m/7000Bm. Hawaii Analytical Laboratory, Honolulu, is certified by:

- NVLAP, certification 200655-0
- HDOH, certification L-14-002
- AIHA ELLAP, certification 101812

4.0 ASBESTOS RESULTS

Materials determined to contain greater than, or equal to, 1% asbestos are considered regulated asbestos-containing material (ACM) under the National Emission Standards for Hazardous Air Pollutants (NESHAP) as specified in 40 Code of Federal Regulations (CFR) Part 61 Subpart M. The U.S. Occupational Safety and Health Administration (OSHA) Asbestos General Industry and Construction Standards also define ACM as 1% asbestos or more by volume under 29 CFR 1910.1001 and 29 CFR 1926.1101, respectively. However, any measurable levels of asbestos fibers are considered to be a health concern, in an uncontrolled work environment.

Thirty-six homogeneous materials suspected of containing asbestos were identified. One homogeneous material (HM 70), underground cement pipes in the IRP Compound was inaccessible and assumed to be ACM without sampling and analysis (Figure 3). Thirty-five homogeneous materials were sampled generating105 samples for analysis. Three materials were identified to contain trace amount of chrysotile with results ranging at <1%. Nine ACM were confirmed in the survey area, with results ranging from 4% to 20% chrysotile asbestos (Table 2).

The suspected ACM descriptions and identifiers are provided in Appendix B. Sample and hazardous material location drawings are provided in Appendix C. Photographs of suspected materials are presented in Appendix D. Laboratory analytical reports, chain-of-custody, and field data forms are provided in Appendix E.

Table 2. Asbestos-Containing Material Determination

Rooms	Locations	HM ID	Material Color	Material	Substrate	Asb	Condition	Estimated Quantity
IRP Building Compound, B2550								
Exterior	Ceiling, walls	2	Off-white	Paint/skim coat	Concrete	ND	Poor	1,000 Sq. ft.
Exterior	Roof	5	White	Paint/skim coat	Concrete	<1% Chrysotile	Poor	200 Sq. ft.
Exterior	Floor	7	Lt. blue	Coating	Concrete	<1% Chrysotile	Poor	340 Sq. ft.
IRP Building Compound, Outside of Buildings								
Exterior	Floor	8	Gray	Bare concrete	None	ND	Poor	1,600 Sq. ft.
Exterior	Floor	48	Black	Expansion joint	Concrete	ND	Good	20 Ln. ft.
Under-ground	**Underground**	**70**	**Unknown**	**Unknown**	**Concrete**	**[1] Assumed ACM**	**Unknown**	**400 Ln. ft.**
IRP Building Compound, B2551								
Exterior	Eave, wall	10	Off-white	Paint/skim coat	CMU	ND	Poor	320 Sq. ft.
Exterior	Floor	13	Lt. blue	Coating	Concrete	<1% Chrysotile	Poor	300 Sq. ft.
Exterior	Eave	15	Brown	Paint/skim coat	Concrete	ND	Poor	20 Ln. ft.
Interior	Walls	59	Black	Tar	CMU	ND	Fair	60 Sq. ft.
Interior	**Floor**	**61**	**Black**	**12" x 12" VFT Mastic**	**Concrete**	**5% Chrysotile 8% Chrysotile**	**Fair**	**20 Sq. ft.**
Interior	Door frame	62	Black	Caulking	Metal	ND	Fair	10 Ln. ft.
IRP Building Compound, B2552								
Exterior	Walls	17	Off-white	Paint/skim coat	CMU	ND	Fair	700 Sq. ft.
Exterior	Eaves, footing	22	Off-white	Paint/skim coat	Concrete	ND	Poor	300 Sq. ft.
Exterior	Floor	25	Gray	Paint/skim coat	Concrete	ND	Fair	60 Sq. ft.
Exterior	Window frames	26	Black	Caulking	Wood	ND	Good	30 Ln. ft.
Plenum, Restroom, Room 1, Storage	Walls	28	Off-white	Paint/skim coat	CMU	ND	Fair	400 Sq. ft.
Plenum, Restroom, Room 1, Storage	Beams, ceiling	30	Off-white	Paint/skim coat	Concrete	ND	Poor	700 Sq. ft.
Plenum, Room 1, Room 2, Storage	Walls	32	Off-white	Drywall	None	ND	Good	820 Sq. ft.
Room 1	Floor	37	Gray	Paint/skim coat	Concrete	ND	Fair	60 Sq. ft.
Room 2	Walls	39	Brown	Wallpaper	CMU	ND	Good	260 Sq. ft.
Room 1	**Door frame**	**40**	**Gray**	**Caulking**	**Metal**	**2% Chrysotile**	**Good**	**10 Ln. ft.**

Rooms	Locations	HM ID	Material Color	Material	Substrate	Asb	Condition	Estimated Quantity
Room 1	Window frames	41	White	Caulking	Metal	ND	Good	20 Ln. ft.
Room 1, Room 2	Walls	42	Brown	Cove base	Drywall	ND	Fair	70 Ln. ft.
Room 1, Room 2	Walls	43	White	Cove base	Drywall	ND	Fair	50 Ln. ft.
Restroom	Sink, urinal	44	White	Caulking	Porcelain	ND	Fair	10 Ln. ft.
Restroom, Room 2	Floor	45	Off-white	12" x 12" VFT	Concrete	ND	Fair	340 Sq. ft.
Room 2	Ceiling	46	White	2' x 4' Acoustic tile	None	ND	Fair	200 Sq. ft.
Undeveloped Project Area								
Ground Level	Debris	63	Bare	Concrete	None	ND	Fair	400 Sq. ft.
Ground Level	**8" Pipe**	**64**	**Lt. gray**	**Transite**	**None**	**15% Chrysotile 5% Crocidolite**	**Fair**	**100 Ln. ft.**
Ground Level	**Debris**	**65**	**Black**	**Coating**	**Metal**	**10% Chrysotile**	**Poor**	**40 Sq. ft.**
Ground Level	**4" Pipes**	**66**	**Lt. gray**	**Transite**	**None**	**18% Chrysotile 3% Crocidolite**	**Fair**	**40 Ln. ft.**
Ground Level	**6" Pipes**	**67**	**Lt. gray**	**Transite**	**None**	**18% Chrysotile 2% Crocidolite**	**Fair**	**60 Ln. ft.**
Ground Level	**12" Pipe**	**68**	**Lt. gray**	**Transite**	**None**	**18% Chrysotile 5% Crocidolite**	**Fair**	**30 Ln. ft.**
Ground Level	**Debris**	**69**	**Black**	**Coating**	**Metal**	**20% Chrysotile**	**Poor**	**160 Ln. ft.**

Note

1) Assumed Asbestos Containing Pipes: Refer to Figure 3. The Contractor must test the pipes for asbestos before disturbance and provide analytical results to the Contracting Officer. If it is not an ACM, the Contractor must give credit back to the Government.

Bold values indicate results above the reporting limit.
The asbestos was found to be chrysotile and crocidolite
Trace amount of asbestos <1%
Good – Material is in an "as installed" condition. It is usable as is and may show cosmetic wear and tear or fading.
Fair – Material is functional for its installed purpose but shows initial signs of deterioration beyond the cosmetic.
Poor – Material shows significant deterioration and may not be functional for its installed purpose. The binding of the material has decreased integrity as indicated by peeling, cracking, or crumbling of the material.

Abbreviations and Acronyms

ACM – Asbestos-Containing Material
HM ID – Homogeneous Material Identifier
ND – Not Detected
VFT – Vinyl Floor Tile
CMU – Concrete Masonry Unit
ln. ft. – Linear Feet
sq. ft. – Square Feet

5.0 LEAD/HEAVY METAL-CONTAINING PAINT RESULTS

The U.S. Department of Housing and Urban Development (HUD) and the EPA define paint containing 5,000 milligrams per kilogram (mg/kg), or 0.5% by weight, or more of lead to be LBP. Paint containing any measurable concentration of lead is considered to be LCP and a health concern. When lead is detected in a multi-layer sample, it is assumed that all layers represented by the sample contain lead at the same concentration. The disturbance of cadmium is regulated by 29 CFR 1926.1127, the OSHA Cadmium Construction Standard. The disturbance of chromium is regulated by 29 CFR 1926.1126, the OSHA Chromium Construction Standard. The OSHA General Industry and Construction Standards also regulate mercury under 29 CFR 1910 Subpart H, I, and Z; and 29 CFR 1926 Subpart D and E. Paints are determined to be hazardous when any measureable amount of lead, cadmium, chromium, or mercury is determined by laboratory analysis.

Thirty-three suspected lead/heavy metal-containing paints were identified and sampled, generating 66 paint chip samples. All samples were analyzed for lead, cadmium, and chromium content. Thirty lead paints were identified/confirmed in the survey area, with results ranging from 42 mg/kg to 4,900 mg/kg. Sixteen of those paints were identified as LBP, at or above 5,000 mg/kg, the threshold for LBP (Table 3). Eleven of the identified lead/non-lead paints contained cadmium ranging from 11 mg/kg to 100 mg/kg. Twenty-one of the lead paints contained chromium ranging from 96 mg/kg to 56,000 mg/kg. Suspected lead-, cadmium-, chromium-containing paint descriptions and identifiers are provided in Appendix B. Sample and hazardous material location drawings are in Appendix C. Photographs of suspected LCP are presented in Appendix D. Laboratory analytical reports, chain-of-custody, and field data forms are provided in Appendix E.

6.0 TCLP METALS RESULTS

The objective of the TCLP analysis is to determine whether toxic constituents in a solid waste will leach into groundwater if the waste is accepted by a municipal solid waste landfill. In accordance with the Resource Conservation and Recovery Act (RCRA), 40 CFR 261.24, the demolished debris with leachability less than the regulatory limit in the TCLP extract is allowed to be disposed of at permitted Subtitle D, Municipal Solid Waste Landfills as non-hazardous waste. Waste stream with leachability greater than the TCLP regulatory limit must be considered as hazardous waste and disposed of at permitted Subtitle C, Hazardous Waste Landfills which are not available in the State of Hawaii. The TCLP results were compared to the regulatory limits for toxicity characteristics regulated by 40 CFR 261.24 to evaluate the acceptability by the local municipal landfill in Guam. All results were below the TCLP regulatory levels; however, the lead results for TCLP 2 and TCLP4 were 4.8 and 4.5 mg/kg and approached the TCLP regulatory level for lead, 5.0 mg/kg (Table 4). The TCLP analytical results are biased and do not meet the requirements for waste characterizations. TCLP testing to determine the “worst-case” waste stream was conducted. The Contractor must be required to coordinate with permitted landfills for waste characterization requirements and conduct TCLP testing on actual waste stream.

Table 3. Lead/Heavy Metal-Containing Paint Determination

Floor	Rooms	Locations	HM ID	Material Color	Material	Substrate	Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Condition	Estimated Quantity
IRP Building Compound, B2550											
1	Exterior	Ceiling, walls	1	Off-white	Paint	Concrete	16,000 - 20,000	<10	2,600	Poor	1,000 Sq. ft.
1	Exterior	Conduit, H-beams, ladder	3	Off-white	Paint	Metal	47,000 - 63,000	<10	12,000	Poor	200 Sq. ft.
Roof	Exterior	Roof	4	White	Paint	Concrete	4,600 - 8,500	<10	1,800	Poor	200 Sq. ft.
1	Exterior	Floor	6	Lt. blue	Coating	Concrete	650 - 5,600	18	1,400	Poor	340 Sq. ft.
IRP Building Compound, B2551											
1	Exterior	Eave, wall	9	Off-white	Paint	CMU	21,000 - 32,000	14	8,200	Poor	320 Sq. ft.
1	Exterior	Conduit, door, door frame, windows	11	Off-white	Paint	Metal	3,600 - 7,600	100	10,000	Poor	40 Sq. ft.
1	Exterior	Floor	12	Lt. blue	Coating	Concrete	140 - 170	23	<80	Poor	300 Sq. ft.
1	Exterior	Eave	14	Brown	Paint	Concrete	24,000 - 42,000	<10	11,000	Poor	20 Ln. ft.
1	Interior	Walls	55	Blue	Paint	CMU	1,400 - 1,600	<10	150	Fair	320 Sq. ft.
1	Interior	Conduit, door frame, window frames	56	Blue	Paint	Metal	1,400 - 2,400	28	1,900	Fair	20 Ln. ft.
1	Interior	Ceiling	57	White	Paint	Concrete	42 - 68	<10	<80	Fair	70 Sq. ft.
1	Interior	Door frame	58	Silver	Paint	Metal	4,900 - 10,000	82	2,200	Fair	40 Ln. ft.
IRP Building Compound, B2552											
1	Exterior	Walls	16	Off-white	Paint	CMU	270 - 310	<10	<80	Fair	700 Sq. ft.
1	Exterior	Eaves	18	Brown	Paint	Concrete	67 - 210	<10	<80	Poor	100 Sq. ft.
1	Exterior	Conduit, door, pipes, roll-up door, windows	19	Off-white	Paint	Metal	13,000 - 59,000	<10	14,000	Poor	120 Sq. ft.
1	Exterior	Window, window frames	20	Off-white	Paint	Wood	580 - 1,700	<10	<80	Good	20 Sq. ft.
1	Exterior	Eaves, footing	21	Off-white	Paint	Concrete	260 - 350	<10	<80	Poor	300 Sq. ft.
1	Exterior	Door, door frame	23	Brown	Paint	Metal	2,300 - 2,800	13	96	Good	30 Sq. ft.
1	Exterior	Floor	24	Gray	Paint	Concrete	640 - 11,000	<10	150	Fair	60 Sq. ft.
1	Plenum, Restroom, Room 1, Storage	Walls	27	Off-white	Paint	CMU	7,100 - 7,500	<10	1,300	Fair	400 Sq. ft.
1	Plenum, Restroom, Room 1, Storage	Beams, ceiling	29	Off-white	Paint	Concrete	480 - 790	<10	<80	Poor	700 Sq. ft.
1	Plenum, Room 1, Room 2, Storage	Walls	31	Off-white	Paint	Drywall	<40	<10	<80	Good	820 Sq. ft.

Floor	Rooms	Locations	HM ID	Material Color	Material	Substrate	Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Condition	Estimated Quantity
1	**Restroom, Room 1, Storage**	**Conduit, pipes, windows**	**33**	**Off-white**	**Paint**	**Metal**	**11,000 - 12,000**	<10	**2,300**	**Fair**	**40 Ln. ft.**
1	Restroom, Room 1, Storage	Door, door frames, window	34	Off-white	Paint	Wood	<40	<10	<80	Good	40 Sq. ft.
1	**Room 1, Storage**	**Door, door frame, roll-up door, roll-up door frame**	**35**	**Brown**	**Paint**	**Metal**	**5,000 - 6,200**	**14**	**710**	**Poor**	**120 Sq. ft.**
1	**Room 1**	**Floor**	**36**	**Gray**	**Paint**	**Concrete**	**59 - 61**	<10	<80	**Fair**	**200 Sq. ft.**
1	**Room 1**	**Door frame, window frame**	**38**	**Brown**	**Paint**	**Wood**	**530 - 580**	<10	**130**	**Good**	**30 Ln. ft.**
Roof	Exterior	Roof	47	White	Coating	Concrete	<40	<10	<80	Good	600 Sq. ft.
IRP Building Compound, Outside of Buildings											
Ground Level	**Exterior**	**Debris**	**49**	**Yellow**	**Paint**	**Metal**	**210,000 - 230,000**	**14**	**46,000**	**Fair**	**80 Sq. ft.**
Ground Level	**Exterior**	**Rock Monument**	**50**	**Brown**	**Paint**	**Rock**	**11,000 - 28,000**	<10	**3,300**	**Fair**	**20 Sq. ft.**
Ground Level	**Exterior**	**Electrical box, pipes. Transformer**	**51**	**Off-white**	**Paint**	**Metal**	**13,000 - 18,000**	**12**	**2,700**	**Good**	**60 Sq. ft.**
Undeveloped Project Area											
Ground Level	**Exterior**	**Debris**	**53**	**Yellow**	**Paint**	**Metal**	**200,000 - 240,000**	**11**	**56,000**	**Poor**	**40 Ln. ft.**
Ground Level	Exterior	Electrical box	54	Lt. gray	Paint	Metal	<40	<10	<80	Fair	20 Sq. ft.
Ground Level	**Exterior**	**Bollards, fire hydrants**	**52**	**Yellow**	**Paint**	**Metal**	**120 - 130**	<10	<80	**Poor**	**550 Ln. ft.**

Note

Bold values indicate results above the reporting limit.

Bold and red values indicate LBP.

Good – Material is in an "as installed" condition. It is usable as is and may show cosmetic wear and tear or fading.

Fair – Material is functional for its installed purpose but shows initial signs of deterioration beyond the cosmetic.

Poor – Material shows significant deterioration and may not be functional for its installed purpose. Paint is bubbling or peeling over 20% or more of surface area and no longer protects the substrate.

Abbreviations and Acronyms

Cd – Cadmium
CMU – Concrete Masonry Unit
sq. ft. – Square Feet
LCP – Lead-Containing Paint, <5,000 mg/kg
mg/kg – milligrams per kilogram or parts per million
LBP – Lead-Based Paint, ≥5,000 mg/kg
Cr – Chromium
ln. ft. – Linear Feet
HM ID – Hazardous Material Identifier

Table 4. Summary of TCLP Sampling and Analysis

Sample	Bldg	Locations	Material	Substrate	TCLP Metals Result* (mg/L)							
					Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
TCLP1	**B2550, B2551**	**Ceiling, eaves, floor, roof, walls**	**Paints**	**Concrete, CMU**	<2	<5	0.06	<0.4	**2.2**	<0.02	<0.75	<0.1
TCLP2	**B2550, B2551**	**Conduit, H-beams, ladder, window frames, door frames**	**Paints**	**Metal**	<2	7.4	0.46	<0.4	**4.8**	<0.02	<0.75	<0.1
TCLP3	**B2552**	**Ceiling, eaves, floor, roof, walls**	**Paints**	**Concrete, CMU**	<2	<5	<0.05	<0.4	**1.2**	<0.02	<0.75	<0.1
TCLP4	**B2552**	**Conduit, windows, window frames, door frames, roll-up door, roll-up door frame**	**Paints**	**Wood, Drywall, Metal**	<2	<5	0.37	<0.4	**4.5**	<0.02	<0.75	<0.1

Note
Bold value was detected but below the regulatory limit.
*TCLP Regulatory Limit: Arsenic 5 mg/L, Barium 100 mg/L, Cadmium 1 mg/L, Chromium 5 mg/L, Lead 5 mg/L, Mercury 0.2 mg/L, Selenium 1 mg/L, and Silver 5 mg/L.

Abbreviations and Acronyms

TCLP – Toxicity Characteristic Leaching Procedure

7.0 SUSPECT PCB-CONTAINING BALLAST RESULTS

Handling, storage, transportation, and disposal of suspect PCB-containing waste are regulated by the Toxic Substance Control Act (TSCA; 40 CFR 761). MNA inventoried seven fluorescent light fixtures, containing a total of seven ballasts, throughout B2552. All fixtures were accessible. Four light ballasts, were inspected, and they were identified as non-PCB ballasts because the "No PCBs" label was observed/the manufactured date was after 1998 and confirmed with the manufacturer SDS as "No PCBs." The inspector accessed this information on the manufacturer's website. The ballasts were in Room 1, Room 2, and Storage room.

8.0 MERCURY RESULTS

A total of four light switches were also inspected in B2552, and four of them were suspected of mercury-containing. Guam has not adopted the EPA Standards for Universal Waste Management (40 CFR 273). Thus, suspected mercury-containing must be disposed of as hazardous waste.

9.0 OTHER HAZARDS AND MATERIALS

9.1 Chemicals and Chemical Storages in IRP Building Compound

The IRP Building Compound has been used as a staging area for various IR investigations. Various chemicals and drums were stored in the Compound. B2551 includes chemicals (methanol, nitric acid, etc.) and used oil. Various 55-gallon drums and other liquid storages were observed. The Installation will remove/dispose of them before construction.

Photograph 2. B2551: Various Chemicals and Used Oil

Photograph 3. IRP Building Compound: 55-Gallon Drums and Storages

9.2 Biohazards (Wasps, Rodents, Molds, Snakes, Wildlife)

During the surveys, wasps and rodents were observed inside and outside B2551 and B2552. The Contractor may assume encountering mold contamination in those buildings. Most of the project site is an undeveloped jungle. The Contractor must assume biohazards including wasps, rodents, snakes, and other wildlife.

9.3 Treated Wooden Utility Poles

Wooden utility poles will be demolished. The local landfill (i.e. Layon Landfill) prohibits receiving treated wood waste. The wooden poles may be reused for the original purpose. If reusing is not feasible, the waste must be disposed of at a permitted off-island disposal facility, in the mainland U.S. The Contractor must provide all necessary testing and analysis required for waste disposal. Chipping treated wood materials to use as mulch or other ground cover is not permitted.

10.0 SUMMARY OF SURVEY RESULTS

MNA conducted a hazardous material survey for the areas and structures to be demolished and cleared. Based on as-built drawing review, visual inspection and sampling and analysis, MNA provides the following summary.

Summary of Hazardous Material Findings

Sampling Areas		Locations	ACM	Paint/Coating				PCB Ballast	Mercury Switch
				LCP	LBP	Cd	Cr		
IRP Building Compound	B550	Exterior	□	◙	◙	◙	◙		
	B2551	Exterior	◙	◙	◙				
		Interior	◙	◙	◙				
	B2552	Exterior		◙	◙	◙	◙		
		Plenum		◙	◙		◙		
		Restroom		◙	◙		◙		◙
		Room 1	◙	◙	◙	◙	◙		◙
		Room 2							◙
		Storage		◙	◙	◙	◙		
	Vicinity	Exterior			◙	◙	◙		
		Underground Concrete Pipes	◙ Assumed ACM						
Undeveloped Project Areas (Jungle)		Scattered Waste Debris	◙ (Transite Pipes)	◙	◙	◙	◙		

Note ◙ indicates presence of hazardous material □ indicates trace amount of hazardous material

Abbreviations and Acronyms

ACM – Asbestos-Containing Material, 1% or higher
Cd – Cadmium
Cr – Chromium
Hg – Mercury
IRP – Installation Restoration Program
LBP – Lead-Based Paint, ≥5,000 mg/kg
LCP – Lead-Containing Paint, <5,000 mg/kg
PCB – Polychlorinated Biphenyls

11.0 RECOMMENDATIONS FOR RENOVATION AND CONSTRUCTION WORK

It is required that properly trained employees perform demolition and construction work that disturbs hazardous materials, in a manner protective of the site workers, the public, facility users, base personnel, and the environment. The following recommendations address OSHA and other applicable federal requirements. These recommendations provide guidance for the management of hazardous building materials and control of occupational and environmental hazards associated with operations, maintenance, renovation, and demolition. These recommendations are based on information gathered during the hazardous materials survey. These recommendations are not intended to constitute a formal work plan but are intended to provide a starting point for the development of a work plan.

11.1 Asbestos-Containing Materials

Any ACM disturbance exceeding 3 square feet or 3 linear feet of friable ACM or generating 0.5 cubic feet of ACM debris is considered a regulated activity. Contractors are required to comply with 29 CFR 1926.1101(k)(3)(i) to identify the presence, location, and quantity of ACM and/or assumed-ACM before any work is begun.

Employees involved in demolition and construction activities that disturb asbestos must conduct work in accordance with 29 CFR 1926.1101, the OSHA Asbestos Construction Standard. Work practices that would trigger these requirements include, but are not limited to, repair, maintenance, or renovation of structures containing asbestos, as well as removal or encapsulation of materials containing asbestos. For each project, the contractor must determine the appropriate safety measures based on the area to be disturbed, the type, volume, and condition of asbestos materials. Applicable work practice guidelines involving the disturbance of asbestos materials are summarized, but are not limited to:

- Contractors must anticipate hazards and utilize appropriate engineering controls and personal protective equipment (PPE).
- Employers must provide and require the use of appropriate PPE for any employee exposed to airborne concentrations of asbestos that exceed OSHA regulatory limits, or for which a required negative exposure assessment is not produced (29 CFR 1926.1101[i][1]).
- Employees must utilize respiratory protection until the initial exposure monitoring assessment documents safe working levels of airborne asbestos (29 CFR 1926.1101[f] and [h]). Additional periodic exposure monitoring may be required.
- An initial exposure monitoring assessment must be carried out when workers are disturbing asbestos to ensure that they are not exposed to airborne asbestos concentrations greater than the Permissible Exposure Limit (PEL) of 0.1 fibers per cubic centimeter (f/cc) of air as an 8-hour time-weighted average (TWA), and the Excursion Limit of 1.0 f/cc over a 30-minute sampling period.

- The work site must be maintained as a controlled regulated area and supervised by a competent person at all times.
- Employees must implement stringent dust control procedures to prevent asbestos in any airborne or settled dust.
- Employees must clean the work area thoroughly using wet methods and a high-efficiency particulate air (HEPA) vacuum. Dry sweeping or air blowing of asbestos-containing debris and dust must be avoided.
- Waste and dust containing asbestos must be collected separately from other construction debris. Workers must conduct prompt and controlled clean up and disposal of asbestos wastes and debris in leak-tight containers.
- Asbestos-containing waste must be wet, packaged, labeled, stored, and disposed of in accordance with applicable regulations.
- Visually inspect the work area to ensure that all asbestos-containing debris and dust has been properly removed.
- Conduct clearance in accordance with contract specifications.

11.2 Lead/Heavy Metal-Containing Paints

Employees involved in renovation or demolition activities that disturb lead-, cadmium-, or chromium-containing paints must conduct work in general accordance with 29 CFR 1926.62 OSHA Lead in Construction Standard, 29 CFR 1926.1127 OSHA Cadmium in Construction Standard, 29 CFR 1926.1126 OSHA Chromium in Construction Standard.

The OSHA General Industry and Construction Standards also regulate mercury under 29 CFR 1910 Subpart H, I, and Z; and 29 CFR 1926 Subpart D and E. Work practices that would trigger these requirements include, but are not limited to, sanding, blasting, welding, cutting, scraping, and spot/whole paint removals. For each project, the contractor must determine the appropriate safety measures based on the area to be disturbed, the lead concentration, and the paint condition. Applicable work practice guidelines involving the disturbance of lead paints are summarized, but are not limited to:

- Contractors must anticipate hazards and utilize appropriate engineering controls and personal protective equipment (PPE).
- Employees must utilize respiratory protection until the initial air monitoring assessment documents safe working levels of airborne lead (29 CFR 1926.62[d][1] and [2][i][A]), airborne cadmium (29 CFR 1926.62[d][1]), airborne chromium (29 CFR 1926.1126[d][1] and [d][2]), and airborne mercury (29 CFR 1926.95).
- An exposure assessment must be carried out when employees are disturbing LCP or LBP/heavy metal-containing paints to ensure that they are not exposed to airborne lead concentrations greater than the Permissible Exposure Limit (PEL) of 50 micrograms per cubic meter (µg/m3) for lead, 5 $\mu g/m^3$ for cadmium, 1,000 µg/m3 for chromium metal, 5

µg/m^3 for chromium (VI), averaged over an 8-hour period. Additional periodic exposure monitoring may be required if the Action Level averaged over an 8-hour period is exceeded.

- Employees must implement stringent dust control procedures to prevent airborne dust containing lead, cadmium, or chromium.
- Employees must clean the work area thoroughly using wet methods and a high-efficiency particulate air (HEPA) vacuum. Dry sweeping or air blowing of debris and dust containing lead, cadmium, or chromium must be avoided.
- Lead-, cadmium-, and chromium-containing debris must be segregated from other wastes, collected, and containerized. Wastes must be characterized per State of Hawaii requirements, including a determination of the waste as hazardous or non-hazardous. Lead-, cadmium-, and chromium-containing waste must be handled and disposed of in accordance with applicable requirements.
- Visually inspect and verify the work area to ensure all lead-containing debris and dust has been properly removed and the project site is free of lead, cadmium, and chromium hazard.
- Conduct clearance in accordance with contract specifications.

11.3 Arsenic-Containing Materials

No suspected arsenic-containing materials were identified in the project areas during this survey. Therefore, no special arsenic control measures are provided.

11.4 PCB-Containing Ballasts

No suspect PCB-containing ballasts were identified in the project areas during this survey. Therefore, no special PCB control measures are provided for handling ballasts.

11.5 Mercury-Containing Light Switches

Trained employees are required to perform disturbance, removal, or release cleanup of suspect mercury-containing light switches, and the work must be performed in accordance with EPA and OSHA regulations. Safeguards, precautions, and protective measures must be implemented to prevent mercury exposure. Applicable work practice guidelines involving mercury-containing items and/or mercury-contaminated materials are summarized, but are not limited to:

- Contractors must anticipate hazards and utilize appropriate engineering controls and personal protective equipment (PPE). In an event light tubs are broken, ventilate the affected area immediately and continuously.
- All work involving mercury-containing items must be performed by properly trained and equipped personnel.
- A written mercury spill response plan must be prepared to aid in spill response if a mercury release occur at the building.

- Clean up leaks and spills and handle disposal operations in compliance with regulatory requirements and spill kit Safety Data Sheet (SDS).
- Trained employees must ventilate the area and clean up mercury spills using the response kit and appropriate equipment and PPE.
- Establish mercury controlled areas for removal or spill cleanup to prevent unauthorized entry of personnel. Maintain a log of employees working in mercury controlled areas.
- All mercury waste must be stored and disposed of in compliance with EPA regulations, and all records involving mercury must be properly maintained.
- Inspect mercury waste containers for leaks in a timely manner.

11.6 Silica in Concrete

Silica exposure is a potential concern during demolition and cement/concrete related works. Worker protection from exposures to respirable crystalline silica is enforced by OSHA (29 CFR 1926.1153; 29 CFR 1910.1053). All appropriate engineering controls must be implemented and PPE may be considered as added protection.

12.0 LIMITATIONS

Industry standard effort was made to identify suspected hazardous building materials during the survey at the project area. However, this does not imply a guarantee that all suspected building materials and hazardous materials were identified by this assessment because certain building materials and/or surfaces may be hidden by walls, flooring/concrete slab, partitions, and/or other building components, existing equipment or furniture, or underground. If any previously unforeseen suspected materials become known, such as any hazardous chemicals in the low-lead or lead-free paint coatings, engineering controls will be required prior to the planned construction.

Paint samples were analyzed for Lead, cadmium, and chromium content only. There is a potential for the presence of other hazardous chemicals in the lead-free or low-lead paint coatings, such as cadmium, chromium, arsenic, zinc, and other metals and chemical substances. Suspect asbestos materials may contain other hazardous substances, such as silica or other mineral fibers. Contractor must anticipate hazards and take all appropriate measures to prevent exposures to site workers, tenants, student/faculty/staff, the public, and the environment.

Material quantities provided in this report are based on visual approximations taken at the time of the survey only and must not be used for bidding purpose. It is the Contractor's responsibility to verify the material quantities and volume of waste prior to bidding.

Analytical results provided in this report do not meet the requirements for waste characterizations. Contractor must coordinate with permitted landfills for waste characterization requirements.

This page is intentionally left blank.

APPENDIX A: INSPECTOR CERTIFICATIONS

Danny Falanug

State of Hawai'i
Asbestos Certification
Training Course Exp. Dates
Falanug
Danny
State Exp. Date 05/25/2024

State of Hawai'i
Lead Based Paint Activities Certification
Falanug
Danny

APPENDIX B: HOMOGENEOUS MATERIALS IDENTIFIED AND SAMPLE TYPES COLLECTED

Homogeneous Materials Identified and Sample Types Collected

HM ID	Building	Floor	Rooms	Locations	Material Color	Material	Substrate	Asb	Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Condition	Estimated Quantity
1	**2550**	**1**	**Exterior**	**Ceiling, walls**	**Off-white**	**Paint**	**Concrete**		**16,000 - 20,000**	<10	**2,600**	**Poor**	**1,000 Sq. ft.**
2	2550	1	Exterior	Ceiling, walls	Off-white	Paint/skim coat	Concrete	ND				Poor	1,000 Sq. ft.
3	**2550**	**1**	**Exterior**	**Conduit, H-beams, ladder**	**Off-white**	**Paint**	**Metal**		**47,000 - 63,000**	<10	**12,000**	**Poor**	**200 Sq. ft.**
4	**2550**	**Roof**	**Exterior**	**Roof**	**White**	**Paint**	**Concrete**		**4,600 - 8,500**	<10	**1,800**	**Poor**	**200 Sq. ft.**
5	2550	Roof	Exterior	Roof	White	Paint Skim coat	Concrete	<1% Chrysotile				Poor	200 Sq. ft.
6	**2550**	**1**	**Exterior**	**Floor**	**Lt. blue**	**Coating**	**Concrete**		**650 - 5,600**	**18**	**1,400**	**Poor**	**340 Sq. ft.**
7	2550	1	Exterior	Floor	Lt. blue	Coating	Concrete	<1% Chrysotile				Poor	340 Sq. ft.
8	IRP Compound	1	Exterior	Floor	Gray	Bare concrete	None	ND				Poor	1,600 Sq. ft.
9	**2551**	**1**	**Exterior**	**Eave, wall**	**Off-white**	**Paint**	**CMU**		**21,000 - 32,000**	**14**	**8,200**	**Poor**	**320 Sq. ft.**
10	2551	1	Exterior	Eave, wall	Off-white	Paint/skim coat	CMU	ND				Poor	320 Sq. ft.
11	**2551**	**1**	**Exterior**	**Conduit, door, door frame, windows**	**Off-white**	**Paint**	**Metal**		**3,600 - 7,600**	**100**	**10,000**	**Poor**	**40 Sq. ft.**
12	**2551**	**1**	**Exterior**	**Floor**	**Lt. blue**	**Coating**	**Concrete**		**140 - 170**	**23**	<80	**Poor**	**300 Sq. ft.**
13	2551	1	Exterior	Floor	Lt. blue	Coating	Concrete	<1% Chrysotile				Poor	300 Sq. ft.
14	**2551**	**1**	**Exterior**	**Eave**	**Brown**	**Paint**	**Concrete**		**24,000 - 42,000**	<10	**11,000**	**Poor**	**20 Ln. ft.**
15	2551	1	Exterior	Eave	Brown	Paint/skim coat	Concrete	ND				Poor	20 Ln. ft.
16	**2552**	**1**	**Exterior**	**Walls**	**Off-white**	**Paint**	**CMU**		**270 - 310**	<10	<80	**Fair**	**700 Sq. ft.**
17	2552	1	Exterior	Walls	Off-white	Paint/skim coat	CMU	ND				Fair	700 Sq. ft.

Homogeneous Materials Identified and Sample Types Collected

HM ID	Building	Floor	Rooms	Locations	Material Color	Material	Substrate	Asb	Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Condition	Estimated Quantity
18	**2552**	**1**	**Exterior**	**Eaves**	**Brown**	**Paint**	**Concrete**		**67 - 210**	<10	<80	**Poor**	**100 Sq. ft.**
19	**2552**	**1**	**Exterior**	**Conduit, door, pipes, roll-up door, windows**	**Off-white**	**Paint**	**Metal**		**13,000 - 59,000**	<10	**14,000**	**Poor**	**120 Sq. ft.**
20	**2552**	**1**	**Exterior**	**Window, window frames**	**Off-white**	**Paint**	**Wood**		**580 - 1,700**	<10	<80	**Good**	**20 Sq. ft.**
21	**2552**	**1**	**Exterior**	**Eaves, footing**	**Off-white**	**Paint**	**Concrete**		**260 - 350**	<10	<80	**Poor**	**300 Sq. ft.**
22	2552	1	Exterior	Eaves, footing	Off-white	Paint/skim coat	Concrete	ND				Poor	300 Sq. ft.
23	**2552**	**1**	**Exterior**	**Door, door frame**	**Brown**	**Paint**	**Metal**		**2,300 - 2,800**	**13**	**96**	**Good**	**30 Sq. ft.**
24	**2552**	**1**	**Exterior**	**Floor**	**Gray**	**Paint**	**Concrete**		**640 - 11,000**	<10	**150**	**Fair**	**60 Sq. ft.**
25	2552	1	Exterior	Floor	Gray	Paint/skim coat	Concrete	ND				Fair	60 Sq. ft.
26	2552	1	Exterior	Window frames	Black	Caulking	Wood	ND				Good	30 Ln. ft.
27	**2552**	**1**	**Plenum, Restroom, Room 1, Storage**	**Walls**	**Off-white**	**Paint**	**CMU**		**7,100 - 7,500**	<10	**1,300**	**Fair**	**400 Sq. ft.**
28	2552	1	Plenum, Restroom, Room 1, Storage	Walls	Off-white	Paint/skim coat	CMU	ND				Fair	400 Sq. ft.
29	**2552**	**1**	**Plenum, Restroom, Room 1, Storage**	**Beams, ceiling**	**Off-white**	**Paint**	**Concrete**		**480 - 790**	<10	<80	**Poor**	**700 Sq. ft.**
30	2552	1	Plenum, Restroom, Room 1, Storage	Beams, ceiling	Off-white	Paint/skim coat	Concrete	ND				Poor	700 Sq. ft.
31	2552	1	Plenum, Room 1, Room 2, Storage	Walls	Off-white	Paint	Drywall		<40	<10	<80	Good	820 Sq. ft.

Homogeneous Materials Identified and Sample Types Collected

HM ID	Building	Floor	Rooms	Locations	Material Color	Material	Substrate	Asb	Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Condition	Estimated Quantity
32	2552	1	Plenum, Room 1, Room 2, Storage	Walls	Off-white	Drywall	None	ND				Good	820 Sq. ft.
33	**2552**	**1**	**Restroom, Room 1, Storage**	**Conduit, pipes, windows**	**Off-white**	**Paint**	**Metal**		**11,000 - 12,000**	<10	**2,300**	**Fair**	**40 Ln. ft.**
34	2552	1	Restroom, Room 1, Storage	Door, door frames, window	Off-white	Paint	Wood		<40	<10	<80	Good	40 Sq. ft.
35	**2552**	**1**	**Room 1, Storage**	**Door, door frame, roll-up door, roll-up door frame**	**Brown**	**Paint**	**Metal**		**5,000 - 6,200**	**14**	**710**	**Poor**	**120 Sq. ft.**
36	**2552**	**1**	**Room 1**	**Floor**	**Gray**	**Paint**	**Concrete**		**59 - 61**	<10	<80	**Fair**	**200 Sq. ft.**
37	2552	1	Room 1	Floor	Gray	Paint/skim coat	Concrete	ND				Fair	60 Sq. ft.
38	**2552**	**1**	**Room 1**	**Door frame, window frame**	**Brown**	**Paint**	**Wood**		**530 - 580**	<10	**130**	**Good**	**30 Ln. ft.**
39	2552	1	Room 2	Walls	Brown	Wallpaper	CMU	ND				Good	260 Sq. ft.
40	**2552**	**1**	**Room 1**	**Door frame**	**Gray**	**Caulking**	**Metal**	**2% Chrysotile**				**Good**	**10 Ln. ft.**
41	2552	1	Room 1	Window frames	White	Caulking	Metal	ND				Good	20 Ln. ft.
42	2552	1	Room 1, Room 2	Walls	Brown	Cove base	Drywall	ND				Fair	70 Ln. ft.
43	2552	1	Room 1, Room 2	Walls	White	Cove base	Drywall	ND				Fair	50 Ln. ft.
44	2552	1	Restroom	Sink, urinal	White	Caulking	Porcelain	ND				Fair	10 Ln. ft.
45	2552	1	Restroom, Room 2	Floor	Off-white	12" x 12" VFT	Concrete	ND				Fair	340 Sq. ft.
46	2552	1	Room 2	Ceiling	White	2' x 4' Acoustic tile	None	ND				Fair	200 Sq. ft.
47	2552	Roof	Exterior	Roof	White	Coating	Concrete		<40	<10	<80	Good	600 Sq. ft.
48	IRP Compound	1	Exterior	Floor	Black	Expansion joint	Concrete	ND				Good	20 Ln. ft.

Homogeneous Materials Identified and Sample Types Collected

HM ID	Building	Floor	Rooms	Locations	Material Color	Material	Substrate	Asb	Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Condition	Estimated Quantity
49	**IRP Compound**	**1**	**Exterior**	**Debris**	**Yellow**	**Paint**	**Metal**		**210,000 - 230,000**	**14**	**46,000**	**Fair**	**80 Sq. ft.**
50	**IRP Compound**	**1**	**Exterior**	**Monument**	**Brown**	**Paint**	**Rock**		**11,000 - 28,000**	<10	**3,300**	**Fair**	**20 Sq. ft.**
51	**IRP Compound**	**1**	**Exterior**	**Electrical box, pipes. Transformer**	**Off-white**	**Paint**	**Metal**		**13,000 - 18,000**	**12**	**2,700**	**Good**	**60 Sq. ft.**
52	**Undeveloped Area**	**1**	**Exterior**	**Bollards, fire hydrants**	**Yellow**	**Paint**	**Metal**		**120 - 130**	<10	<80	**Poor**	**550 Ln. ft.**
53	**Undeveloped Area**	**1**	**Exterior**	**Debris**	**Yellow**	**Paint**	**Metal**		**200,000 - 240,000**	**11**	**56,000**	**Poor**	**40 Ln. ft.**
54	**Undeveloped Area**	1	Exterior	Electrical box	Lt. gray	Paint	Metal		<40	<10	<80	Fair	20 Sq. ft.
55	**2551**	**1**	**Interior**	**Walls**	**Blue**	**Paint**	**CMU**		**1,400 - 1,600**	<10	**150**	**Fair**	**320 Sq. ft.**
56	**2551**	**1**	**Interior**	**Conduit, door frame, window frames**	**Blue**	**Paint**	**Metal**		**1,400 - 2,400**	**28**	**1,900**	**Fair**	**20 Ln. ft.**
57	**2551**	**1**	**Interior**	**Ceiling**	**White**	**Paint**	**Concrete**		**42 - 68**	<10	<80	**Fair**	**70 Sq. ft.**
58	**2551**	**1**	**Interior**	**Door frame**	**Silver**	**Paint**	**Metal**		**4,900 - 10,000**	**82**	**2,200**	**Fair**	**40 Ln. ft.**
59	2551	1	Interior	Walls	Black	Tar	CMU	ND				Fair	60 Sq. ft.
60	**2551**	**1**	**Interior**	**Floor**	**Green Black**	**12" x 12" VFT Mastic**	**Concrete**	**4% Chrysotile 10% Chrysotile**				**Fair**	**20 Sq. ft.**
61	**2551**	**1**	**Interior**	**Floor**	**Black**	**12" x 12" VFT Mastic**	**Concrete**	**5% Chrysotile 8% Chrysotile**				**Fair**	**20 Sq. ft.**
62	2551	1	Interior	Door frame	Black	Caulking	Metal	ND				Fair	10 Ln. ft.
63	Undeveloped Area	1	Exterior	Debris	Bare	Concrete	None	ND				Fair	400 Sq. ft.

Homogeneous Materials Identified and Sample Types Collected

HM ID	Building	Floor	Rooms	Locations	Material Color	Material	Substrate	Asb	Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Condition	Estimated Quantity
64	Undeveloped Area	1	Exterior	8" Pipe	Lt. gray	Transite	None	15% Chrysotile 5% Crocidolite				Fair	100 Ln. ft.
65	Undeveloped Area	1	Exterior	Debris	Black	Coating	Metal	10% Chrysotile				Poor	40 Sq. ft.
66	Undeveloped Area	1	Exterior	4" Pipes	Lt. gray	Transite	None	18% Chrysotile 3% Crocidolite				Fair	40 Ln. ft.
67	Undeveloped Area	1	Exterior	6" Pipes	Lt. gray	Transite	None	18% Chrysotile 2% Crocidolite				Fair	60 Ln. ft.
68	Undeveloped Area	1	Exterior	12" Pipe	Lt. gray	Transite	None	18% Chrysotile 5% Crocidolite				Fair	30 Ln. ft.
69	Undeveloped Area	1	Exterior	Debris	Black	Coating	Metal	20% Chrysotile				Poor	160 Ln. ft.
70	IRP Compound	1	Underground	Pipes	N/A	Concrete	Metal	Assume ACM				Unknown	400 Ln. ft.

Bold values indicate results above the reporting limit.

All asbestos found to be chrysotile.

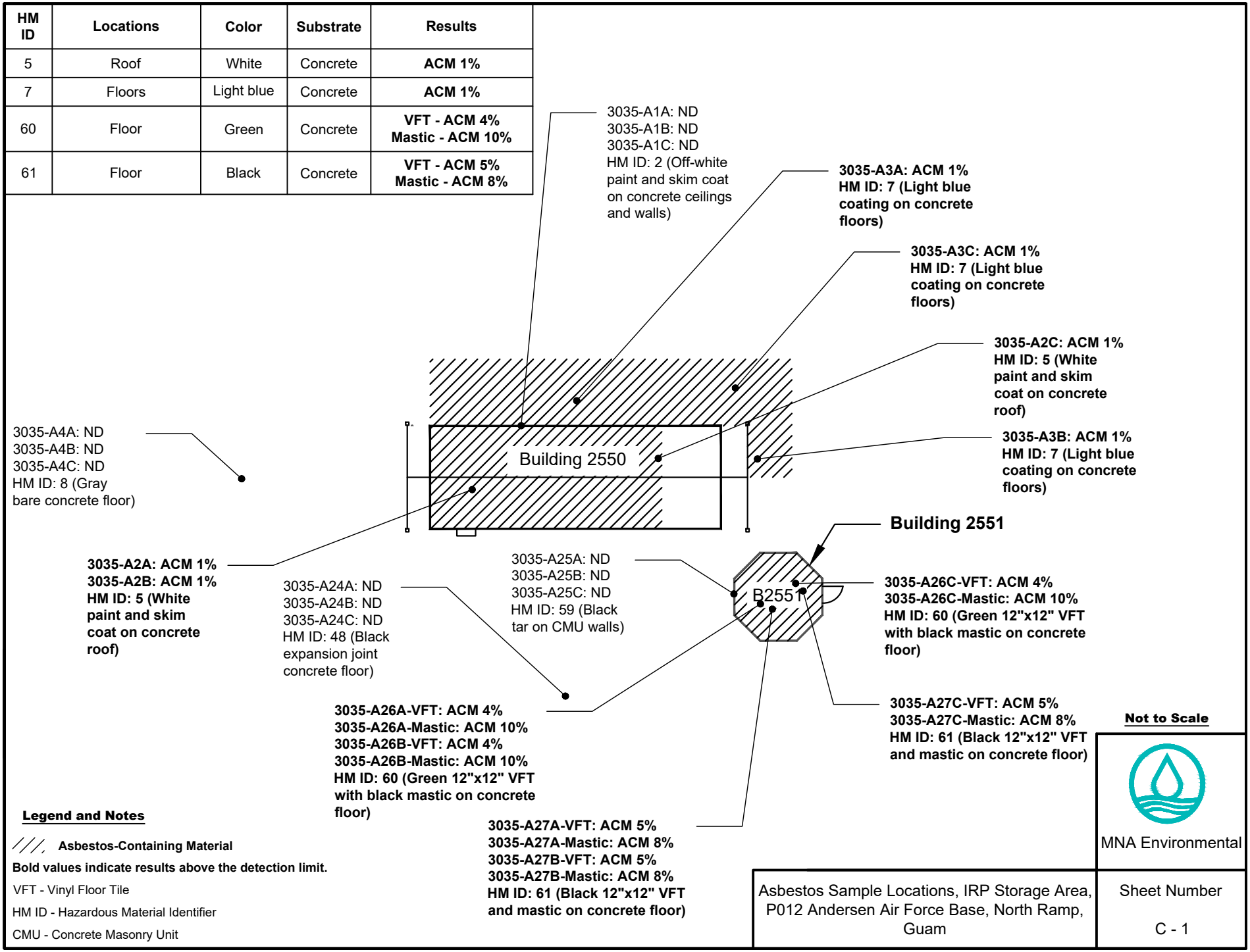
Abbreviations and Acronyms

Asb - Asbestos
ACM - Asbestos-Containing Material
CMU - Concrete Masonry Unit
HM ID - Homogeneous Material Identifier
LBP - Lead-Based Paint ≥>5,000 mg/kg
LCP - Lead-Containing Material <5,000 mg/kg
ln. ft. - linear feet
mg/kg - milligrams per kilogram, equivalent to parts per million
ND - Not Detected
sq. ft. - square feet
VFT - Vinyl Floor Tile

APPENDIX C: SAMPLE AND HAZARDOUS MATERIAL LOCATION DRAWINGS

List of Drawings	
B2550 and B2551: Asbestos Sample Locations	C-1
B2552 Asbestos Sample Locations: Interior	C-2
B2552 Asbestos Sample Locations: Exterior	C-3
B2550 and B2551: Heavy Metals Sample Locations	C-4 – C-5
B2552 Heavy Metals Sample Locations	C-6 – C-7
Abandoned Debris Containing Asbestos	C-8
Various Heavy Metal Containing Materials	C-9

HM ID	Locations	Color	Substrate	Results
5	Roof	White	Concrete	**ACM 1%**
7	Floors	Light blue	Concrete	**ACM 1%**
60	Floor	Green	Concrete	**VFT - ACM 4% Mastic - ACM 10%**
61	Floor	Black	Concrete	**VFT - ACM 5% Mastic - ACM 8%**



Not to Scale

Legend and Notes

Asbestos-Containing Material

Bold values indicate results above the detection limit.

VFT - Vinyl Floor Tile

HM ID - Hazardous Material Identifier

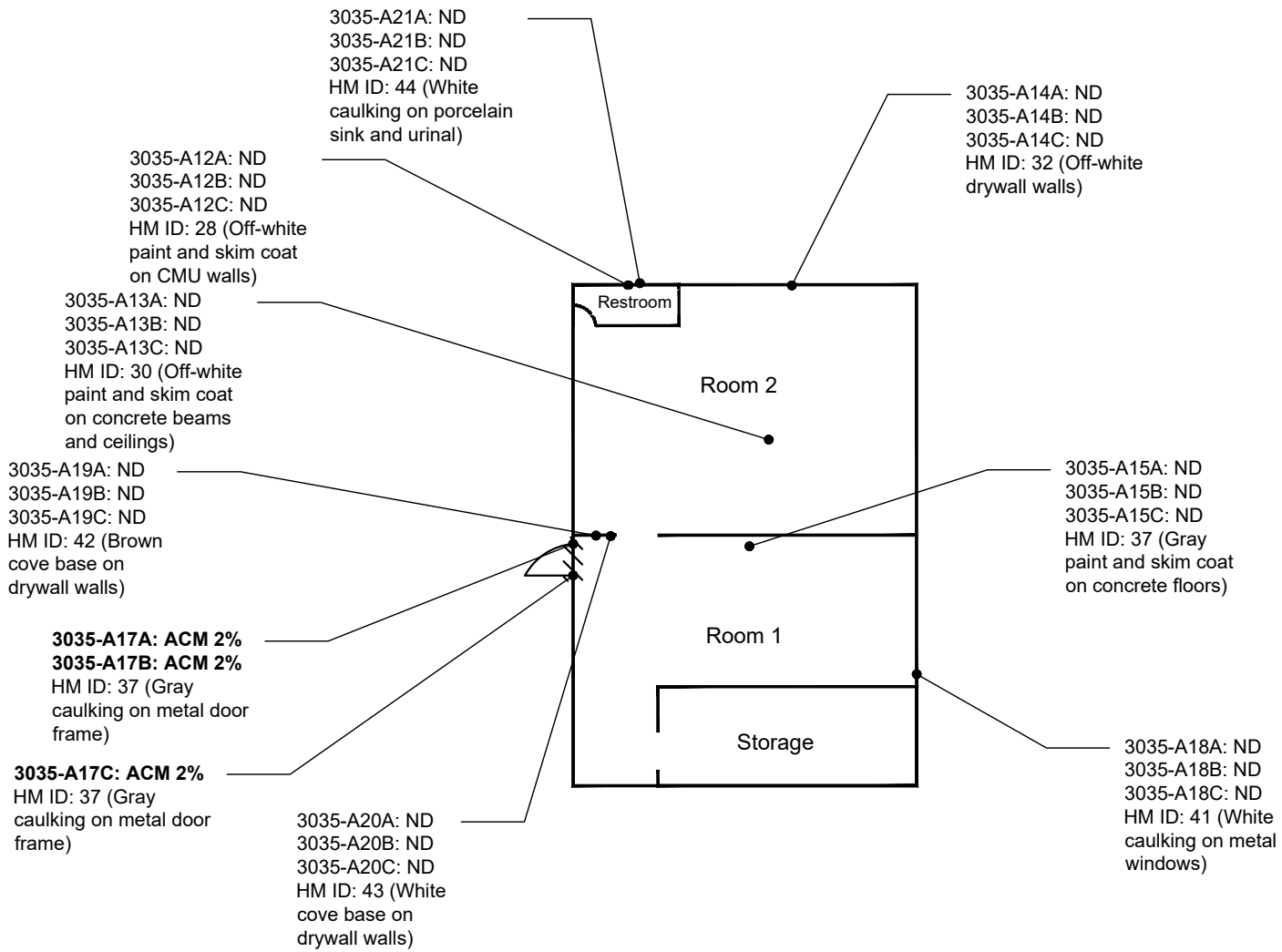
CMU - Concrete Masonry Unit

MNA Environmental

Asbestos Sample Locations, IRP Storage Area, P012 Andersen Air Force Base, North Ramp, Guam

Sheet Number

C - 1



Not to Scale

Legend and Notes

Visual Extent of Asbestos-Containing Material

Bold values indicate results above the detection limit.

CMU - Concrete Masonry Unit

HM ID - Hazardous Material Identifier

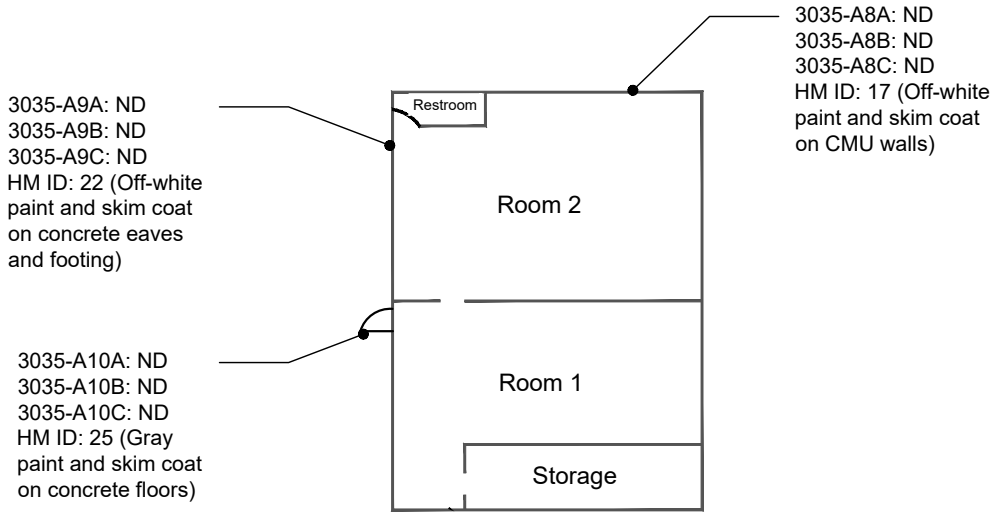
mg/kg - milligrams per kilogram (equivalent to ppm- parts per million)

MNA Environmental

Asbestos Sample Locations, IRP Storage Area-2, P012 Andersen Air Force Base, North Ramp, Guam

Sheet Number

C - 2



Not to Scale

MNA Environmental

Legend and Notes

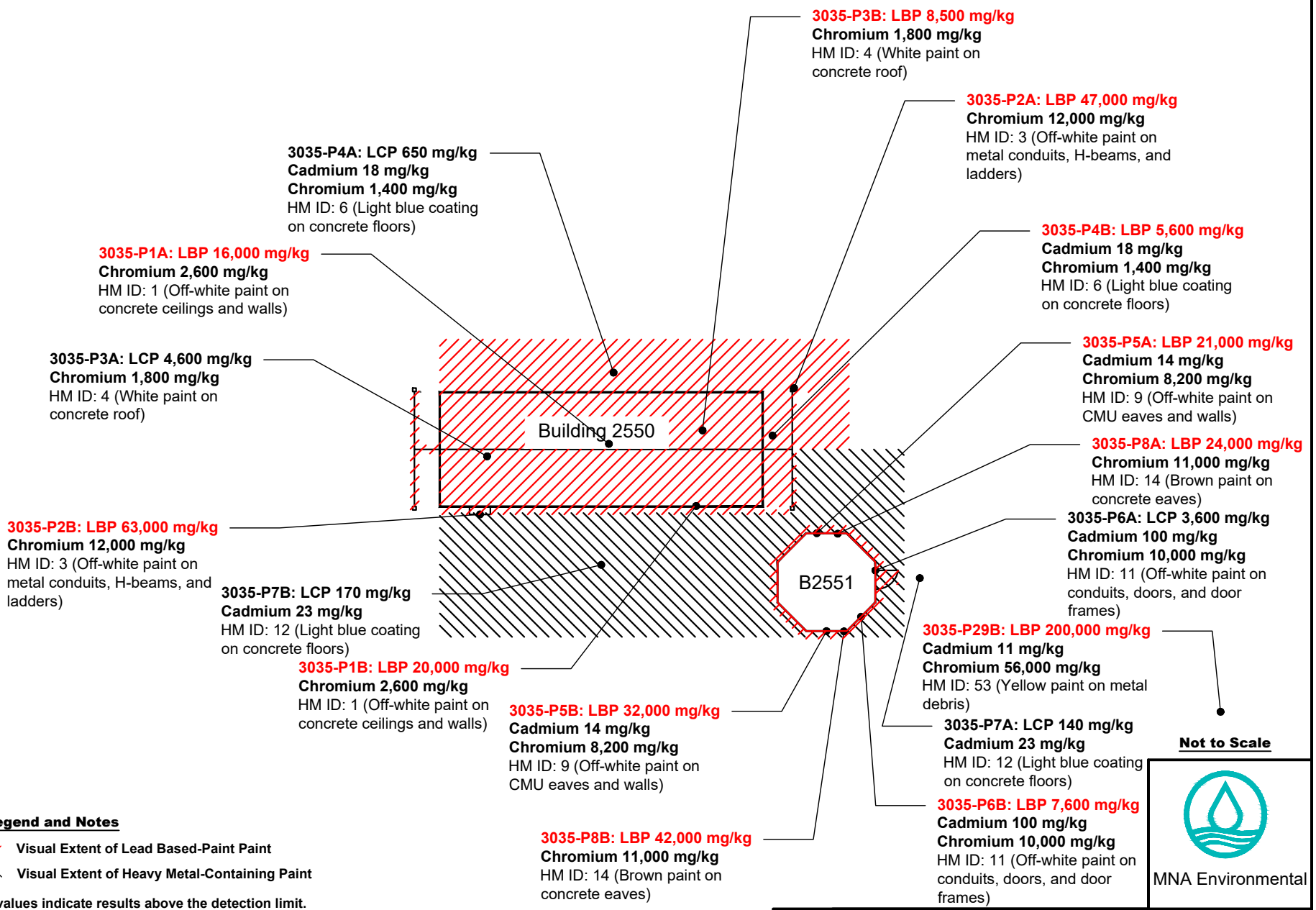
HM ID - Hazardous Material Identifier

CMU - Concrete Masonry Unit

Asbestos Sample Locations, IRP Storage Area Exterior, P012 Andersen Air Force Base, North Ramp, Guam

Sheet Number

C - 3



Legend and Notes

Visual Extent of Lead Based-Paint Paint

Visual Extent of Heavy Metal-Containing Paint

Bold values indicate results above the detection limit.

CMU - Concrete Masonry Unit

HM ID - Hazardous Material Identifier

mg/kg - milligrams per kilogram (equivalent to ppm- parts per million)

MNA Environmental

Heavy Metals Sample Locations, IRP Storage Area, P012 Andersen Air Force Base, North Ramp, Guam

Sheet Number

C - 4

HM ID	Locations	Paint Color	Substrate	Results (mg/kg)
1	Ceilings and walls	Off-white	Concrete	**LBP 16,000 - 20,000** **Chromium 2,600**
3	Conduits, H-beams, and ladders	Off-white	Metal	**LBP 47,000 - 63,000** **Chromium 12,000**
4	Roof	White	Concrete	**LBP 4,600 - 8,500** **Chromium 1,800**
6	Floor	Light blue	Concrete	**LBP 650 - 5,600** **Cadmium 18** **Chromium 1,400**
9	Eaves and walls	Off-white	CMU	**LBP 21,000 - 32,000** **Cadmium 14** **Chromium 8,200**
11	Conduits, doors, and door frames	Off-white	Metal	**LBP 3,600 - 7,600** **Cadmium 100** **Chromium 10,000**
12	Floors	Light blue	Concrete	**LCP 140 - 170** **Cadmium 23**
14	Eaves	Brown	Concrete	**LBP 24,000 - 42,000** **Chromium 11,000**

Not to Scale

Legend and Notes

Bold values indicate results above the detection limit.

CMU - Concrete Masonry Unit

HM ID - Hazardous Material Identifier

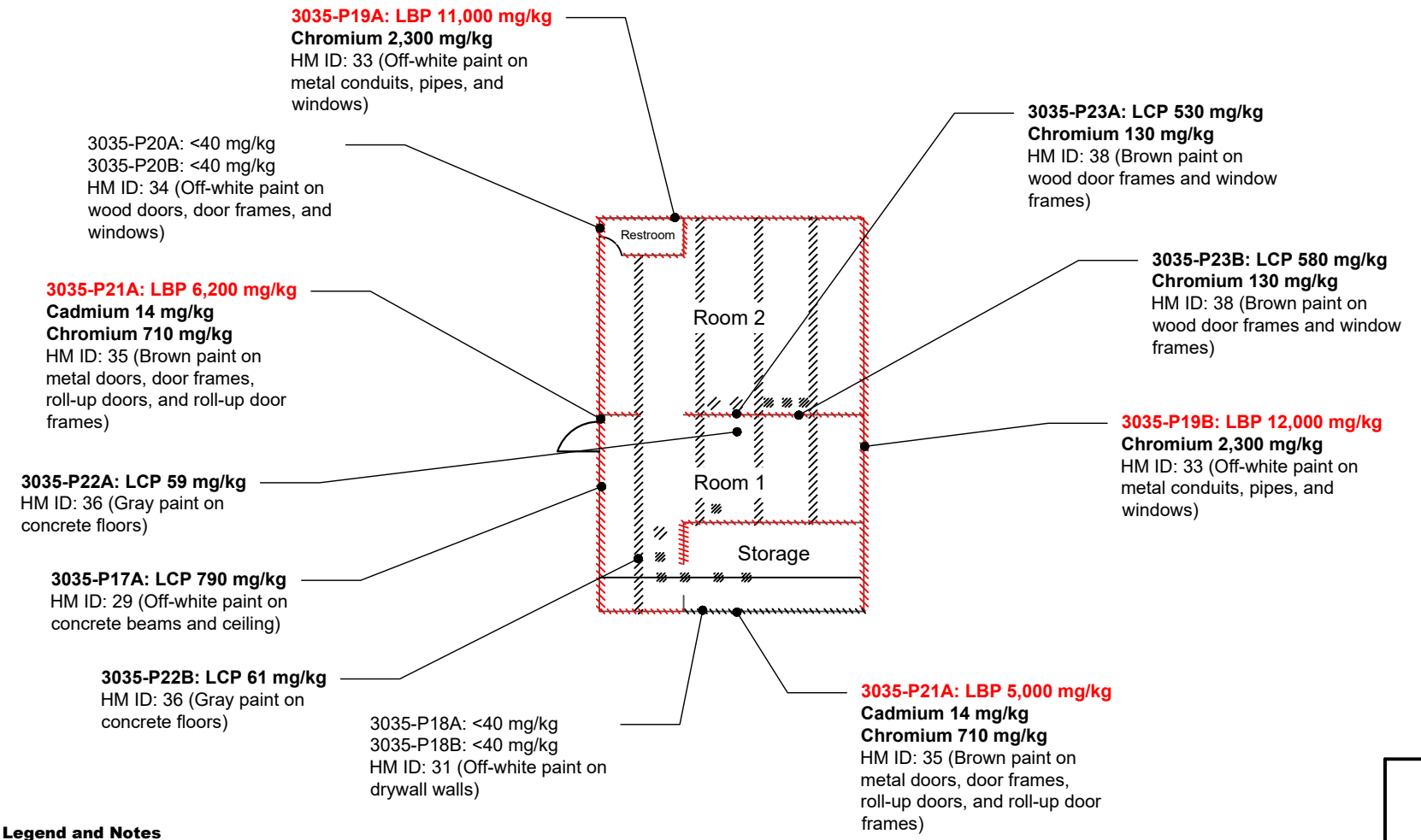
mg/kg - milligrams per kilogram (equivalent to ppm- parts per million)

MNA Environmental

Heavy Metals Sample Locations, IRP Storage Area, P012 Andersen Air Force Base, North Ramp, Guam

Sheet Number

C - 5



Not to Scale

Legend and Notes

Visual Extent of Lead Based-Paint Paint

Visual Extent of Heavy Metal-Containing Paint

Bold values indicate results above the detection limit.

CMU - Concrete Masonry Unit

HM ID - Hazardous Material Identifier

mg/kg - milligrams per kilogram (equivalent to ppm- parts per million)

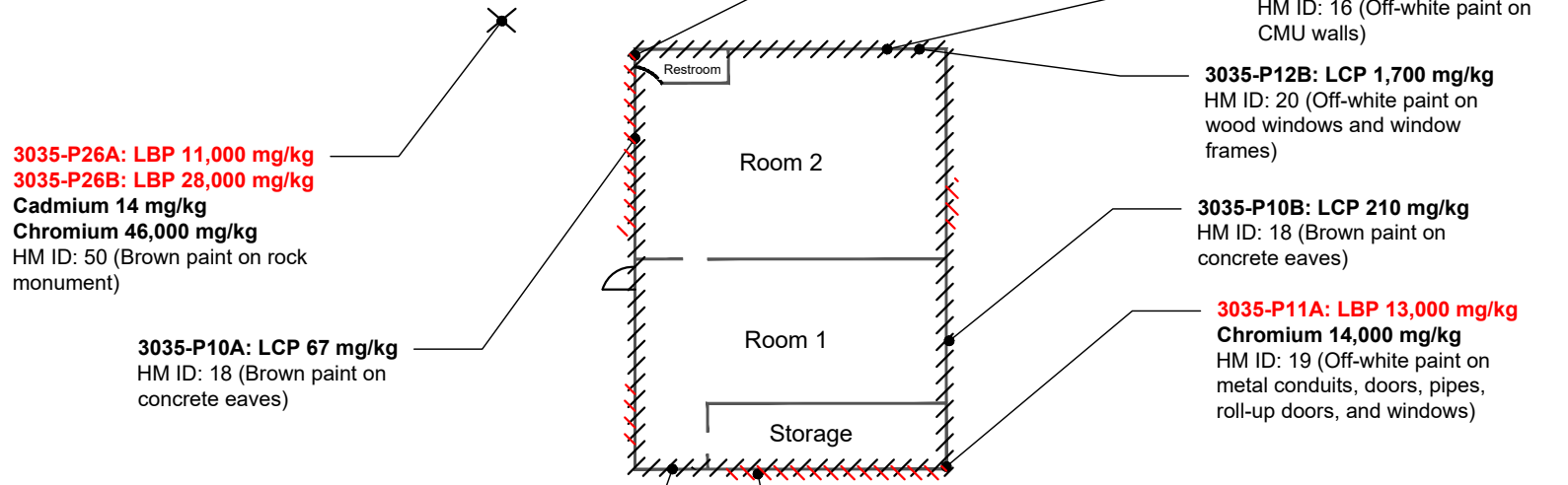
MNA Environmental

Heavy Metals Sample Locations, IRP Storage Area-2, P012 Andersen Air Force Base, North Ramp, Guam

Sheet Number

C - 6

HM ID	Locations	Paint Color	Substrate	Results (mg/kg)
16	Walls	Off-white	CMU	**LCP 270 - 310**
18	Eaves	Brown	Concrete	**LCP 67 - 210**
19	Conduits, doors, pipes, roll-up doors, and windows	Off-white	Metal	**LBP 13,000 - 59,000** **Chromium 14,000**
20	Windows and window frames	Off-white	Wood	**LCP 580 - 1,700**
49	Debris	Yellow	Metal	**LBP 210,000 - 230,000** **Cadmium 14 mg/kg** **Chromium 46,000 mg/kg**
50	Monument	Brown	Rock	**LBP 11,000 - 28,000** **Chromium 3,300**



3035-P12A: LCP 580 mg/kg
HM ID: 20 (Off-white paint on wood windows and window frames)

3035-P9A: LCP 270 mg/kg
HM ID: 16 (Off-white paint on CMU walls)

3035-P12B: LCP 1,700 mg/kg
HM ID: 20 (Off-white paint on wood windows and window frames)

3035-P26A: LBP 11,000 mg/kg
3035-P26B: LBP 28,000 mg/kg
Cadmium 14 mg/kg
Chromium 46,000 mg/kg
HM ID: 50 (Brown paint on rock monument)

3035-P10B: LCP 210 mg/kg
HM ID: 18 (Brown paint on concrete eaves)

3035-P10A: LCP 67 mg/kg
HM ID: 18 (Brown paint on concrete eaves)

3035-P11A: LBP 13,000 mg/kg
Chromium 14,000 mg/kg
HM ID: 19 (Off-white paint on metal conduits, doors, pipes, roll-up doors, and windows)

3035-P9B: LCP 310 mg/kg
HM ID: 16 (Off-white paint on CMU walls)

3035-P25A: LBP 210,000 mg/kg
Cadmium 14 mg/kg
Chromium 46,000 mg/kg
HM ID: 49 (Yellow paint on metal debris)

3035-P11B: LBP 59,000 mg/kg
Chromium 14,000 mg/kg
HM ID: 19 (Off-white paint on metal conduits, doors, pipes, roll-up doors, and windows)

Not to Scale

Legend and Notes

Visual Extent of Lead Based-Paint Paint

Visual Extent of Heavy Metal-Containing Paint

Bold values indicate results above the detection limit.

CMU - Concrete Masonry Unit

HM ID - Hazardous Material Identifier

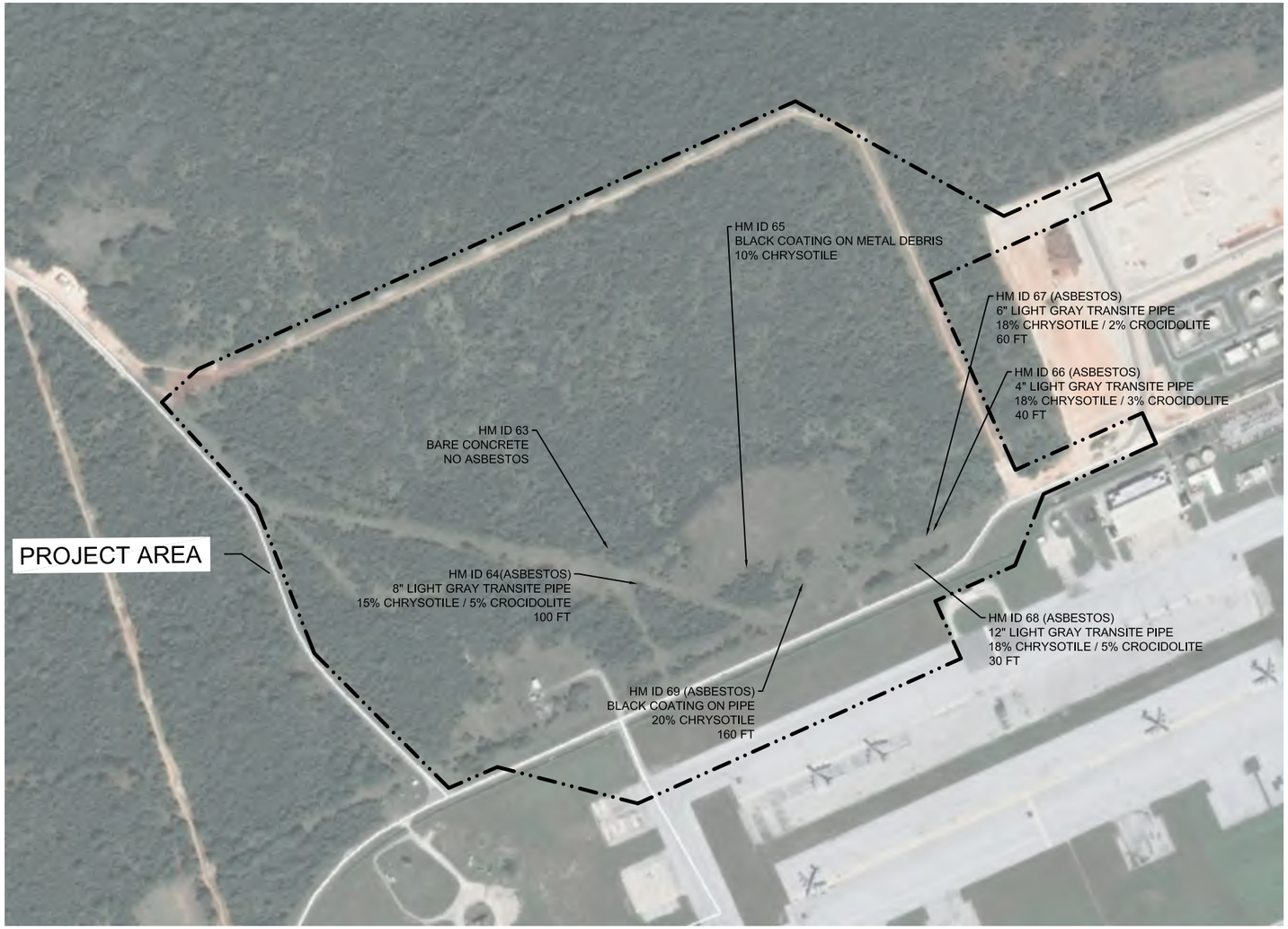
mg/kg - milligrams per kilogram (equivalent to ppm- parts per million)

MNA Environmental

Heavy Metals Sample Locations, IRP Storage Area Exterior, P012 Andersen Air Force Base, North Ramp, Guam

Sheet Number

C - 7



C-8

A1 ABANDONED DEBRIS - ASBESTOS

SCALE: 1" = 300'

GRAPHIC SCALE

0 150' 300' 600'

SCALE: 1"=300'

NORTH ARROW

TRUE N

NAVFAC

Name DD MM 2023

Registration Number # Date

DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742219F0315
JCG NO. D34300003

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	DRW:	REV:
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

ABANDONED DEBRIS - ACM

SCALE: AS SHOWN

EPROJECTS NO.: 1665555

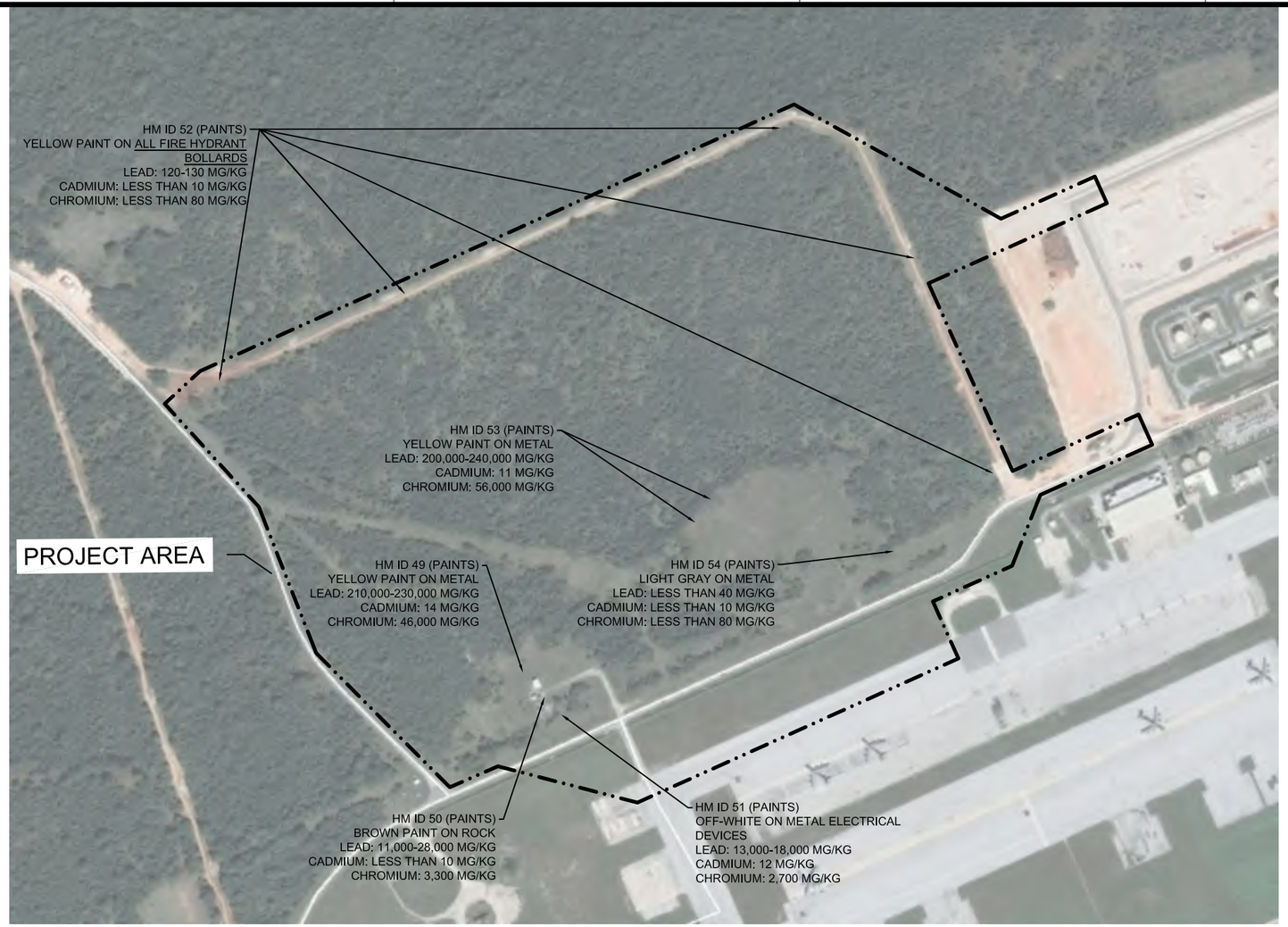
CONSTR CONTROL NO.

NAVFAC DRAWING NO.

SHEET OF

C-8

IF SHEET IS LESS THAN 22" X 34"
REDUCED PRINT. USE GRAPHIC SCALES



ACRONYMS AND ABBREVIATIONS

MG/KG: MILLIGRAMS PER KILO GRAM

C-9

A1 HEAVY METAL CONTAINING PAINTS

SCALE: 1" = 300'

GRAPHIC SCALE

0 150' 300' 600'

SCALE: 1"=300'

NORTH ARROW

TRUE N

NAVFAC

Name DD MM 2023

Registration Number # Date

DISTRICT OF COLUMBIA SEAL

Jacobs / BURNS McDONNELL

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742219F0315
JCG NO. D3430003

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	DRW:	REV:
PM/DM		XX
BRANCH MANAGER		XX
CHIEF ENG/ARCH		XX
FIRE PROTECTION		XX

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC JOINT REGION MARIANAS (JRM)
ANDERSEN AIR FORCE BASE GUAM

FY2024 MCAF P-012/ AJJY183012
NORTH AIRCRAFT PARKING RAMP

ABANDONED DEBRIS - LEAD CONTAINING PAINTS

SCALE: AS SHOWN

EPROJECTS NO.: 1665555

CONSTR CONTROL NO.

NAVFAC DRAWING NO.

SHEET OF

C-9

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

APPENDIX D: PHOTOGRAPHS

HM ID: 1
Building 2550

Exterior
Off-white paint on concrete wall.

LBP: 16,000 – 20,000 mg/kg
Non-Cadmium
Chromium: 2,600 mg/kg

HM ID: 2
Building 2550

Exterior
Off-white paint and skim coat on concrete wall.

Non-ACM

HM ID: 3
Building 2550

Exterior
Off-white paint on metal H-beam.

LBP: 47,000 – 63,000 mg/kg
Non-Cadmium
Chromium: 12,000 mg/kg

HM ID: 4
Building 2550

Exterior
White paint on concrete roof.

LBP: 4,000 – 8,500 mg/kg
Non-Cadmium
Chromium: 1,800 mg/kg

HM ID: 5
Building 2550

White paint and skim coat on concrete roof.

Trace Asbestos: <1% Chrysotile

HM ID: 6
Building 2550

Exterior
Light blue coating on concrete floor.

LBP: 650 – 5,600 mg/kg
Cadmium: 18 mg/kg
Chromium: 1,400 mg/kg

HM ID: 7
Building 2550

Exterior
Light blue coating on concrete floor.

Trace Asbestos: <1% Chrysotile

HM ID: 8
IRP Storage Area

Exterior
Gray bare concrete floor.

Non-ACM

HM ID: 9
Building 2551

Exterior
Off-white paint on concrete masonry unit (CMU) wall.

LBP: 21,000 – 321,000 mg/kg
Cadmium: 14 mg/ kg
Chromium: 8,200 mg/kg

HM ID: 10
Building 2551

Exterior
Off-white paint and skim coat on CMU wall.

Non-ACM

HM ID: 11
Building 2551

Exterior
Off-white paint on metal door.

LBP: 3,600 – 7,600 mg/kg
Cadmium: 100 mg/kg
Chromium: 10,000 mg/kg

HM ID: 12
Building 2551

Exterior
Light blue coating on concrete floor.

LCP: 140 – 170 mg/kg
Cadmium: 23 mg/kg
Non-Chromium

HM ID: 13
Building 2551

Exterior
Light blue coating on concrete floor.

Trace Asbestos: <1% Chrysotile

HM ID: 14
Building 2551

Exterior
Brown paint on concrete eave.

LBP: 24,000 – 42,000 mg/kg
Non-Cadmium
Chromium: 11,000 mg/kg

HM ID: 15
Building 2551

Exterior
Brown paint and skim coat on concrete eave.

Non-ACM

HM ID: 16
Building 2552

Exterior
Off-white paint on CMU wall.

LCP: 270 - 310 mg/kg
Non-Cadmium/Chromium

HM ID: 17
Building 2552

Exterior
Off-white paint and skim coat on CMU wall.

Non-ACM

HM ID: 18
Building 2552

Exterior
Brown paint on concrete eave.

LCP: 67 - 210 mg/kg
Non-Cadmium/Chromium

HM ID: 19
Building 2552

Exterior
Off-white paint on metal vent.

LBP: 13,000 – 59,000 mg/kg
Non-Cadmium
Chromium: 14,000 mg/kg

HM ID: 20
Building 2552

Exterior
Off-white paint on wood window frame.

LCP: 580 – 1,700 mg/kg
Non-Cadmium/Chromium

HM ID: 21
Building 2552

Exterior
Off-white paint on concrete eave.

LCP: 260 – 350 mg/kg
Non-Cadmium/Chromium

HM ID: 22
Building 2552

Exterior
Off-white paint and skim coat on concrete eave.

Non-ACM

HM ID: 23
Building 2552

Exterior
Brown paint on metal door.

LCP: 2,300 – 2,800 mg/kg
Cadmium: 13 mg/kg
Chromium: 96 mg/kg

HM ID: 24
Building 2552

Exterior
Gray paint on concrete floor.

LBP: 640 – 11,000 mg/kg
Non-Cadmium
Chromium: 150 mg/kg

HM ID: 25
Building 2552

Exterior
Gray paint and skim coat on concrete floor.

Non-ACM

HM ID: 26
Building 2552

Exterior
Black caulking on wood window frame.

Non-ACM

HM ID: 27
Building 2552

Room 1
Off-white paint on CMU wall.

LBP: 7,100 – 7,500 mg/kg
Non-Cadmium
Chromium: 1,300 mg/kg

HM ID: 28
Building 2552

Room 1
Off-white paint and skim coat on CMU wall.

Non-ACM

HM ID: 29
Building 2552

Room 1
Off-white paint on concrete ceiling.

LCP: 480 – 790 mg/kg
Non-Cadmium/Chromium

HM ID: 30
Building 2552

Room 1
Off-white paint and skim coat on concrete ceiling.

Non-ACM

HM ID: 31
Building 2552

Room 2
Off-white paint on drywall wall.

Non-LCP/LBP
Non-Cadmium/Chromium

HM ID: 32
Building 2552

Room 2
Off-white drywall wall.

Non-ACM

HM ID: 33
Building 2552

Restroom
Off-white paint on metal pipe.

LBP: 11,000 – 12,000 mg/kg
Non-Cadmium
Chromium: 2,300 mg/kg

HM ID: 34
Building 2552

Room 1
White paint on wood door.

Non-LCP/LBP
Non-Cadmium/Chromium

HM ID: 35
Building 2552

Storage room
Brown paint on metal roll-up door.

LBP: 5,000 – 6,200 mg/kg
Cadmium: 14 mg/kg
Chromium: 710 mg/kg

HM ID: 36
Building 2552

Room 1
Gray paint on concrete floor.

LCP: 59 – 61 mg/kg
Non-Cadmium/Chromium

HM ID: 37
Building 2552

Room 1
Gray paint and skim coat on concrete floor.

Non-ACM

HM ID: 38
Building 2552

Room 1
Brown paint on wood door frame.

LCP: 530 – 580 mg/kg
Non-Cadmium
Chromium: 130 mg/kg

HM ID: 39
Building 2552

Room 2
Brown wallpaper on CMU wall.

Non-ACM

HM ID: 40
Building 2552

Room 1
Gray caulking on metal door frame.

ACM: 2% Chrysotile

HM ID: 41
Building 2552

Room 1
White caulking on metal window frame.

Non-ACM

HM ID: 42
Building 2552

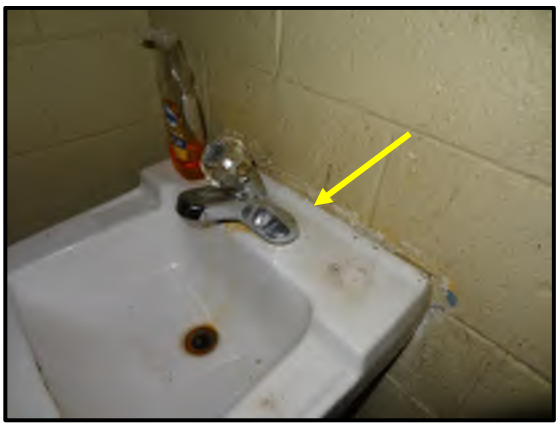
Room 1
Brown cove base on drywall wall.

Non-ACM

HM ID: 43
Building 2552

Room 2
White cove base on drywall wall.

Non-ACM



HM ID: 44
Building 2552

Restroom
White caulking on porcelain sink.

Non-ACM

HM ID: 45
Building 2552

Room 2
Off-white 12” x 12” vinyl floor tile on concrete floor.

Non-ACM

HM ID: 46
Building 2552

Room 2
White 2’ x 4’ acoustic tile ceiling.

Non-ACM

HM ID: 47
Building 2552

Exterior
White coating on concrete roof.

Non-LCP/LBP
Non-Cadmium/Chromium

HM ID: 48
IRP Storage Area

Exterior
Black expansion joint on concrete floor.

Non-ACM

HM ID: 49
IRP Storage Area

Exterior
Yellow paint on metal debris.

LBP: 210,000 – 230,000 mg/kg
Cadmium: 14 mg/kg
Chromium: 46,000 mg/kg

HM ID: 50
IRP Storage Area

Exterior
Brown paint on rock monument.

LBP: 11,000 – 28,000 mg/kg
Non-Cadmium
Chromium: 3,300 mg/kg

HM ID: 51
IRP Storage Area

Exterior
Off-white paint on metal transformer.

LBP: 13,000 – 18,000 mg/kg
Cadmium: 12 mg/kg
Chromium: 2,700 mg/kg

HM ID: 52
GR 2 Area

Exterior
Yellow paint on metal fire hydrant.

LCP: 120 – 130 mg/kg
Non-Cadmium/Chromium

HM ID: 53
Undeveloped Area

Exterior
Yellow paint on metal debris.

LBP: 200,000 – 240,000 mg/kg
Cadmium: 11 mg/kg
Chromium: 56,000 mg/kg

HM ID: 54
Undeveloped Area

Exterior
Light gray paint on metal electrical box.

Non-LCP/LBP
Non-Cadmium/Chromium

HM ID: 55
Building 2551

Interior
Blue paint on CMU wall.

LCP: 1,400 – 1,600 mg/kg
Non-Cadmium
Chromium: 150 mg/kg

HM ID: 56
Building 2551

Interior
Blue paint on metal conduit.

LCP: 1,400 – 2,400 mg/kg
Cadmium: 28 mg/kg
Chromium: 1,900 mg/kg

HM ID: 57
Building 2551

Interior
White paint on concrete ceiling.

LCP: 42 – 68 mg/kg
Non-Cadmium/Chromium

HM ID: 58
Building 2551

Interior
Silver paint on metal door frame.

LBP: 4,900 – 10,000 mg/kg
Cadmium: 82 mg/kg
Chromium: 2,200 mg/kg

HM ID: 59
Building 2551

Interior
Black tar on CMU wall.

Non-ACM

HM ID: 60
Building 2551

Interior
Green 12” x 12” vinyl floor tile with black mastic on concrete floor.

ACM: 4% - 10 Chrysotile

HM ID: 61
Building 2551

Interior
Black 12” x 12” vinyl floor tile with black mastic on concrete floor.

ACM: 5% - 8% Chrysotile

HM ID: 62
Building 2551

Interior
Black caulking on metal door frame.

Non-ACM

HM ID: 63
Undeveloped Area

Exterior
Bare concrete debris.

Non-ACM

HM ID: 64
Undeveloped Area

Exterior
Light gray 8” transite pipe.

ACM: 15% Chrysotile and 5% Crocidolite

HM ID: 65
Undeveloped Area

Exterior
Black coating on metal debris.

ACM: 10% Chrysotile

HM ID: 66
Undeveloped Area

Exterior
Light gray 4” transite pipe.

ACM: 18% Chrysotile and 3% Crocidolite

HM ID: 67
Undeveloped Area

Exterior
Light gray 6” transite pipe.

ACM: 18% Chrysotile and 2% Crocidolite

HM ID: 68
Undeveloped Area

Exterior
Light gray 12” transite pipe.

ACM: 18% Chrysotile and 5% Crocidolite

HM ID: 69
Undeveloped Area

Exterior
Black coating on metal debris.

ACM: 20% Chrysotile

APPENDIX E: LABORATORY ANALYTICAL REPORTS

SECTION 02 83 00

LEAD REMEDIATION
11/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE Z9.2	(2012) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

Andersen Air Force Base

IHMMP	(2020) Installation Hazardous Materials Management Plan

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2023; ERTA 1 2023) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

Naval Facilities Engineering Command Marianas, Joint Region Marianas, Guam

ISWMP	(2013) DoD Integrated Solid Waste Management Plan for DoD Base Guam

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780	(1995; Errata Aug 1996;Rev Ch. 7 - 1997) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.21	Safety Training and Education
29 CFR 1926.33	Access to Employee Exposure and Medical Records
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication

29 CFR 1926.62	Lead
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.103	Respiratory Protection
29 CFR 1926.1126	Chromium
29 CFR 1926.1127	Cadmium
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

U.S. NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND (NAVFAC)

ND OPNAVINST 5100.23	(2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES (UL)

UL 586	(2009; Reprint Sep 2022) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne

concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of cadmium of 2.5 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of chromium (VI) of 2.5 micrograms per cubic meter of air averaged over an 8-hour period.

1.2.2 Area Sampling

Sampling of lead, cadmium, chromium concentrations within the lead, cadmium, chromium hazard control area and inside the physical boundaries which is representative of the airborne lead, cadmium, chromium concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

1.2.3 Cadmium Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1127. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

PEL (micrograms/cubic meter of air) = 40/No. hrs worked per day

1.2.4 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead, cadmium and chromium hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead, cadmium and chromium hazard. The CP must be a licensed or certified lead-based paint abatement Supervisor or Project Designer.

1.2.5 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

1.2.6 Chromium (VI) Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1126. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

PEL (micrograms/cubic meter of air) = 40/No. hrs worked per day

Hereafter, "Chromium (VI)" is indicated as "Chromium" in this section.

1.2.7 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

1.2.8 Deleading

Activities conducted by a person who offers to eliminate lead-based paint or lead-based paint hazards or paints containing cadmium/chromium or to plan such activities in buildings or other structures.

1.2.9 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead, cadmium, chromium to which an employee is exposed, averaged over an 8-hour workday as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.2.10 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead, cadmium, chromium contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.11 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds. The use of the term Lead in this section also refers to paints containing detectable concentrations of Cadmium and Chromium. For the purposes of the section lead-based paint (LBP) and paint with lead (PWL) may contain cadmium and chromium.

1.2.12 Lead-Based Paint (LBP)

Paint or other surface coating that contains 5,000 milligrams per kilogram (mg/kg) lead or more or 0.5 percent by weight.

1.2.13 Lead, Cadmium, Chromium Control Area

A system of control methods to prevent the spread of lead, cadmium, chromium dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

1.2.14 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

PEL (micrograms/cubic meter of air) = 400/No. hrs worked per day

1.2.15 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

1.2.16 Personal Sampling

Sampling of airborne lead, cadmium, chromium concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Samples must be representative of the employees' work tasks. Breathing zone must be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

1.2.17 Physical Boundary

Area physically roped or partitioned off around lead, cadmium, chromium control area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

Assume all painted surfaces including abandoned waste debris contain lead, cadmium, and chromium, unless the laboratory analytical results indicate otherwise. Refer to the Hazardous Material Survey Report provided at the of Section 02 82 00 ASBESTOS REMEDIATION.

Construction activities impacting PWL or material containing lead, cadmium, chromium which are covered by this specification include the disturbance, demolition, or removal of material containing lead, cadmium, chromium in the project site.

Paint in good condition will not be removed prior to demolition activities, except where activities, such as cutting, grinding, or penetration, would generate airborne dust. Paints in poor conditions, such as cracking, peeling, chipping or flaking, must be removed prior to any demolition activities. Paint waste must be tested for Toxicity Characteristic Leaching Procedure (TCLP), and the results must be provided to the Contracting Officer. The Hazardous Material Survey Report provides limited TCLP testing results. The lead results, 1.2 - 4.8 milligrams per liter (mg/L) approached the TCLP regulatory limit, 5 mg/L. Assume the paint waste would fail the TCLP test.

When structures or materials with lead/cadmium/chromium paint are demolished or disturbed, implement engineering controls to prevent release of lead/cadmium/chromium paints, debris, and dust.

Provide additional sampling and testing to meet requirements of disposal facilities at no cost to the Government.

1.3.1 Protection of Existing Areas to Remain

Project work including, but not limited to, lead, cadmium, chromium hazard abatement work, storage, transportation, and disposal must be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, restore work and areas to the original condition.

1.3.2 Coordination with Other Work

Coordinate with work being performed in adjacent areas to ensure there are no exposure issues. Explain coordination procedures in the Lead, Cadmium, Chromium Compliance Plan and describe how the Contractor will prevent lead, cadmium, and chromium exposure to other contractors and Government personnel performing work unrelated to lead, cadmium and chromium activities.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Competent Person Qualifications; G

Training Certification; G

Occupational and Environmental Assessment Data Report (if paint is removed); G

Medical Examinations; G

Lead, Cadmium, Chromium Waste Management Plan; G

Lead, Cadmium, Chromium Compliance Plan; G

Written Evidence of TSD Approval; G

SD-03 Product Data

Respirators

Vacuum Filters

Negative Air Pressure System; G

Materials and Equipment

Expendable Supplies

Pressure Differential Log; G

SD-06 Test Reports

Occupational and Environmental Assessment Data Report; G

Sampling Results; G

Pressure Differential Recordings For Local Exhaust System

SD-07 Certificates

Testing Laboratory; G

Clearance Certification; G

SD-11 Closeout Submittals

Hazardous Waste Manifest; G

Turn-In Documents or Weight Tickets; G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform

responsibilities specified in paragraph COMPETENT PERSON (CP) RESPONSIBILITIES. Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), Cadmium standard (29 CFR 1926.1127) which shows ability to assess occupational and environmental exposure to lead, cadmium, chromium; experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Demonstrate a minimum of 5 years experience implementing OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), and Cadmium standard (29 CFR 1926.1127). Submit proper documentation that the CP is trained and licensed in accordance with federal, State, and local laws. The CP must be a licensed/certified lead-based paint abatement Supervisor or Project Designer in accordance with federal, State, and local regulations. The CP must be designated in writing by his/her employer.

1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead, cadmium, and chromium training specified in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, and is certified to perform or supervise deleading, lead removal or demolition activities in Guam.

1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform analysis, testing, and reporting of airborne or material concentrations of lead, cadmium, and chromium. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis must be OSHA approved.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

a. Verify training meets all federal, State, and local requirements.

b. Review and approve Lead, Cadmium, Chromium Compliance Plan for conformance to the applicable referenced standards.

c. Continuously inspect paint coating disturbance work for conformance with the approved plan.

d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.

e. Ensure work is performed in strict accordance with specifications at all times.

f. Control work to prevent hazardous exposure to humans and to the environment at all times.

g. Supervise final cleaning of the lead, cadmium, chromium control area and make recommendations for further cleaning.

h. Certify the conditions of the work as called for elsewhere in this specification.

1.5.2.2 Lead, Cadmium, Chromium Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of lead, cadmium and chromium, LBP/PWL or MCL at least 30 calendar days prior to the start of work. Include in the plan a sketch showing the location, size, and details of lead, cadmium, chromium control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead, cadmium, chromium is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead, cadmium, chromium related work and demolition, collected waste water and dust containing lead, cadmium, chromium and debris, visual inspections, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead, cadmium, chromium is not released outside of the hazard control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental inspections, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan, as applicable. Include a description of arrangements made among contractors on multi-contractor worksites to inform affected employees and to clarify responsibilities to control exposures.

The plan must be developed and signed by a certified Lead Supervisor or Lead Project Designer by the USEPA authorized State (or local) certification and accreditation program. The plan must include the name, his/her position in the company, and training certifications of the CP.

1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of receiving the laboratory results, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 the Contractor must provide documentation. Submit a rationale statement that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62,29 CFR 1926.1126, 29 CFR 1926.1127 and supporting the Lead, Cadmium, Chromium Compliance Plan.

a. The initial monitoring must represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62,29 CFR 1926.1126, 29 CFR 1926.1127. The data must represent the worker's regular daily exposure to lead, cadmium, chromium for stated work.

b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting, and torch burning where lead, cadmium, and chromium containing coatings are present.

c. The initial assessment must determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead, cadmium, chromium compliance plan per 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.5.2.4 Medical Examinations

Initial medical surveillance as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 must be made available to all employees exposed to lead, cadmium, chromium at any time (one day) above the action level. Full medical surveillance must be made available to all employees on an annual basis who are or may be exposed to lead, cadmium, and chromium in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Adequate records must show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead, cadmium, chromium as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

1.5.2.5 Training

Train each employee performing work that disturbs lead, cadmium, chromium, who performs LBP/MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and Guam and local regulations where appropriate.

1.5.2.6 Respiratory Protection Program

a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

b. Establish and implement a work site-specific respiratory protection program as required by 29 CFR 1926.103, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 29 CFR 1926.55.

1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

1.5.2.8 Lead, Cadmium, Chromium Waste Management

The Lead, Cadmium, Chromium Waste Management Plan must comply with applicable requirements of federal, State, and local hazardous waste regulations and address:

a. Identification and classification of wastes associated with the work.

b. Estimated quantities of wastes to be generated and disposed of.

c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of USEPA, State hazardous waste permits, manifests, and USEPA Identification numbers.

d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.

e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.

g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Clean up and containerize wastes daily.

h. Include any process that may alter or treat waste rendering a hazardous waste and non hazardous waste.

i. Unit cost for hazardous waste disposal according to this plan.

1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, installation rules, and regulations of federal, State, and local authorities regarding lead, cadmium, and chromium. Comply with the applicable requirements of the current issue of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, EM 385-1-1, ND OPNAVINST 5100.23. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirements apply. The following programs regarding removing, handling, storing, transporting, and disposing of lead, cadmium, and chromium-contaminated materials apply:

a. IHMMP and ISWMP

b. Licensing or certification by the USEPA authorized State (or local) certification and accreditation program is required.

1.5.3 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.02 inch of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the hazard control area is removed. Submit pressure differential recordings for each work day to the PQP for review and to the Contracting Officer within 24-hours from the end of each work day.

1.5.4 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Waste Management Plan and the Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead, cadmium and chromium dust, fume and mist. Respirators must comply with the requirements of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.6.2 Special Protective Clothing

Personnel exposed to lead, cadmium, chromium contaminated dust must wear proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

1.6.5 Abrasive Removal Equipment

The use of powered machine for vibrating, sanding, grinding, or abrasive blasting is prohibited unless equipped with local exhaust ventilation systems equipped with high efficiency particulate air (HEPA) filters.

1.6.6 Negative Air Pressure System

Not applicable if the removal method does not generate airborne paint chips and dust.

1.6.6.1 Minimum Requirements

Do not proceed with work in the area until control area is set up and HEPA filtration systems are in place. The negative air pressure system must meet the requirements of ASSE/SAFE Z9.2 including approved HEPA filters in accordance with UL 586. Negative air pressure equipment if used must be equipped with new HEPA filters, and be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. 1.6.7 Vacuum Systems

Vacuum systems must be suitably sized for the project, and filters must be capable of trapping and retaining all mono-disperse particles as small as 0.3 micrometer (mean aerodynamic diameter) at a minimum efficiency of

99.97 percent. Properly dispose of used filters that are being replaced.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Keep materials and equipment needed to complete the project available and on the site. Submit a description of the materials and equipment required; including Safety Data Sheets (SDSs) for material brought onsite to perform the work.

2.1.1 Expendable Supplies

Submit a description of the expendable supplies required.

2.1.1.1 Polyethylene Bags

Disposable bags must be polyethylene plastic and be a minimum of 6 mil thick (4 mils thick if double bags are used) or any other thick plastic material shown to demonstrate at least equivalent performance; and capable of being made leak-tight. Leak-tight means that solids, liquids or dust cannot escape or spill out.

2.1.1.2 Polyethylene Leak-tight Wrapping

Wrapping used to wrap lead, cadmium, chromium contaminated debris must be polyethylene plastic that is a minimum of 6 mil thick or any other thick plastic material shown to demonstrate at least equivalent performance.

2.1.1.3 Polyethylene Sheeting

Sheeting must be polyethylene plastic with a minimum thickness of 6 mil, or any other thick plastic material shown to demonstrate at least equivalent performance; and be provided in the largest sheet size reasonably accommodated by the project to minimize the number of seams. Where the project location constitutes an out of the ordinary potential for fire, or where unusual fire hazards cannot be eliminated, provide flame-resistant polyethylene sheets which conform to the requirements of NFPA 701.

2.1.1.4 Tape and Adhesive Spray

Tape and adhesive must be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive must retain adhesion when exposed to wet conditions, including amended water. Tape must be minimum 2 inches wide, industrial strength.

2.1.1.5 Containers

When used, containers must be leak-tight and be labeled in accordance with

EPA, DOT and OSHA standards.

2.1.1.6 Chemical Paint Strippers

Chemical paint strippers must not contain methylene chloride and be formulated to prevent stain, discoloration, or raising of the substrate materials.

2.1.1.7 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers must be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

2.1.1.8 Detergents and Cleaners

Detergents or cleaning agents must not contain trisodium phosphate and have demonstrated effectiveness in lead, cadmium, and chromium control work using cleaning techniques specified by HUD 6780 guidelines.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

a. Notify the Contracting Officer 20 days prior to the start of any lead disturbance or demolition work.

3.1.1.2 Lead, Cadmium, Chromium Control Area

a. Physical Boundary - Provide physical boundaries around the lead, cadmium, chromium control area by roping off the area designated in the work plan or providing curtains, portable partitions or other barriers to ensure that lead, cadmium, and chromium will not escape outside of the lead, cadmium, and chromium control area. Prohibit the general public or base personnel from accessing the lead, cadmium, chromium control areas.

b. Warning Signs - Provide warning signs at approaches to lead, cadmium, chromium control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs must comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Negative Air Pressure System Containment

a. If required, operate the negative air pressure systems to provide at least 4 air changes per hour inside the containment. Operate the local exhaust unit equipment continuously until the containment is removed. Smoke test the negative air pressure system for leaks at the beginning of each shift. The certified supervisor is responsible to continuously monitor and keep a pressure differential log. Submit the continuously monitored pressure differential log. Do not use the building ventilation system as the local exhaust system. Terminate the local exhaust system out of doors. All filters must be new at the beginning of the project and be periodically changed as necessary to

maintain specified pressure differential and disposed of as lead contaminated waste.

b. Discontinuing Negative Air Pressure System. Operate the negative air pressure system continuously during abatement activities. At the completion of the project, units must be run until full cleanup has been completed and final clearance testing requirements have been met. Dismantling of the negative air pressure systems must conform to written decontamination procedures be as presented in the Lead, Cadmium, Chromium Compliance Plan. Seal the HEPA filter machine intakes with polyethylene to prevent environmental contamination.

3.1.1.4 Decontamination Facility

Provide clean and contaminated change rooms and wash facilities in accordance with this specification and 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

3.1.1.5 Eye Wash Station

Provide suitable facilities within the work area for quick drenching or flushing of the eyes where eyes may be exposed to injurious conditions.

3.1.1.6 Mechanical Ventilation System

a. Use adequate ventilation to control personnel exposure to lead, cadmium, and chromium in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Evaluate and maintain local exhaust ventilation systems in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.

c. Use locally exhausted, power actuated tools or manual hand tools.

3.1.1.7 Personnel Protection

Personnel must wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead, cadmium, chromium control area. Do not allow personnel in the lead, cadmium, chromium control area unless they have been appropriately trained and provided with engineering controls and protective equipment.

3.2 Lead, Cadmium, Chromium Control Area Requirements

Establish a lead, cadmium, chromium control area by completely establishing barriers and physical boundaries around the area or structure of paint/ coating removal operations or disturbance will be performed.

3.3 APPLICATION

3.3.1 Lead, Cadmium, Chromium Work

Perform lead, cadmium, chromium work in accordance with approved Lead, Cadmium, Chromium Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead,

cadmium, chromium when the work is performed in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, 40 CFR 745, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

3.3.2 Removal of Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium

Manual or power sanding or grinding of lead, cadmium, chromium surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. Select paint coating removal processes to minimize contamination of work areas outside the control area with lead, cadmium, chromium contaminated dust or other lead, cadmium, chromium contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of heavy metals. Describe this removal process in the Lead, Cadmium, Chromium Compliance Plan.

3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead, cadmium, chromium controlled area, they must perform the following decontamination procedures and must not leave the work place wearing any clothing or protective equipment worn in the control area:

a. Vacuum all clothing before entering the contaminated change room.

b. Remove protective clothing in the change room, and place them in an approved impermeable disposal bag.

c. Shower, or

d. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.

e. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

3.4.1 Tests

3.4.1.1 Air Sampling

Conduct sampling for lead, cadmium, chromium in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Air sampling must be directed or performed by the CP.

a. The CP must be on the job site for the air sampling to oversee the paint removal work to ensure that the requirements of the contract are met during the entire removal operation.

b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift if dust-generating activities are taking place.

c. Submit results of air samples, signed by the CP, within 72-hours after the laboratory results are obtained.

d. Conduct area air sampling daily, on each shift in which paint removal operations are performed, in areas immediately adjacent to the lead, cadmium, and chromium control area and at the site perimeter, downwind of the work. Conduct sufficient area monitoring to ensure unprotected personnel are not exposed at or above the lead, cadmium, and chromium action levels. If 30 micrograms of lead per cubic meter of air or 2.5 micrograms of cadmium/chromium per cubic meter of air is reached or exceeded, stop work, correct the conditions(s) causing the increased levels. Determine if condition(s) require any further change in work methods. Resume removal work only after the CP and the Contracting Officer give approval. Document all activities.

3.4.1.2 Sampling After Removal

After the visual inspection, if bare soil is present during external removal operations, collect soil samples per Government-approved method. If applicable, provide sampling and analysis in the Lead, Cadmium, Chromium Compliance Plan for Government review.

3.4.1.3 Testing of Material Containing Lead Residue

Test residue in accordance with 40 CFR 261 for hazardous waste.

3.5 CLEANING AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead, cadmium, chromium operation has been completed, clean the controlled area of all visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated in the Lead, Cadmium, Chromium Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then HEPA vacuum all contaminated areas. The CP must then certify in writing that the area has been cleaned of lead, cadmium, and chromium contamination before clearance.

3.5.1.1 Clearance Certification

The CP must certify in writing that successful visual inspection was achieved; the engineering controls and respiratory protection used for the employees were adequate; the work procedures were performed in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127; and that there were no visible accumulations of material, debris, and dust containing lead, cadmium, chromium left in the work site.

3.5.2 Disposal

a. Dispose of material, whether hazardous or non-hazardous in accordance with all laws and provisions and all federal, State, or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

b. Contractor is responsible for segregation of waste. Collect lead,

cadmium, chromium contaminated waste, scrap, debris, bags, containers, equipment, and lead, cadmium, chromium contaminated clothing that may produce airborne concentrations of lead, cadmium, chromium particles. Label the containers in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 40 CFR 261, 40 CFR 262 and corresponding local regulations.

c. If determined hazardous by characterization of waste streams, dispose of lead, cadmium, chromium contaminated material classified as hazardous waste at an EPA approved hazardous waste treatment, storage, or disposal facility off Government property.

d. Accumulate waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums or appropriately sized container for smaller volumes. Properly label each drum to identify the type of hazardous material (49 CFR 172). For hazardous waste, the collection container requires marking/labeling in accordance with 40 CFR 262 and corresponding state regulations during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for accumulation of waste containers. Coordinate authorized accumulation volumes and time limits with the host installation environmental function.

e. Handle, store, transport, and dispose lead, cadmium, chromium or lead, cadmium, chromium contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

f. All lead waste generation, management, and disposal will be coordinated with the host installation environmental function.

3.5.2.1 Disposal Documentation

Coordinate all disposal or off-site shipments of lead, cadmium, and chromium waste with the host installation environmental function. Submit written evidence of TSD approval to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead, cadmium, chromium disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.

3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility is received and approved by the Contracting Officer. The manifest must detail and certify the amount of lead, cadmium, chromium containing materials or non-hazardous waste delivered to the treatment or disposal facility.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02 84 16

HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY
11/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Andersen Air Force Base

IHMMP	(2020) Installation Hazardous Materials Management Plan

Naval Facilities Engineering Command Marianas, Joint Region Marianas, Guam

ISWMP	(2013) DoD Integrated Solid Waste Management Plan for DoD Base Guam

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 178	Specifications for Packagings

1.2 REQUIREMENTS

Removal and disposal of PCB containing lighting ballasts and associated mercury-containing lamps. Contractor may encounter leaking PCB ballasts.

1.3 DEFINITIONS

1.3.1 Certified Industrial Hygienist (CIH)

An industrial hygienist hired by the contractor must be certified by the American Board of Industrial Hygiene.

1.3.2 Leak

Leak or leaking means any instance in which a PCB article, PCB container, or PCB equipment has any PCBs on any portion of its external surface.

1.3.3 Lamps

Lamp is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic spectrum. Examples of common electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

1.3.4 Polychlorinated Biphenyls (PCBs)

PCBs as used mean the same as PCBs, and all related items, as defined in 40 CFR 761, Section 3, Definitions.

1.3.5 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

Perform PCB related work in accordance with 40 CFR 761. Perform mercury-containing lamps storage and transport in accordance with 40 CFR 261, 40 CFR 264, 40 CFR 265, IHMMP, and ISWMP.

1.4.2 Training

Instruction and certification of training of all persons involved in the removal of PCB containing lighting ballasts and mercury-containing lamps is the responsibility of the Certified Industrial Hygienist (CIH). Include in the instruction: The dangers of PCB and mercury exposure, decontamination, safe work practices, and applicable OSHA and EPA regulations. The CIH must review and approve the PCB and Mercury-Containing Lamp Removal Work Plans.

1.4.3 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site of 29 CFR 1910.1000, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 265, 40 CFR 268, 40 CFR 270, and of the Contractor removal work plan and disposal plan for PCB and for associated mercury-containing lamps.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Qualifications of CIH; G

Training Certification; G

PCB and Lamp Removal Work Plan; G

PCB and Lamp Disposal Plan; G

SD-11 Closeout Submittals

Transporter Certification of notification to EPA of their PCB waste activities and EPA ID numbers; G

Certification of Decontamination

Certificate of Disposal and/or recycling. Submit to the Government before application for payment within 30 days of the date that the disposal of the PCB and mercury-containing lamp waste identified on the manifest was completed.

Testing Results

1.6 ENVIRONMENTAL REQUIREMENTS

Use special clothing:

a. Disposable gloves (polyethylene)

b. Eye protection

c. PPE as required by CIH

1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of PCB and mercury-containing lamp removal work.

1.8 QUALITY ASSURANCE

1.8.1 Qualifications of CIH

Submit the name, address, and telephone number of the Industrial Hygienist selected to perform the duties in paragraph CERTIFIED INDUSTRIAL HYGIENIST. Submit training certification that the Industrial Hygienist is certified, including certification number and date of certification or re certification.

1.8.2 PCB and Lamp Removal Work Plan

Submit a job-specific plan within 20 calendar days after Notice to Proceed of the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated mercury-containing lamps. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures. The plan must be approved and signed by the Certified Industrial Hygienist. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work.

1.8.3 PCB and Lamp Disposal Plan

Submit a PCB and lamp Disposal Plan within 45 calendar days after award of contract, complying with the applicable requirements of federal, state, and local PCB waste regulations and address:

a. Estimated quantities of wastes to be generated, disposed of, and recycled.

b. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of EPA and state PCB and mercury-containing lamp waste permit applications and EPA identification numbers, as required.

c. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.

d. Spill prevention, containment, and cleanup contingency measures to be implemented.

e. Work plan and schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Clean up and containerize wastes daily.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, and high intensity discharge (HID) lamps in accordance with local, state, or federal regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition

by-products may be produced. Do not break or damage mercury containing fluorescent lamps or high intensity discharge lamps.

3.1.1 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761, 40 CFR 262 40 CFR 263, and the applicable requirements of this section, including but not limited to:

a. Obtaining suitable PCB and mercury-containing lamp storage sites.

b. Notifying Contracting Officer prior to commencing the operation.

c. Reporting leaks and spills to the Contracting Officer.

d. Cleaning up spills.

e. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.

f. Maintaining inspection, inventory and spill records.

3.2 PCB SPILL CLEANUP REQUIREMENTS

3.2.1 PCB Spills

Immediately report to the Contracting Officer any PCB spills.

3.2.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

3.2.3 PCB Spill Cleanup

40 CFR 761, subpart G. Initiate cleanup of spills as soon as possible, but no later than 24 hours of its discovery. Mop up the liquid with rags or other conventional absorbent. Properly contain and dispose of spent absorbent as solid PCB waste.

3.2.4 Records and Certification

Document the cleanup with records of decontamination in accordance with 40 CFR 761, Section 125, Requirements for PCB Spill Cleanup. Provide test results of cleanup and certification of decontamination.

3.3 REMOVAL

3.3.1 Ballasts

As ballast are removed from the lighting fixture, inspect label on ballast. Ballasts without a "No PCB" label must be assumed to contain PCBs and containerized and disposed of as required under paragraphs STORAGE FOR DISPOSAL and DISPOSAL. If there are less than 1600 "No PCB" labeled lighting ballasts, dispose of them as normal demolition debris. If there are more than 1600 "No PCB" labeled ballasts, establish whether

the "No PCB" labeled ballasts contain diethylhexyl phthalate (DEHP) either by test or by checking with the ballast manufacturer indicated on the label. Submit testing results and/or written confirmation from the manufacturer to the Contracting Officer. If the ballasts do not contain DEHP, dispose of them as normal construction debris. If they do contain DEHP, dispose of them as hazardous material in accordance with Federal, State, and local regulations. As a basis of bid assume ballasts with "No PCB" labels and do not contain DEHP and may disposed of as normal construction debris. If 1600 or more DEHP ballasts are disposed of in a 24 hour period, notify the National Response Team at 800-424-8802.

3.3.2 Lighting Lamps

Remove lighting tubes/lamps from the lighting fixture and carefully place (unbroken) into appropriate containers (original transport boxes or equivalent). In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as hazardous waste as specified herein.

3.4 STORAGE FOR DISPOSAL

3.4.1 Storage Containers for PCBs

49 CFR 178. Store PCB in containers approved by DOT for PCB.

3.4.2 Storage Containers for lamps

Store mercury containing lamps in appropriate DOT containers.

3.4.3 Labeling of Waste Containers

Label with the following:

a. Date the item was placed in storage and the name of the cognizant activity/building.

b. "Caution Contains PCB," conforming to 40 CFR 761, CFR Subpart C. Affix labels to PCB waste containers.

c. Label mercury-containing lamp waste in accordance with 40 CFR 261. Affix labels to all lighting waste containers.

3.5 DISPOSAL

Dispose of off Government property in accordance with EPA, DOT, and local regulations at a permitted site.

3.5.1 Identification Number

Federal regulations 40 CFR 761, and 40 CFR 263 require that generators, transporters, commercial storers, and disposers of PCB waste possess U.S. EPA identification numbers. Verify that the activity has a U.S. EPA generator identification number for use on the Uniform Hazardous Waste manifest. If not, advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work.

3.5.2 Transporter Certification

Comply with disposal and transportation requirements outlined in 40 CFR 761

and 40 CFR 263. Before transporting the PCB waste, sign and date the manifest acknowledging acceptance of the PCB waste from the Government. Return a signed copy to the Government before leaving the job site. Ensure that the manifest accompanies the PCB waste at all times. Submit transporter certification of notification to EPA of their PCB waste activities (EPA Form 7710-53).

3.5.2.1 Certificate of Disposal and/or Recycling

40 CFR 761. Include in the certificate for the PCBs and PCB items disposed:

a. The identity of the disposal and or recycling facility, by name, address, and EPA identification number.

b. The identity of the PCB waste affected by the Certificate of Disposal including reference to the manifest number for the shipment.

c. A statement certifying the fact of disposal and or recycling of the identified PCB waste, including the date(s) of disposal, and identifying the disposal process used.

d. A certification as defined in 40 CFR 761.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02 84 33

REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs)
11/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Andersen Air Force Base

IHMMP	(2020) Installation Hazardous Materials Management Plan

Naval Facilities Engineering Command Marianas, Joint Region Marianas, Guam

ISWMP	(2013) DoD Integrated Solid Waste Management Plan for DoD Base Guam

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.145	Specifications for Accident Prevention Signs and Tags
29 CFR 1910.1000	Air Contaminants
40 CFR 112	Oil Pollution Prevention
40 CFR 761.40	Marking Requirements
40 CFR 761.65	Storage for Disposal
40 CFR 761.217	Exception Reporting
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 174	Carriage by Rail
49 CFR 175	Carriage by Aircraft

49 CFR 176	Carriage by Vessel
49 CFR 177	Carriage by Public Highway
49 CFR 178	Specifications for Packagings
49 CFR 179	Specifications for Tank Cars

1.2 REQUIREMENTS

The work includes the removal and disposal of transformers or other oil containing electrical equipment. Assume transformers and electrical equipment to be demolished contain less than 50 ppm of PCB. However, collect and analyze oil samples for PCB. Perform work in accordance with 40 CFR 761, IHMMP, ISWMP, and the requirements specified herein.

1.3 DEFINITIONS

1.3.1 Leak

Leak or leaking means any instance in which a PCB Article, PCB Container, or PCB Equipment has any PCBs on any portion of its external surface.

1.3.2 PCBs

PCBs as used mean the same as PCBs, PCB Article, PCB Article Container, PCB Container, PCB Equipment, PCB Item, PCB Transformer, PCB-Contaminated Electrical Equipment, as defined in 40 CFR 761, Section 3, Definitions.

1.3.3 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

1.4 REGULATORY QUALITY ASSURANCE

1.4.1 Training

Instruct employees on the dangers of PCB exposure, on respirator use, decontamination, and applicable OSHA and EPA regulations.

1.4.2 Industrial Hygienist

Obtain the services of an industrial hygienist to review and approve the PCB removal plan, including determination of the need for personnel protective equipment (PPE) in performing PCB removal work.

1.4.3 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site 29 CFR 1910.1000, 40 CFR 761, and Contractor work practices for removal, storage and disposal of PCBs.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

PCB Removal Work Plan; G

PCB Disposal Plan; G

SD-07 Certificates

Training certification

Qualifications of IH; G

Notification

Transporter Certification of notification to EPA of their PCB waste activities and EPA ID numbers; G

Disposal Facility Certification of notification to EPA of their PCB waste activities and EPA ID numbers, G

Certification of Decontamination for PCB Spill

Post Cleanup Sampling Data

Certificate of Disposal

1.6 EQUIPMENT

1.6.1 Special Clothing

Work clothes consist of PPE as required by OSHA regulations, including, but not limited to the following:

a. Disposable coveralls

b. Gloves (Disposable rubber gloves may be worn under these)

c. Disposable foot covers (polyethylene)

d. Chemical safety goggles

e. Half mask cartridge respirator.

1.6.2 Special Clothing for Government Personnel

Provide PPE specified in paragraph SPECIAL CLOTHING to the Contracting Officer as required for inspection of the work.

1.6.3 PCB Spill Kit

Assemble a spill kit to include the following items:

ITEM	MINIMUM QUANTITY
1. Disposable gloves (polyethylene)	6 prs
2. Gloves with a high degree of impermeability to PCB	6 prs
3. Disposable coveralls with permeation resistance to PCB	4 ea
4. Chemical safety goggles	2 ea
5. Disposable foot covers (polyethylene)	6 prs
6. PCB Caution Sign: "PCB Spill--Authorized Personnel Only"	2 ea
7. Banner guard or equivalent banner material	100 feet
8. Absorbent material	5 bags
9. Blue polyethylene waste bags	5 ea
10. Cloth backed tape	1 roll
11. Area access logs, blank	10 ea
12. Brattice cloth, 6' x 6'	1 piece
13. Rags	20 ea
14. Ball point pens	20 ea
15. Herculite, 4' x 4' and 8' x 8'	2 ea and 1 ea
16. Blank metal signs and grease pencils	2 ea
17. Waste containers 55 gallon drum, may be used as container for kit	1 ea

1.7 QUALITY ASSURANCE

1.7.1 Training Certification

Submit certificates, prior to the start of work but after the main abatement submittals, signed and dated by the CIH and by each employee stating that the employee has received training. Organize certificates by individual worker, not grouped by type of certificates.

1.7.2 Qualifications of IH

Submit the name, address, and telephone number of the Industrial Hygienist selected to perform the duties in paragraph INDUSTRIAL HYGIENIST. Submit

proper documentation that the Industrial Hygienist is certified, including certification number and date of certification/recertification.

1.7.3 PCB Removal Work Plan

Submit a detailed job-specific plan of the work procedures to be used in the removal of PCB-containing materials, not to be combined with other hazardous abatement plans. Provide a Table of Contents for each abatement submittal which follows the sequence of requirements in the contract. Include in the plan a sketch showing the location, size, and details of PCB control areas, location and details of decontamination rooms, change rooms, shower facilities, and mechanical ventilation system. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of PCB related work, PCB disposal plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that PCB contamination is not spread or carried outside of the control area. Obtain approval of the plan prior to the start of PCB removal work.

1.7.4 PCB Disposal Plan

Submit a PCB Disposal Plan within 45 calendar days after award of contract for Contracting Officer's approval. Comply with applicable requirements of Federal, State, and local PCB waste regulations and address:

a. Identification of PCB wastes associated with the work.

b. Estimated quantities of wastes to be generated and disposed of.

c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of EPA, Guam, and local PCB waste permits and EPA Identification numbers.

d. Names and qualifications (experience and training) of personnel who will be working on-site with PCB wastes.

e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

f. Spill prevention, containment, and cleanup contingency measures to be implemented.

g. Work plan and schedule for PCB waste containment, removal and disposal. Clean up and containerize wastes daily. If contractor does not have access to an approved, long-term (i.e., 1-year) storage facility, PCB wastes can only be stored for 30 calendar days from the "removal from service" or "out of service" date per 40 CFR 761.65. The contractor must ensure there are disposal contracts in place to remove PCB waste within 30 calendar days which includes time necessary to prepare, execute, and sign Uniform Hazardous Waste Manifests. The "removal from service" or "out of service" date is the date that the first PCB waste is removed and placed in storage.

1.7.5 Notification

Notify the Contracting Officer 20 calendar days prior to the start of PCB removal work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 PCB Control Area

Isolate PCB control area by physical boundaries to prevent unauthorized entry of personnel. Food, drink and smoking materials are not permitted in areas where PCBs are handled or PCB items are stored. Control areas must also be identified with the PCB mark per 40 CFR 761 and other warning signs as appropriate.

3.1.2 Personnel Protection

Workers must wear and use PPE, as recommended by the Industrial Hygienist, upon entering a PCB control area. If PPE is not required per the IH, specify in the PCB removal work plan.

3.1.3 Footwear

Work footwear remains inside work area until completion of the job.

3.1.4 Permissible Exposure Limits (PEL)

PEL for PCBs is 3.1 E-08 lb/cubic foot on an 8-hour time weighted average basis.

3.1.5 Special Hazards

a. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced.

b. Do not heat PCBs to temperatures of 135 degrees F or higher without Contracting Officer's concurrence.

3.1.6 PCB Caution Label

40 CFR 761, Subpart C. Affix labels to PCB waste containers and other PCB-contaminated items. Provide label with sufficient print size to be clearly legible, with bold print on a contrasting background, displaying the following: CAUTION: Contains PCBs (Polychlorinated Biphenyls). Annotate PCB waste containers with the "removal from service" or "out of service" date. Use the date that the first PCB waste was generated and placed into storage.

3.1.7 PCB Caution Sign

29 CFR 1910.145. Provide signs at approaches to PCB control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area.

3.2 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the complete removal of PCBs located at the site as indicated or specified in

accordance with local, State, or Federal regulations. Package and mark PCB as required by EPA and DOT regulations and dispose of off Government property in accordance with EPA, DOT, and local regulations at a permitted site.

3.2.1 No Smoking

Smoking is not permitted within 50 feet of the PCB control area. Provide "No Smoking" signs as directed by the Contracting Officer.

3.2.2 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761 and the applicable requirements of this section, including but not limited to:

a. Obtaining advance approval of PCB storage sites.

b. Notifying Contracting Officer prior to commencing the operation.

c. Reporting leaks and spills to the Contracting Officer. A reportable quantity of one pound of PCBs spilled, or more, requires an additional notification to the National Response Center. The National Response Center notification must be coordinated with the Government.

d. Cleaning up spills.

e. Maintaining an access log of employees working in a PCB control area and providing a copy to the Contracting Officer upon completion of the operation.

f. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.

g. Maintaining a spill kit as specified in paragraph PCB SPILL KIT.

h. Maintaining inspection, inventory and spill records.

3.3 PCB TRANSFORMERS

3.3.1 Draining of Transformer Liquid

Perform work in accordance with 49 CFR 171, 49 CFR 172, 49 CFR 173, 49 CFR 174, 49 CFR 175, 49 CFR 176, 49 CFR 177, 49 CFR 178, and 49 CFR 179, Subchapter C and as specified herein. Drain the transformer, switches, and regulators of free flowing liquid prior to transportation. Place the drained liquids in DoT Spec drums. The drums must not contain more than 50 gallons of oil. If the equipment cannot be drained, then place it in DoT Spec drums. DoT drum specifications must meet UN 1A1/Y1.6 (steel drum) or UN 1H1/Y1.6 (plastic drum). Storage of liquid PCB waste will require a Spill Prevention, Control, and Countermeasures (SPCC) Plan to be submitted as part of the PCB Disposal Plan per 40 CFR 112.

3.3.2 Markings

Provide drums and drained PCB-contaminated electrical equipment with caution label markings as specified in paragraph PCB CAUTION LABEL.

3.3.3 Laboratory Analysis

Provide all transformers with a laboratory analysis for turn-in. The only two exceptions to this rule are:

a. The transformer is hermetically sealed (solder sealed or fusion sealed. No access ports or openings).

b. The name plate states that the transformer contains Pyranol, Interteen, etc.

Attach a copy of the lab analysis to the transformer itself.

3.3.4 Markings

3.3.4.1 Transformers, Less Than 50 ppm

Add absorbent material to absorb residue oil remaining after draining. Write the date drained on the transformer. Determine if the metal carcass can be recycled and dispose or recycle in accordance with all applicable regulations. Storage of drained liquid PCB waste will require a SPCC Plan per 40 CFR 112.

3.3.4.2 Transformers, 50-499 ppm

Same procedure as transformers in the less than 50 ppm range.

3.3.4.3 Transformers, Greater Than 500 ppm

Stencil date drained on the transformer. Contractor must subcontract the disposal/recycling effort of PCB waste. The Government will be required to sign as generator of the PCB waste on manifests.

3.3.4.4 Drums

Stencil on DOT-approved 55 gallon drums containing PCB liquid the following:

a. ppm

b. Date drum filled

c. Serial number of transformer liquid came from

d. National Stock Number

(1) "9999-00-OIL" for <50 ppm

(2) "9999-00-CONPCB" for 50-499 ppm

(3) "9999-00-PCBOIL" for >500 ppm

Do not mix different ppms in the same drum. Drums must have a 2 inch ullage space from the top of the drum. PCB drums must be stored in properly marked storage areas per 40 CFR 761.40. SPCC plan per 40 CFR 112 required for the storage area prior to any liquid PCB waste being stored.

3.4 PCB REMOVAL

Select PCB removal procedure to minimize contamination of work areas with PCB or other PCB-contaminated debris/waste. Handle PCBs such that no skin contact occurs. PCB removal process must be described in the work plan.

3.4.1 Confined Spaces

As feasible, do not carry out PCB handling operations in confined spaces. A confined space means a space having limited means of egress and inadequate cross ventilation.

3.4.2 Control Area

Establish a PCB control area around the PCB item as specified in paragraph PCB CONTROL AREA. Only personnel briefed on the elements in the paragraph TRAINING and on the handling precautions are allowed into the area.

3.4.3 Exhaust Ventilation

If used, discharge exhaust ventilation for PCB operations to the outside and away from personnel.

3.4.4 Temperatures

As feasible, handle PCBs at ambient temperatures and not at elevated temperatures.

3.4.5 Solvent Cleaning

Clean contaminated tools, containers, etc., after use by rinsing three times with an appropriate solvent or by wiping down three times with a solvent wetted rag. Suggested solvents are Stoddard solvent or hexane.

3.4.6 Drip Pans

Drip pans are required under portable PCB transformers and rectifiers in use or stored for use. Provide the pans with a containment volume of at least one and one-half times the internal volume of PCBs in the item.

3.4.7 Evacuation Procedures

Provide written procedures for evacuation of injured workers. Do not delay aid for a seriously injured worker for reasons of decontamination.

3.5 PCB SPILL CLEANUP REQUIREMENTS

3.5.1 PCB Spills

Immediately report to the Contracting Officer any PCB spills on the ground or in the water, PCB spills in drip pans, or PCB leaks. If a reportable quantity of 1 pound of PCBs spilled, provide a notification to the National Response Center. Notification to the National Response Center must be coordinated with the Government prior to calling the National Response Center at 800-424-8802 or 202-267-2675.

3.5.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a "PCB

Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

3.5.3 PCB Spill Cleanup

40 CFR 761, Subpart G. Initiate cleanup of spills as soon as possible, but no later than 48 hours after its discovery. To clean up spills, personnel must wear the PPE prescribed in paragraph SPECIAL CLOTHING of this section. If misting, elevated temperatures or open flames are present, or if the spill is situated in a confined space, notify the Contracting Officer. Mop up the liquid with rags or other conventional absorbent. Properly contain and dispose of spent absorbent and removed materials as solid PCB waste. Materials contaminated and removed due to the PCB spill must be replaced with new materials and restored to the existing condition prior to the spill at no additional cost to the Government.

If contractor does not have access to an approved, long-term (i.e., 1-year) PCB storage facility, the solid PCB waste must be disposed of within 30 calendar days per 40 CFR 761.65. The start date is the date that the first absorbent solid waste with PCBs is generated.

In accordance with 40 CFR 761, Subpart G, verification sampling for PCBs is required to ensure that any surface or area affected by the PCB spill is not contaminated with PCBs.

For spills on porous surfaces, excavation and removal may be required. Remove material to the extent of the PCB contamination.

3.5.4 Records and Certification

Document the cleanup with records of decontamination in accordance with 40 CFR 761, Section 125, Requirements for PCB Spill Cleanup. Provide certification of decontamination.

3.5.5 Sampling Requirements

Perform post cleanup sampling as required by 40 CFR 761, Section 130, Sampling Requirements. Do not remove boundaries of the PCB control area until site is determined satisfactorily clean by the Contracting Officer.

3.6 STORAGE FOR DISPOSAL

3.6.1 Storage Containers for PCBs

49 CFR 178. Store liquid PCBs in Department of Transportation (DOT) Specification 17E containers. Store nonliquid PCB mixtures, articles, or equipment in DOT Specification 5, 5B, or 17C containers with removable heads.

3.6.2 Waste Containers

Label with the following:

a. "Solid (or Liquid) Waste Polychlorinated Biphenyls"

b. The PCB Caution Label, paragraph PCB CAUTION LABEL

c. The "removal from service" or "out of service" date the item was

placed in storage and the name of the cognizant activity/building.

3.6.3 PCB Articles and PCB-Contaminated Items

Label with items b. through c. above.

3.6.4 Approval of Storage Site

If contractor does not have access to an approved, long-term (i.e., 1-year) storage facility, PCB wastes can only be stored for 30 calendar days from the "removal from service" or "out of service" date per 40 CFR 761. The contractor must ensure there are disposal contracts in place to remove PCB waste in 30 calendar days which includes time necessary to prepare, execute, and sign Uniform Hazardous Waste Manifests. Contact the Contracting Officer to determine who will sign manifests for the Government. Government will require 5 working days to review manifests prior to signature to ensure accuracy. To avoid exceeding the 30 calendar day limit, contractor may be required to perform multiple PCB waste shipments and must account for that in their PCB Removal Work Plan, PCB Disposal Plan, and project management scope. Obtain in advance Contracting Officer approval using the following criteria without exception.

a. Adequate roof and walls to prevent rainwater from reaching the stored PCBs.

b. An adequate floor which has continuous curbing with a minimum 6 inch high curb. Such floor and curbing must provide a containment volume equal to at least two times the internal volume of the largest PCB article or PCB container stored therein or 25 percent of the total internal volume of all PCB equipment or containers stored therein, whichever is greater.

c. No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area.

d. Floors and curbing constructed of continuous smooth and impervious materials such as portland cement, concrete or steel to prevent or minimize penetrations of PCBs.

e. Not located at a site which is below the 100-year flood water elevation.

f. Post each storage site with the PCB Caution Sign, paragraph PCB CAUTION SIGN.

g. For storage of PCB waste in excess of 30 calendar days from the "out of service" or "removal from service" date, storage site must meets all facility design criteria of 40 CFR 761 to store PCB waste. In addition, formal in-writing approval by the EPA of "Notification of PCB Activity", Form Approved OMB No. 2070-0112, for storage is required.

3.7 CLEANUP

Maintain surfaces of the PCB control area free of accumulations of PCBs. Restrict the spread of dust and debris; keep waste from being distributed over work area.

Do not remove the PCB control area and warning signs prior to the Contracting Officer's approval. Reclean areas showing residual PCBs.

3.8 DISPOSAL

Comply with disposal requirements and procedures outlined in 40 CFR 761. Do not accept PCB waste unless it is accompanied by a manifest signed by the Government. The Government is responsible to sign the PCB manifest as the Generator of the waste (block 15 on Uniform Hazardous Waste Manifest). Provide the manifest to the Contracting Officer at least 10 working days prior to the scheduled disposal date to the Installation Environmental Officer for review and signing of the manifest. Sufficient time must be considered to ensure that the manifest is signed and the PCB waste removed from Government property within the regulatory time limit. Before transporting the PCB waste, sign and date the manifest acknowledging acceptance of the PCB waste from the Government. Return a signed copy to the Government before leaving the job site. Ensure that the manifest accompanies the PCB waste at all times. Submit transporter certification of notification to EPA of their PCB waste activities. Submit Disposal Facility Certification of notification to EPA of their PCB waste activities and EPA ID numbers.

3.8.1 PCB Exception Reporting

If the signed PCB waste manifest is not received by the PCB disposal facility within 45 calendar days from the date it was signed by the Generator, the Government will prepare and submit an Exception Report per 40 CFR 761.217 and Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Notify the Contracting Officer and Installation Environmental Office of the status and location of the PCB waste at 35 calendar days and 45 calendar days. Report any delays in transportation to the Contracting Officer and Installation Environmental Office. Provide a copy of the completed manifest to the Contracting Officer and Installation Environmental Office once it is signed as accepted by the disposal facility.

3.8.2 Certificate of Disposal

40 CFR 761. Submit to the Government within 30 calendar days of the date that the disposal of the PCB waste identified on the manifest was completed. Include in the certificate for the PCBs and PCB items disposed:

a. The identity of the disposal facility, by name, address, and EPA identification number.

b. The identity of the PCB waste affected by the Certificate of Disposal including reference to the manifest number for the shipment.

c. A statement certifying the fact of disposal of the identified PCB waste, including the date(s) of disposal, and identifying the disposal process used.

d. A certification as defined in 40 CFR 761, Section 3.

3.8.2.1 Payment Upon Furnishing Certificate of Disposal of PCBs

Payment will not be made until the certificate of disposal has been furnished to the Contracting Officer.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 03 30 00

CAST-IN-PLACE CONCRETE
02/19, CHG 10: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; R 2015) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 301	(2020) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(2017) Guide to Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305.1	(2014) Specification for Hot Weather Concreting
ACI 305R	(2020) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI MNL-2	(2019; 11th Edition) ACI Manual of Concrete Inspection
ACI MNL-15	(2020) Field Reference Manual: Specifications for Concrete Construction ACI 301-20 with Selected ACI References
ACI SPEC 308.1	>(2023) External Curing of Cast-in-Place Concrete - Specification

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M	(2018) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A184/A184M	(2024) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615/A615M	(2024) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2024) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A934/A934M	(2022) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1022/A1022M	(2016b) Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement
ASTM A1060/A1060M	(2016b) Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1064/A1064M	(2024) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2025a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2024a) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2024) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2020) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C78/C78M	(2022) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	(2025) Standard Specification for Ready-Mixed Concrete
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2024) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2024a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2024) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2024) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C311/C311M	(2025) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C494/C494M	(2024) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2024) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2025a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C803/C803M	(2023) Standard Test Method for Penetration Resistance of Hardened Concrete
ASTM C873/C873M	(2015) Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
ASTM C900	(2015) Standard Test Method for Pullout Strength of Hardened Concrete
ASTM C920	(2018; R 2024) Standard Specification for Elastomeric Joint Sealants
ASTM C989/C989M	(2024) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1012/C1012M	(2024) Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ASTM C1016	(2014; R 2022) Standard Test Method for Determination of Water Absorption of Sealant Backing (Joint Filler) Material

ASTM C1074	(2019; E 2021) Standard Practice for Estimating Concrete Strength by the Maturity Method
ASTM C1077	(2024) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1157/C1157M	(2023) Standard Performance Specification for Hydraulic Cement
ASTM C1218/C1218M	(2020c) Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
ASTM C1260	(2023) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	(2008; R 2015) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1567	(2025) Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2022) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1778	(2023) Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
ASTM D471	(2016a; R 2021) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D789	(2015) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2628	(1991; R 2016) Standard Specification for

	Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D2835	(1989; R 2017) Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D5759	(2012; R 2020) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2021) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM E96/E96M	(2024a) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM E329	(2023) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E1643	(2018a) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E1745	(2017; R 2023) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

COMPOSITE PANEL ASSOCIATION (CPA)

ANSI/CPA A135.4	(2012; R2020) Basic Hardboard

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI RB4.1	(2016) Supports for Reinforcement Used in Concrete
CRSI SP0001-31-DL-I	(2024) Manual of Standard Practice

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1	(2009) DOC Voluntary Product Standard PS 1-07, Structural Plywood

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate

1.2 DEFINITIONS

a. "Cementitious material" as used herein includes all portland cement, pozzolan, fly ash, and slag cement.

b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.

c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.

d. "Supplementary cementing materials" (SCM) include coal fly ash, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.

e. "Design strength" (f'c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.

f. "Mass Concrete" is any concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 3 feet or more regardless of temperature.

g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.

h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.

i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Concrete Curing Plan

Quality Control Program; G

Quality Control Personnel Certifications; G

Quality Control Organizational Chart

Laboratory Accreditation; G

Maturity Method Data

SD-02 Shop Drawings

Reinforcing Steel; G

SD-03 Product Data

Joint Sealants; G

Joint Filler; G

Formwork Materials

Recycled Aggregate Materials; G

Cementitious Materials; G

Vapor Retarder; G

Concrete Curing Materials; G

Reinforcement; G

Liquid Chemical Floor Hardeners and Sealers

Admixtures; G

Mechanical Reinforcing Bar Connectors; G

Waterstops; G

Biodegradable Form Release Agent

Pumping Concrete; G

Nonshrink Grout; G

SD-05 Design Data

Construction and Movement Joints Locations and Details; G

Concrete Mix Design; G

SD-06 Test Reports

Concrete Mix Design; G

Fly Ash; G

Pozzolan; G

Slag Cement; G

Aggregates; G

Portland Cement; G

Blended Cements; G

Compressive Strength Tests; G

Slump Tests

Water

SD-07 Certificates

Reinforcing Bars

Welder Qualifications

VOC Content for Form Release Agents, Curing Compounds, and Concrete Penetrating Sealers

Safety Data Sheets

Forest Stewardship Council (FSC) Certification

Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Liquid Chemical Floor Hardeners and Sealers

Joint Sealants; S

Curing Compound

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301, ACI 304R and ASTM A934/A934M requirements and recommendations. Do not deliver concrete until vapor retarder, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers in occupied spaces.

1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be

accurately identified after bundles are broken and tags removed.

1.6 QUALITY ASSURANCE

1.6.1 Design Data

1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit all documentation required in ACI 301 Section 4 and as specified in this section. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, supplementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. Required average strength can be documented by field experience if field strength test data are available and represent a single group of at least 10 consecutive strength tests for one mixture, using materials and conditions similar to those expected for work, and encompassing a period of not less than 45 days. The average of field strength tests must equal or exceed fcr'. Changes in materials, conditions, and proportions within the test record must not have been more closely restricted than those for the proposed work. Test records must not be more than 24 months old. Obtain mix design approval from the contracting officer prior to concrete placement.

1.6.2 Shop Drawings

1.6.2.1 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.6.3 Control Submittals

1.6.3.1 Concrete Curing Plan

Submit proposed materials, methods and duration for curing concrete elements in accordance with ACI SPEC 308.1.

1.6.3.2 Pumping Concrete

Submit proposed materials and methods for pumping concrete. Include mix designs, pumping equipment including type of pump and size and material

for pipe, and maximum length and height concrete is to be pumped.

1.6.3.3 VOC Content for form release agents, curing compounds, and concrete penetrating sealers

Submit certification for the form release agent, curing compounds, and concrete penetrating sealers that indicate the VOC content of each product.

1.6.3.4 Safety Data Sheets

Submit Safety Data Sheets (SDS) for all materials that are regulated for hazardous health effects. SDS must be readily accessible during each work shift to employees when they are at the construction site.

1.6.4 Test Reports

1.6.4.1 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.6.4.2 Slag Cement

Submit test results in accordance with ASTM C989/C989M for slag cement. Submit test results performed within 6 months of submittal date.

1.6.4.3 Aggregates

Submit test results in accordance with ASTM C33/C33M, and ASTM C1293 or ASTM C1567 as required in the paragraph titled ALKALI-AGGREGATE REACTION.

1.6.5 Quality Control Program

Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. Include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. Provide all quality control reports to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of ACI MNL-15 and CRSI SP0001-31-DL-I at project site.

1.6.6 Quality Control Personnel Certifications

Submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a quality control organizational chart defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit American Concrete Institute certification for the following:

a. CQC personnel responsible for inspection of concrete operations.

b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.

c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

1.6.6.1 Quality Manager Qualifications

Holds a current license as a professional engineer in a U.S. state or territory with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

1.6.6.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with ACI MNL-2 or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in ACI MNL-2.

b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of ASTM E329.

c. Testing agencies that perform testing services on concrete materials must meet the requirements of ASTM C1077.

1.6.7 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the requirements of ASTM C1077 and be accredited by a nationally recognized independent authority for ASTM C1077 laboratory evaluation; including International Accreditation Service (IAS), Cement and Concrete Reference Laboratory (CCRL), National Voluntary Laboratory Accreditation Program (NVLAP), Construction Materials Engineering Council (CMEC), American Association for Laboratory Accreditation (A2LA), and AASHTO Accreditation Program (AAP).

1.6.8 Laboratory Accreditation

Laboratory and testing facilities are provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, comply with the following requirements:

a. Aggregate Testing and Mix Proportioning: Studies performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state or territory competent in concrete materials who is competent in concrete materials and must sign all reports and designs.

b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.

c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.7 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to material manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain one of the following ventilation conditions during the curing period or for 72 hours after installation:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 84 degrees F and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.7.1 Submittals for Environmental Performance

a. Provide data indication the percentage of post-industrial pozzolan (fly ash, slag cement) cement substitution as a percentage of the full product composite by weight.

b. Provide data indicating the percentage of post-industrial and post-consumer recycled content aggregate.

c. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.

d. Provide product data stating the location where all products were manufactured

e. For projects using FSC certified formwork, provide chain-of-custody documentation for all certified wood products.

f. For projects using reusable formwork, provide data showing how formwork is reused.

g. Provide SDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.

h. Provide SDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

1.8 SUSTAINABLE DESIGN REQUIREMENTS

1.8.1 Forest Stewardship Council (FSC) Certification

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

1.9 QUALIFICATIONS FOR WELDING WORK

Welding procedures must be in accordance with AWS D1.4/D1.4M.

Verify that Welder qualifications are in accordance with AWS D1.4/D1.4M for welding of reinforcement or under an equivalent qualification test approved in advance. Welders are permitted to do only the type of welding for which each is specifically qualified.

PART 2 PRODUCTS

2.1 FORMWORK MATERIALS

a. Form-facing material in contact with concrete must be lumber, plywood, tempered concrete-form-grade hardboard, metal, plastic, or treated paper that creates specified appearance and texture of concrete surface. Submit product information on proposed form-facing materials if different from that specified herein.

b. Design formwork, shores, reshores, and backshores to support loads transmitted to them and to comply with applicable building code requirements.

c. Design formwork and shoring for load redistribution resulting from stressing of post-tensioned reinforcement. Ensure that formwork allows movement resulting from application of prestressing force.

d. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.

e. Design formwork to accommodate waterstop materials in joints at locations indicated in Contract Documents.

f. Provide temporary openings in formwork if needed to facilitate cleaning and inspection.

g. Design formwork joints to inhibit leakage of mortar.

h. Limit deflection of facing materials for concrete surfaces exposed to view to 1/240 of center-to-center spacing of facing supports.

i. Do not use earth cuts as forms for vertical or sloping surfaces.

j. Submit product information on proposed form-facing materials if different from that specified herein.

2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with NIST PS 1, B-B concrete form panels or better or ANSI/CPA A135.4, hardboard for smooth form lining. Submit data verifying that composite wood products contain no urea formaldehyde resins. Virgin wood used must be FSC-certified.

2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to NIST PS 1, B-B, concrete form, not less

than 5/8-inch thick.

2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to NIST PS 1, B-B, high density form overlay, not less than 5/8-inch thick.

2.1.2 Plastic Forms

Provide plastic forms that contain a minimum of 50 percent post-consumer recycled content, or a minimum of 50 percent post-industrial recycled content.

2.1.3 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORMWORK ACCESSORIES

a. Use commercially manufactured formwork accessories, including ties and hangers.

b. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Form Ties

a. Use form ties with ends or end fasteners that can be removed without damage to concrete.

b. For secondary containment structures (including, but not limited to, fuel pits and vaults) and other structures indicated in Contract Documents, use form ties with integral water barrier plates or other acceptable positive water barriers in walls.

c. The breakback distance for ferrous ties must be at least 2 in. for Surface Finish-2.0 or Surface Finish-3.0, as defined in ACI 301.

d. Submit manufacturer's data sheet on form ties.

2.2.2 Waterstops

Submit manufacturer's data sheet on waterstop materials and splices.

2.2.2.1 Fuel Resistant Waterstop

Waterstop must be made of synthetic rubber, thermoplastic elastometric rubber, or other suitable compound material. Waterstop must be able to withstand long-term exposure to jet fuel Type Jet-A, JP-8 and diesel fuel without failure or permanent deterioration and must be tested in accordance with ASTM D471. Submit certification by the product manufacturer of the fuel resistance of the waterstop. Unless indicated otherwise, waterstops must be a minimum of 3/16 inch by 6 inches wide ribbed-style with centerbulb. Only manufacturer's shop-fabricated splice sections must be used for waterstop splices at corners intersections and angular joints.

2.2.3 Biodegradable Form Release Agent

a. Provide form release agent that is colorless, biodegradable, and rapeseed oil-based or soy oil-based or water-based, with a low (maximum of 55 grams/liter (g/l)) VOC content.

b. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

c. Provide form release agent that reduces formwork moisture absorption, and does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene. Submit documentation indicating type of biobased material in product and biobased content. Indicate relative dollar value of biobased content products to total dollar value of products included in project.

d. Submit manufacturer's product data on formwork release agent for use on each form-facing material.

2.2.4 Chamfer Materials

Use lumber materials with dimensions of 3/4 x 3/4 in.

2.2.5 Construction and Movement Joints Locations and Details

a. Submit details and locations of construction joints in accordance with the requirements herein.

b. Locate construction joints within middle one-third of spans of slabs, beams, and girders. If a beam intersects a girder within the middle one-third of girder span, the distance between the construction joint in the girder and the edge of the beam must be at least twice the width of the larger member.

c. For members with post-tensioning tendons, locate construction joints where tendons pass through centroid of concrete section.

d. Locate construction joints in walls and columns at underside of slabs, beams, or girders and at tops of footings or slabs.

e. Make construction joints perpendicular to main reinforcement.

f. Provide movement joints where indicated in Contract Documents or in accepted alternate locations.

g. Submit location and detail of movement joints if different from those indicated in Contract Documents.

h. Submit manufacturer's data sheet on expansion joint materials.

i. Provide keyways where indicated in Contract Documents. Longitudinal keyways indicated in Contract Documents must be at least 1-1/2 in. deep, measured perpendicular to the plane of the joint, unless indicated otherwise.

2.2.6 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and

design indicated in Contract Documents.

2.3 CONCRETE MATERIALS

2.3.1 Cementitious Materials

2.3.1.1 Portland Cement

a. Unless otherwise specified, provide cement that conforms to ASTM C150/C150M Type II/V where in contact with earth and Type I/II elsewhere.

b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

c. For portland cement manufactured in a kiln fueled by hazardous waste, maintain a record of source for each batch. Supplier must certify that the hazardous waste is neutralized by the manufacturing process and that no additional pollutants are discharged.

d. Submit information along with evidence demonstrating compliance with referenced standards. Include types of cementitious materials, manufacturing locations, shipping locations, and certificates showing compliance.

e. Store cementitious materials and keep dry and free from contaminants.

2.3.1.2 Blended Cements

a. Conform to ASTM C595/C595M Type IP IS .

b. Slag cement added to the Type IS or Type IT blended cements must meet ASTM C989/C989M.

c. The pozzolan added to the Type IP or Type IT blended cements must meet ASTM C618 Class F, and interground with the cement clinker. The manufacturer must state in writing that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. The percentage and type of pozzolan used in the blend must not change from that submitted for the aggregate evaluation and mixture proportioning.

2.3.1.3 Fly Ash

a. ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 6 percent.

b. If fly ash is used it must range from 15 to 20 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Do not use fly ash when it cannot meet the minimum level. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759.

2.3.1.4 Slag Cement

ASTM C989/C989M, Grade 120.

2.3.1.5 Other Supplementary Cementitious Materials

Natural pozzolan must be raw or calcined and conform to ASTM C618, Class N, including the optional requirement for uniformity.

Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) must conform to ASTM C618, Class F or N, and the following additional requirements:

a. The strength activity index at 28 days of age at least 95 percent of the control specimens.

b. The average particle size not exceed 6 microns.

c. The sum of SiO_2 plus Al_2O_3 plus Fe_2O_3 greater than 77 percent.

2.3.2 Water

a. Water or ice must comply with the requirements of ASTM C1602/C1602M.

b. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.

c. Provide water potable water; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

d. Protect mixing water and ice from contamination during storage and delivery.

e. Submit test report showing water complies with ASTM C1602/C1602M.

2.3.3 Aggregate

2.3.3.1 Normal-Weight Aggregate

a. Conform to ASTM C33/C33M.

b. Obtain aggregates used in concrete from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.

c. Provide sand that is at least 50 percent natural sand.

d. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.

e. Submit types, pit or quarry locations, producers' names, aggregate supplier statement of compliance with ASTM C33/C33M, and ASTM C1293 expansion data not more than 18 months old.

2.3.3.2 Recycled Aggregate Materials

Use a minimum of 25 percent recycled aggregate, depending on local availability and conforming to requirements of the mix design. Recycled aggregate to include: recovered glass recovered concrete recovered porcelain recovered stone that meets the aggregate requirements

specified. Submit recycled material request with the aggregate certification submittals and do not use until approved by the Contracting Officer.

2.3.4 Admixtures

a. Chemical admixtures must conform to ASTM C494/C494M.

b. Air-entraining admixtures must conform to ASTM C260/C260M.

c. Do not use calcium chloride admixtures.

d. Use a corrosion-inhibiting admixture for all concrete.

e. Viscosity modifying admixtures (VMA) must conform to ASTM C494/C494M, Type S.

f. Crystalline Waterproofing Admixture: Hydrophilic crystalline concrete admixture to provide permanently waterproof concrete. The admixture reacts chemically with water and un-hydrated cement particles to form insoluble microscopic needle-shaped crystals that fill capillary pores and self-seal micro-cracks in the concrete and block the pathways for water and waterborne contaminants. Include in all concrete for secondary containment structures (pits and vaults).

g. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.

h. Protect stored admixtures against contamination, evaporation, or damage.

i. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.

j. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI SPEC 308.1 Section 2. Submit product data for concrete curing compound s. Submit manufactures instructions for placement of curing compound.

2.4.2 Nonshrink Grout

Nonmetallic, nonshrink grout in accordance with ASTM C1107/C1107M with minimum compressive strength of 6,000 psi at 28 days.

2.4.3 Floor Finish Materials

2.4.3.1 Liquid Chemical Floor Hardeners and Sealers

a. Hardener must be a colorless aqueous solution containing a blend of

inorganic silicate or siliconate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufactures instructions for placement of liquid chemical floor hardener.

b. Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit manufactures instructions for placement of sealers.

2.4.4 Expansion/Contraction Joint Filler

ASTM D1751 or ASTM D1752 Type I or Type II. Provide material 1/2 inch thick, unless otherwise indicated. Use only ASTM D1752 Type II cork material in the areas with possible exposure to fuel.

2.4.5 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

2.4.5.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T. Fuel resistant for surfaces subjected to exposure to fuel.

2.4.5.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T or NT. FS SS-S-200, no sag, gray color for fuel resistant application.

2.4.5.3 Backer Rod

Provide backer rod material that is a compressible, non-shrinking, non-staining, non-absorbing material, nonreactive with the joint sealant. The material must have a melting point at least 3 degrees C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The material must have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C1016. Use material that is 25 plus or minus 5 percent larger in diameter than the nominal width of the crack. Foam material must be closed-cell type.

2.4.5.4 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

2.4.5.5 Lubricant for Preformed Compression Seals

ASTM D2835.

2.4.6 Vapor Retarder

ASTM E1745 Class A B polyethylene sheeting, minimum 15 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.5 CONCRETE MIX DESIGN

2.5.1 Properties and Requirements

a. Use materials and material combinations listed in this section and the contract documents.

b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.

c. Selected target slump must meet the requirements of this section, the contract documents, and must not exceed 9 in. Concrete must not show visible signs of segregation.

d. Enforce the target slump for the duration of the project. Determine the slump by ASTM C143/C143M. Slump tolerances must meet the requirements of ACI 117.

e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

f. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3, with the total air content in accordance with the requirements of the paragraph titled DURABILITY.

g. Measure air content at the point of delivery in accordance with ASTM C173/C173M or ASTM C231/C231M.

h. Concrete for slabs to receive a hard-troweled finish must not contain an air-entraining admixture or have a total air content greater than 3 percent.

i. Concrete properties and requirements for each portion of the structure are specified in the table below. Refer to the paragraph titled DURABILITY for more details on exposure categories and their requirements.

	Minimum *f'c* psi	**Exposure Categories^**	**Miscellaneous Requirements**
Footings, mat slabs and drilled piers	5000 at 28 days	S0 ; C2; W2; F0	Nominal maximum aggregate size must be 1 in. Maximum slump: 8 in, with 2 to 4 in verified slump prior to adding water-reducing or plasticizing admixture

	Minimum f'_c psi	Exposure Categories^	Miscellaneous Requirements
Columns, walls, and elevated slabs	5000 at 28 days	S0 ; C2; W2; F0	Nominal maximum aggregate size must be 3/4 in. Maximum slump: 8 in, with 2 to 4 in verified slump prior to adding water-reducing or plasticizing admixture Maximum w/cm: 0.40
Sidewalks, curbs and gutters, electrical ductbanks	3500 at 28 days	S0 ; C1 ; W0 ; F0	Nominal maximum aggregate size must be 1 in. Maximum slump: 8 in, with 2 to 4 in verified slump prior to adding water-reducing or plasticizing admixture Maximum w/cm: 0.50
Unreinforced concrete	2500 at 28 days	S0 ; C1 ; W0 ; F0	Nominal maximum aggregate size must be 1 in Maximum w/cm: 0.60

2.5.2 Durability

2.5.2.1 Alkali-Aggregate Reaction

Do not use any aggregate susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

a. For each aggregate used in concrete, the expansion result determined in accordance with ASTM C1293 must not exceed 0.04 percent at one year.

b. For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with ASTM C1567 must not exceed 0.10 percent at an age of 16 days.

c. Alkali content in concrete (LBA) must not exceed 4 pounds per cubic yard for moderately reactive aggregate or 3 pounds per cubic yard for highly reactive aggregate. Determine reactivity by testing in accordance with ASTM C1293 and categorize in accordance with ASTM C1778. Alkali content is calculated as follows:
LBA = (cement content, pounds per cubic yard) × (equivalent alkali content of portland cement in percent/100 percent)

2.5.2.2 Freezing and Thawing Resistance

a. Provide concrete meeting the following requirements based on exposure class assigned to members for freezing-and-thawing exposure in

Contract Documents:

Exposure class	Maximum *w/cm*	Minimum *f'c*, psi	Air content	Additional Requirements
F0	N/A	2500	N/A	

2.5.2.3 Corrosion and Chloride Content

a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members requiring protection against reinforcement corrosion in Contract Documents.

b. Submit documentation verifying compliance with specified requirements.

c. Determine water-soluble chloride ion content contributed from constituents including water, aggregates, cementitious materials, and admixtures for the concrete mixture by ASTM C1218/C1218M at age between 28 and 42 days.

d. The maximum water-soluble chloride ion (Cl-) content in concrete, percent by mass of cement is as follows:

Exposure class	Maximum *w/cm*	Minimum f'c, psi	Maximum water-soluble chloride ion (CL-) content in concrete, percent by mass of cement
Reinforced concrete			
C0	N/A	2500	1.00
C1	N/A	2500	0.30
C2	0.4	5000	0.15

2.5.2.4 Sulfate Resistance

a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members for sulfate exposure.

Exposure class	Maximum w/cm	Minimum f'c, psi	Required cementitious materials-types			Calcium chloride admixture
			ASTM C150/C150M	ASTM C595/C595M	ASTM C1157/C1157M	
S0	N/A	2500	N/A	N/A	N/A	No restrictions

* For seawater exposure, other types of portland cements with tricalcium aluminate (C3A) contents up to 10 percent are acceptable if the w/cm does not exceed 0.40.

** The amount of the specific source of the pozzolan or slag cement to be used must be at least the amount determined by test or service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slag used must not be less than the amount tested in accordance with ASTM C1012/C1012M and meeting the requirements maximum expansion requirements listed herein.

*** If Type V cement is used as the sole cementitious material, the

optional sulfate requirement of 0.040 percent maximum expansion in ASTM C150/C150M is required.

^ Other available types of cement, such as Type III or Type I, are acceptable in exposure classes S1 or S2 if the C3A contents are less than 8 or 5 percent, respectively.

b. Alternative combinations of cementitious materials of those listed in this paragraph are acceptable if they meet the maximum expansion requirements listed in the following table:

Exposure class	**Maximum expansion when tested using ASTM C1012/C1012M**		
	At 6 months	**At 12 months**	**At 18 months**
S1	0.10 percent	N/A	N/A
S2	0.05 percent	0.10 percent^	N/A
S3	N/A	N/A	0.10 percent

^The 12-month expansion limit applies only when the measured expansion exceeds the 6-month maximum expansion limit.

2.5.2.5 Concrete Temperature

The temperature of concrete as delivered must not exceed 95 degrees F .

2.5.2.6 Concrete Permeability

a. Provide concrete meeting the requirements of the following table based on exposure class assigned to members requiring low permeability in the Contract Documents.

Exposure class	**Maximum *w/cm***	**Minimum f'c, psi**	**Additional minimum requirements**
W0	N/A	2500	None
W1	0.5	4000	None
W2	0.50	4000	None

b. Submit documentation verifying compliance with specified requirements.

2.5.3 Trial Mixtures

In accordance with ACI 301.

2.5.4 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94/C94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets

with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94/C94M:

a. Type and brand cement

b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete

c. Maximum size of aggregate

d. Amount and brand name of admixtures

e. Total water content expressed by water cementitious material ratio

2.6 REINFORCEMENT

Shop Fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

a. Bend reinforcement cold. Reinforcement must be bent cold in the shop to shapes as indicated. Rebending of a reinforcing bar that has been bent incorrectly is not permitted. Bending must be in accordance with the standard approved practice and by approved machine methods. Provide hooks and bends that are in accordance with the Contract Documents. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.

b. Submit manufacturer's certified test report for reinforcement.

c. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.

d. Submit request with locations and details of splices not indicated in Contract Documents.

e. Submit request to place column dowels without using templates.

f. Submit request for field cutting, including location and type of bar to be cut and reason field cutting is required.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

2.6.1 Reinforcing Bars

a. Deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.

b. ASTM A615/A615M with the bars marked S, Grade 60. Provide reinforcing bars that contain a minimum of 50 percent recycled content. See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total recycled content requirements.

c. Reinforcing bars may contain post-consumer or post-industrial recycled content.

d. Submit mill certificates for reinforcing bars.

2.6.1.1 Bar Mats

a. Conform to ASTM A184/A184M.

b. If coated bar mats are required, repair damaged coating as required in the paragraph titled GALVANIZED REINFORCING BARS EPOXY-COATED REINFORCING BARS and DUAL-COATED REINFORCING BARS.

2.6.2 Mechanical Reinforcing Bar Connectors

a. Provide 125 percent minimum yield strength of the reinforcement bar.

b. Mechanical splices for galvanized reinforcing bars must be galvanized or coated with dielectric material.

c. Mechanical splices used with epoxy-coated or dual-coated reinforcing bars must be coated with dielectric material.

d. Submit data on mechanical splices demonstrating compliance with this paragraph.

2.6.3 Wire

a. Provide wire reinforcement that contains a minimum of50 percent recycled content.See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total recycled content requirements. Wire reinforcement may contain post-consumer or post-industrial recycled content. Provide flat sheets of welded wire reinforcement for slabs and toppings.

b. Plain or deformed steel wire must conform to ASTM A1064/A1064M.

c. Stainless steel wire must conform to ASTM A1022/A1022M.

2.6.4 Welded Wire Reinforcement

a. Use welded wire reinforcement specified in Contract Documents and conforming to one or more of the specifications given herein.

b. Plain welded wire reinforcement must conform to ASTM A1064/A1064M, with welded intersections spaced no greater than 12 in. apart in direction of principal reinforcement.

c. Deformed welded wire reinforcement must conform to ASTM A1064/A1064M, with welded intersections spaced no greater than 16 in. apart in direction of principal reinforcement.

d. Zinc-coated (galvanized) welded wire reinforcement must conform to ASTM A1060/A1060M. Repair coating damage incurred during shipment, storage, handling, and placing of zinc-coated (galvanized) welded wire reinforcement in accordance with ASTM A780/A780M. If damaged area exceeds 2 percent of surface area in each linear foot of each wire or welded wire reinforcement, the sheet containing the damaged area must not be used. The 2 percent limit on damaged coating area includes repaired areas damaged before shipment as required by ASTM A1060/A1060M.

2.6.5 Reinforcing Bar Supports

a. Provide reinforcement support types within structure as required by Contract Documents. Conform to CRSI RB4.1. Submit description of reinforcement supports and materials for fastening coated reinforcement if not in conformance with CRSI RB4.1.

b. Do not use precast concrete blocks as bar support or spacers in walls or elevated slabs.

c. Legs of supports in contact with formwork may be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

2.6.6 Dowels for Load Transfer in Floors

Provide greased dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to ASTM A615/A615M, Grade 50.

2.6.7 Welding

a. Provide weldable reinforcing bars that conform to ASTM A706/A706M, Grade 60 (420), including Supplement S1.

b. Comply with AWS D1.4/D1.4M unless otherwise specified. Do not tack weld reinforcing bars.

c. Welded assemblies of steel reinforcement produced under factory conditions, such as welded wire reinforcement, bar mats, and deformed bar anchors, are allowed.

PART 3 EXECUTION

3.1 EXAMINATION

a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.

b. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.

c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

3.2.1 General

a. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

b. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

3.2.2 Subgrade Under Foundations and Footings

a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder.

b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

3.2.3 Subgrade Under Slabs on Ground

a. Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

b. Clean previously constructed subgrade or fill of foreign materials.

c. Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

d. Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

3.2.4 Edge Forms and Screed Strips for Slabs

a. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface, strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment.

b. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

3.2.5 Reinforcement and Other Embedded Items

a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

3.3 FORMS

a. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade.

b. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch. Place chamfer strips in corners of formwork to

produce beveled edges on permanently exposed surfaces.

c. Provide formwork with clean-out openings to permit inspection and removal of debris.

d. Inspect formwork and remove foreign material before concrete is placed.

e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.

f. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in formwork after concrete has reached initial setting. Brace formwork to resist lateral deflection and lateral instability.

g. Fasten form wedges in place after final adjustment of forms and before concrete placement.

h. Provide anchoring and bracing to control upward and lateral movement of formwork system.

i. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.

j. Provide runways for moving equipment. Support runways directly on formwork or structural members. Do not support runways on reinforcement. Loading applied by runways must not exceed capacity of formwork or structural members.

k. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.

l. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

3.3.1 Coating

a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.

b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.

c. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

3.3.2 Reuse

a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.

b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.

c. Remove leaked mortar from formwork joints before reuse.

3.3.3 Forms for Standard Rough Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

3.3.4 Forms for Standard Smooth Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view and surfaces to receive dampproof coating.

3.3.5 Form Ties

a. For post-tensioned structures, do not remove formwork supports until stressing records have been accepted by the Contracting Officer.

b. After ends or end fasteners of form ties have been removed, repair tie holes in accordance with ACI 301 Section 5 requirements.

3.3.6 Tolerances for Form Construction

a. Construct formwork so concrete surfaces conform to tolerances in ACI 117.

b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within ACI 117 tolerances.

c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

3.3.7 Removal of Forms and Supports

a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.

b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.

c. Do not damage concrete during removal of vertical formwork for columns, walls, and sides of beams. Perform needed repair and finishing operations required on vertical surfaces. If forms are removed before end of specified curing period, provide curing and protection.

d. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive

strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

3.3.8 Strength of Concrete Required for Removal of Formwork

If removal of formwork, reshoring, or backshoring is based on concrete reaching a specified in-place strength, mold and field-cure cylinders in accordance with ASTM C31/C31M. Test cylinders in accordance with ASTM C39/C39M. Alternatively, use one or more of the methods listed herein to evaluate in-place concrete strength for formwork removal.

a. Tests of cast-in-place cylinders in accordance with ASTM C873/C873M. This option is limited to slabs with concrete depths from 5 to 12 in.

b. Penetration resistance in accordance with ASTM C803/C803M.

c. Pullout strength in accordance with ASTM C900.

d. Maturity method in accordance with ASTM C1074. Submit maturity method data using project materials and concrete mix proportions used on the project to demonstrate the correlation between maturity and compressive strength of laboratory cured test specimens to the Contracting Officer.

3.4 WATERSTOP INSTALLATION AND SPLICES

a. Provide waterstops in construction joints as indicated.

b. Install formwork to accommodate waterstop materials. Locate waterstops in joints where indicated in Contract Documents. Minimize number of splices in waterstop. Splice waterstops in accordance with manufacturer's written instructions. Install only factory-manufactured premolded mitered corners and intersections. Field splices are only allowed along straight sections and must be made by therman fusion.

c. Install waterstops to form a continuous diaphragm in each joint. Make adequate provisions to support and protect waterstops during progress of work. Protect waterstops protruding from joints from damage.

3.4.1 Fuel Resistant Waterstop

Shop made fittings using a machine specifically designed to mechanically weld the waterstop. Use a portable power saw to miter or straight cut the ends to be joined to ensure good alignment and contact between joined surfaces. Maintain continuity of the characteristic features of the cross section of the waterstop (for example ribs, tabular center axis, and protrusions) across the splice.

Miter cut ends to be joined with sharp knife or shears. The ends must be thermally fused. Install and secure in place prior to concrete placement in accordance to manufacturer's written recommendations.

3.5 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

a. Unless otherwise specified, place reinforcement and miscellaneous materials in accordance to ACI 301. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.

b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

c. Nonprestressed cast-in-place concrete members must have concrete cover for reinforcement given in the following table:

Concrete Exposure	**Member**	**Reinforcement**	**Specified cover, in.**
Cast against and permanently in contact with ground	All	All	3
Exposed to weather or in contact with ground	All	No. 6 through No. 18 bars	2
		No. 5 bar, W31 or D31 wire, and smaller	2
Not exposed to weather or in contact with ground	Slabs, joists, and walls	No. 14 and No. 18 bars	2
		No. 11 bar and smaller	2
	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals, and hoops	2

3.5.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

3.5.2 Vapor Retarder

a. Install in accordance with ASTM E1643. Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape.

b. Remove torn, punctured, or damaged vapor retarder material and provide with new vapor retarder prior to placing concrete. Concrete placement must not damage vapor retarder material.

3.5.3 Reinforcement Supports

Provide reinforcement support in accordance with CRSI RB4.1 and ACI 301 Section 3 requirements. Do not use precast concrete blocks as bar support or spacers in walls or elevated slabs.

3.5.4 Splicing

As indicated in the Contract Documents. For splices not indicated follow ACI 301. Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus 2 inches.

3.5.5 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.5.6 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.5.7 Inspection of Reinforcement

Inspect and verify proper reinforcement grade, shape, cross section and condition. Do not use reinforcement with the following defects:

a. Bar lengths, depths, and bends beyond specified fabrication tolerances.

b. Bends or kinks not indicated on drawings or approved shop drawings.

c. Bars with reduced cross section due to rusting or other cause.

3.5.8 Placing Reinforcement

Place reinforcement in accordance with ACI 301.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

Precast concrete units must be wedge shaped, not larger than 3-1/2 by 3-1/2 inches, and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

For bars or welded wire fabric not supported direct on earth, supports must be of plastic-coated steel or stainless steel protected bar supports. Do not use precast concrete blocks to support bars or welded wire fabrics in elevated horizontal structures (i.e., slabs, beams, etc.) or vertical

structures (i.e., columns, walls, etc.).

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 301 and CRSI SP0001-31-DL-I. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

b. Equip supports on ground and similar surfaces with sand-plates.

c. Support welded wire reinforcement as required for reinforcing bars.

d. Secure reinforcements to supports by means of tie wire. Provide black, soft iron wire, not less than 16 gage.

e. Accurately place reinforcement, securely tie at intersections, and hold in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.

f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents and upon approval from the Contracting Officer.

3.5.9 Spacing of Reinforcing Bars

a. As indicated in the Contract Documents.

b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

3.5.10 Concrete Protection for Reinforcement

In accordance with the Contract Documents.

3.5.11 Welding

In accordance with AWS D1.4/D1.4M.

3.6 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with ASTM C94/C94M, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Utilize batching equipment such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.6.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and

TESTING.

3.6.2 Mixing

a. Mix concrete in accordance with ASTM C94/C94M, ACI 301 and ACI 304R.

b. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates. If discharge is acceptable after more than 90 minutes the air content, slump, and concrete temperature must be tested and must be within the specified limits. A retarder must be used to facilitate placing and finishing when concrete temperature is 85 degrees F or greater.

c. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture, within the manufacturer's recommended dosage, to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

3.6.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.7 PLACING CONCRETE

Place concrete in accordance with ACI 301 Section 5. Place concrete within 15 minutes of discharge into non-agitating equipment.

3.7.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 4 inches greater than indicated.

3.7.2 Pumping

ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

3.7.3 Hot Weather

Meet the requirements of ACI 305.1 unless otherwise specified. Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of

newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.7.4 Bonding

Roughen and clean surfaces of set concrete at joints of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Use bonding agent is required, obtain bonding of fresh concrete that has set as follows:

a. At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; dampen but do not saturate roughened and cleaned surface of set concrete immediately prior to placing fresh concrete.

b. At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; dampen but do not saturate the roughened and cleaned surface of set concrete and cover with a cement grout coating.

c. Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

3.8 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

3.8.1 Mixing Equipment

Before concrete pours, designate on-site area to be paved later in project for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

3.8.2 Hardened, Cured Waste Concrete

Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement. Use hardened, cured waste concrete as aggregate in concrete mix if approved by Contracting Officer.

3.8.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

3.8.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material. Return excess cement to supplier. Institute deconstruction and construction waste separation and recycling for use in manufacturer's programs. When such a program is not available, seek local recyclers to reclaim the materials.

3.9 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

3.9.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

3.9.2 Not Against Forms (Top of Walls)

Finish surfaces not otherwise specified with wood floats to even surfaces. Match adjacent finishes.

3.9.3 Formed Surfaces

3.9.3.1 Tolerances

Tolerances in accordance with ACI 117 and as indicated.

3.9.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view or surface not to receive dampproof coating a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

3.9.3.3 Standard Smooth Finish

Provide for surfaces exposed to public view or surface not to receive dampproof coating a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

3.10 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with ACI 301 and ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Where straightedge measurements are specified, provide straightedge.

3.10.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater. Do no use grate tampers ("jitterbugs").

3.10.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. Finish concrete in accordance with ACI 301 Section 5 for a scratched finish.

3.10.1.2 Floated

Use for exterior slabs where not otherwise specified. Finish concrete in accordance with ACI 301 Section 5 for a floated finish.

3.10.1.3 Steel Troweled

Use for floors intended as walking surfaces. Finish concrete in accordance with ACI 301 Section 5 for a steel troweled finish.

3.10.1.4 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with ACI 301 Section 5 for a broomed finish.

3.10.1.5 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. Round edges and joints with an edger having a radius of 1/8 inch.

3.10.1.6 Chemical-Hardener Treatment

Apply liquid-chemical floor hardener where indicated after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. Apply first coat at one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow to dry 24 hours between coats.

Apply approved proprietary chemical hardeners in accordance with manufacturer's printed directions.

3.10.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints 1 inch deep, or one fourth the slab thickness whichever is deeper, with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

3.10.3 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.10.4 Curbs

Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool

after the surface has been finished. Provide expansion joints 1/2 inch thick and spaced every 100 feet maximum unless otherwise indicated. Perform pavement finish.

3.10.5 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, 24 inches long, 12 inches wide and 4 inches thick, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

3.11 JOINTS

3.11.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Make joints perpendicular to main reinforcement. Continue and develop reinforcement across construction joints. Locate construction joints as follows:

3.11.1.1 Construction Joints for Constructability Purposes

a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.

b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.

c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.11.2 Isolation Joints in Slabs on Ground

a. Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

b. Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Clean groove of foreign matter and loose particles after surface has dried.

3.11.3 Contraction Joints in Slabs on Ground

a. Provide joints to form panels as indicated.

b. Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.

c. Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.

3.11.4 Sealing Joints in Slabs on Ground

a. Seal contraction and control joints which are to receive finish flooring material with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

b. Leave sealed groove ready to receive filling material that is provided as part of finish floor covering work.

3.12 CURING AND PROTECTION

Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

3.12.1 Curing Periods

ACI 301 Section 5, except 10 days for vault bottom slab, vault walls, retaining walls, or pavement. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.12.2 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

3.12.3 Curing Unformed Surfaces

a. Accomplish initial curing of unformed surfaces, such as monolithic

slabs, floor topping, and other flat surfaces, by membrane curing.

b. Accomplish final curing of unformed surfaces by any of curing methods specified, as applicable.

c. Accomplish final curing of concrete surfaces to receive liquid floor hardener of finish flooring by moisture-retaining cover curing.

3.12.4 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 5 degrees F in any one hour nor 49 degrees F in any 24-hour period.

3.12.5 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.12.6 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.13 FIELD QUALITY CONTROL

3.13.1 Aggregate Testing

3.13.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there must be one sieve analysis and fineness modulus determination in accordance with ASTM C136/C136M and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, immediately resample and retest the fine aggregate. If there is another failure on any sieve, immediately report the fact to the Contracting Officer, stop concreting, and take immediate steps to correct the grading.

3.13.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, provide a sieve analysis in accordance with ASTM C136/C136M for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor is responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations must show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, immediately resample and retest the coarse aggregate. If the second sample fails on any sieve, report that fact to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation will be considered out of control and reported to the Contracting Officer. Stop concreting and take immediate steps to correct the grading.

3.13.2 Concrete Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

3.13.3 Concrete Testing

3.13.3.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each 20 cubic yards (maximum) of concrete. If the measured slump at point of delivery is greater than specified, a check test will be performed on a new sample from point of delivery. If the check test fails, concrete is considered to have failed to meet the requirements of this specification. If the measured slump is less than specified, adjustments will be permitted in accordance with ASTM C94/C94M. If the test of slump of the adjusted mixture fails, concrete is considered to have failed to meet the requirements of this specification.

3.13.3.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.13.3.3 Compressive Strength Tests

ASTM C39/C39M. Make six 6 inch by 12 inch or nine 4 inch by 8 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two 6 inch by 12 inch or three 4 inch by 8 inch cylinders

at 7 days, two 6 inch by 12 inch or three 4 inch by 8 inch cylinders at 28 days, and hold two 6 inch by 12 inch or three 4 inch by 8 inch cylinders in reserve. Take samples for strength tests for each concrete mixture placed each day not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two 6 inch by 12 inch or three 4 inch by 8 inch cylinders from the same concrete sample tested at 28 days . Concrete compressive tests must meet the requirements of this section, the Contract Document, and ACI 301.

3.13.3.4 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

a. Failure to meet compressive strength tests as evaluated.

b. Reinforcement not conforming to requirements specified.

c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.

d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.

e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.

f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the Contracting Officer.

3.13.3.5 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Conduct investigations into non-conforming materials at the Contractor's expense. The Contractor is responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

3.13.3.6 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C42/C42M, and as follows:

a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.

b. Test cores after moisture conditioning in accordance with ASTM C42/C42M if concrete they represent is more than superficially wet under service.

c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

d. Strength of cores from each member or area are considered satisfactory if their average compressive strength is equal to or greater than 85 percent of the design compressive strength, and if no single core strength is less than 75 percent of the design compressive strength. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted only when approved by the Contracting Officer.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

3.14 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure, inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. Prepare a report documenting these defects which includes recommendations for repair, removal or remediation and submit to the Contracting Officer for approval before any corrective work is accomplished.

3.14.1 Crack Repair

Prior to final acceptance, document all cracks in excess of 0.02 inches wide or surface not to receive dampproof coating and repair. Submit the proposed method and materials to repair the cracks to the Contracting Officer for approval. Address the amount of movement expected in the crack due to temperature changes and loading.

3.14.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to the Contracting Officer.

3.14.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

SECTION 04 20 00

UNIT MASONRY
05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615/A615M	(2024) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A641/A641M	(2019; R 2025) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A951/A951M	(2011) Standard Specification for Steel Wire for Masonry Joint Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1008/A1008M	(2024) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1064/A1064M	(2024) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C90	(2024a) Standard Specification for

	Loadbearing Concrete Masonry Units
ASTM C207	(2024) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	(2025) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2023) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2024) Standard Specification for Chemical Admixtures for Concrete
ASTM C641	(2023) Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates
ASTM C780	(2025) Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C1019	(2024a) Standard Test Method for Sampling and Testing Grout
ASTM C1384	(2012a) Standard Specification for Admixtures for Masonry Mortars
ASTM C1611/C1611M	(2021) Standard Test Method for Slump Flow of Self-Consolidating Concrete
ASTM D2000	(2018; R 2024) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2287	(2019) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

THE MASONRY SOCIETY (TMS)

TMS 402/602	(2022) Building Code Requirements and Specification for Masonry Structures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Cut CMU Drawings; G

Reinforcement Detail Drawings; G

SD-03 Product Data

Hot Weather Procedures; G

Cementitious Materials; G

SD-04 Samples

Concrete Masonry Units (CMU); G

Admixtures for Masonry Mortar; G

Anchors, Ties, and Bar Positioners; G

Joint Reinforcement; G

SD-05 Design Data

Masonry Compressive Strength; G

Bracing Calculations; G

SD-06 Test Reports

Field Testing of Mortar

Field Testing of Grout

SD-07 Certificates

Concrete Masonry Units (CMU)

Cementitious Materials

Admixtures for Masonry Mortar

Admixtures for Grout

Anchors, Ties, and Bar Positioners

Joint Reinforcement

SD-08 Manufacturer's Instructions

Admixtures for Masonry Mortar

Admixtures for Grout

1.3 QUALITY ASSURANCE

1.3.1 Special Masonry Inspector Qualifications

Refer to Section 01 45 35 SPECIAL INSPECTIONS for qualifications and responsibilities of the masonry construction special inspector.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver, store, handle, and protect material to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.4.1 Masonry Units

Cover and protect masonry units from precipitation. Conform to handling and storage requirements of TMS 402/602.

1.4.2 Reinforcement, Anchors, and Ties

Store steel reinforcing bars, coated anchors, ties, and joint reinforcement above the ground. Maintain steel reinforcing bars and uncoated ties free of loose mill scale and loose rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious material in dry, weathertight enclosures or completely cover. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination and segregation.

1.5 SITE CONDITIONS

Conform to TMS 402/602 for hot weather masonry erection.

1.5.1 Hot Weather Procedures

When ambient air temperature exceeds 100 degrees F, or exceeds 90 degrees F and the wind velocity is greater than 8 mph, comply with TMS 402/602 Article 1.8 D for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Design - Specified Compressive Strength of Masonry

The specified compressive strength of masonry, f'm, is as indicated for each type of masonry.

2.1.2 Performance - Verify Masonry Compressive Strength

Verify specified compressive strength of masonry using the "Unit Strength Method" of TMS 402/602. Submit calculations and certifications of unit and mortar strength.

Verify specified compressive strength of masonry using the "Prism Test Method" of TMS 402/602 when the "Unit Strength Method" cannot be used. Submit test results.

2.2 MANUFACTURED UNITS

2.2.1 General Requirements

Do not change the source of materials, which will affect the appearance of the finished work, after the work has started except with Contracting Officer's approval. Submit test reports from an approved independent

laboratory. Certify test reports on a previously tested material as the same materials as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2.2 Concrete Units

2.2.2.1 Aggregates

Test lightweight aggregates, and blends of lightweight and heavier aggregates in proportions used in producing the units, for stain-producing iron compounds in accordance with ASTM C641,visual classification method. Do not incorporate aggregates for which the iron stain deposited on the filter paper exceeds the "light stain" classification.

2.2.2.2 Concrete Masonry Units (CMU)

2.2.2.2.1 Size

Provide units with specified dimension of 8 inches wide, 8 inches high, and 16 inches long.

2.2.2.2.2 Surfaces

Provide units with exposed surfaces that are smooth and of uniform texture.

2.2.2.2.3 Unit Types

a. Hollow Load-Bearing Units: ASTM C90, lightweight or medium weightor normal weight. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

2.2.2.2.4 Jamb Units

Provide jamb units of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

Provide sash jamb units with a 3/4 by 3/4 inch groove near the center at end of each unit.

2.3 EQUIPMENT

2.3.1 Vibrators

Maintain at least one spare vibrator on site at all times.

2.3.2 Grout Pumps

Pumping through aluminum tubes is not permitted.

2.3.3 Masonry Saws

Masonry saws must have guards with a semi-circular enclosure over the blade. A method for retaining blade fragments must be incorporated into the design of the semi-circular enclosure.

2.3.4 Griders

Masonry grinders you must have appropriate guards, ensure the work rest is set close to the wheel (typically within 1/8 inch).

2.4 MATERIALS

2.4.1 Mortar Materials

2.4.1.1 Cementitious Materials

Provide cementitious materials that conform to those permitted by ASTM C270.

2.4.1.2 Hydrated Lime and Alternates

Provide lime that conforms to one of the materials permitted by ASTM C207 for use in combination with portland cement, hydraulic cement, and blended hydraulic cement. Do not use lime in combination with masonry cement or mortar cement.

2.4.1.3 Admixtures for Masonry Mortar

Use mortar that contains a water-repellent admixture in accordance with ASTM C1384. Provide a water-repellent admixture, in accordance with ASTM C1384 and of the same brand and manufacturer as the block's integral water-repellent, in the mortar used to place concrete masonry units that have an integral water-repellent admixture.

2.4.1.4 Aggregate and Water

Provide aggregate (sand) and water that conform to materials permitted by ASTM C270.

2.4.2 Grout and Ready-Mix Grout Materials

2.4.2.1 Cementitious Materials for Grout

Provide cementitious materials that conform to those permitted by ASTM C476.

2.4.2.2 Admixtures for Grout

Water-reducing admixtures in accordance with ASTM C494/C494M Type F or G and viscosity-modifying admixtures in accordance with ASTM C494/C494M Type S are permitted for use in grout. Other admixtures require approval by the Contracting Officer.

2.4.2.3 Aggregate and Water

Provide fine and coarse aggregates and water that conform to materials permitted by ASTM C476.

2.5 MORTAR AND GROUT MIXES

2.5.1 Mortar Mix

a. Provide mortar Type S unless specified otherwise herein.

b. Use ASTM C270 Type S cement-lime mortar or mortar cement mortar for seismic-force-resisting elements indicated.

c. Provide mortar that conforms to ASTM C270. Use Type M mortar for foundation walls.

d. Provide Type N or S mortar for non-load-bearing, non-shear-wall interior masonry.

e. For field-batched mortar, measure component materials by volume. Use measuring boxes for materials that do not come in packages, such as sand, for consistent batching. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Do not hand mix mortar unless approved by the Contracting Officer. Maintain workability of mortar by remixing or retempering. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

f. For preblended mortar, follow manufacturer's mixing instructions.

2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to ASTM C476, fine. Use conventional grout with a slump between 8 and 11 inches. Use self-consolidating grout with slump flow of 24 to 30 inches and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of 3000 psi in 28 days, as tested in accordance with ASTM C1019. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that grout meets the specified requirements. Use ready-mixed grout that conforms to ASTM C476.

2.6 ACCESSORIES

2.6.1 Grout Barriers

Grout barriers for vertical cores that consist of fine mesh wire, fiberglass, or expanded metal.

2.6.2 Anchors, Ties, and Bar Positioners

2.6.2.1 General

a. Fabricate anchors and ties without drips or crimps. Size anchors and ties to provide a minimum of 5/8 inch mortar cover from each face of masonry.

b. Fabricate steel wire anchors and ties from wire in accordance with ASTM A1064/A1064M and hot-dip galvanize in accordance with ASTM A153/A153M.

c. Fabricate joint reinforcement in accordance with ASTM A951/A951M. Hot dip galvanize joint reinforcement in exterior walls and in interior walls exposed to moist environment in accordance with ASTM A153/A153M. Galvanize joint reinforcement in other interior walls in accordance with ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below.

d. Fabricate sheet metal anchors and ties in accordance with ASTM A1008/A1008M. Hot dip galvanize sheet metal anchors and ties in exterior walls and in interior walls exposed to moist environment in

accordance with ASTM A153/A153M Class B. Galvanize sheet metal anchors and ties in other interior walls in accordance with ASTM A653/A653M, Coating Designation G60.

e. Submit two anchors, ties and bar positioners of each type used, as samples.

2.6.2.2 Wire Mesh Anchors

Provide wire mesh anchors of 1/4 inch mesh galvanized hardware cloth, in accordance with ASTM A185/A185M, with length not less than 12 inches, at intersections of interior non-bearing masonry walls.

2.6.2.3 Dovetail Anchors

Provide dovetail anchors of 3/16 inch diameter steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. Use these anchors to connect the exterior masonry wythe as it passes over the face of concrete columns, beams, or walls. Fill cells immediately above and below these anchors unless solid units are used. Furnish dovetail slots, which are specified to be installed by others, in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.6.2.4 Bar Positioners

Factory-fabricate bar positioners, used to prevent displacement of reinforcing bars during the course of construction, from 9 gauge steel wire or equivalent, and hot-dip galvanized. Bar positioners must be suitable for intended use and be corrosion resistant steel. Bar positioners not fully contained within the wythe must be hot-dip galvanized.

2.6.3 Joint Reinforcement

Factory fabricate joint reinforcement in accordance with ASTM A951/A951M, welded construction. Provide ladder type joint reinforcement, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units and with all wires a minimum of 9 gauge. Size joint reinforcement to provide a minimum of 5/8 inch cover from each face. Space crosswires not more than 16 inches. Provide joint reinforcement for straight runs in flat sections not less than 10 feet long. Provide joint reinforcement with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

2.6.4 Reinforcing Steel Bars

Provide reinforcing steel bars and rods in accordance with ASTM A615/A615M or ASTM A996/A996M, Grade 60.

2.6.5 Concrete Masonry Control Joint Keys

Provide control joint keys of a factory fabricated solid section of natural or synthetic rubber (or combination thereof) in accordance with ASTM D2000 M2AA-805 with a minimum durometer hardness of 80 or polyvinyl chloride in accordance with ASTM D2287 Type PVC 654-4 with a minimum durometer hardness of 85. Form the control joint key with a solid shear

section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch, to fit neatly, but without forcing, in masonry unit jamb sash grooves.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to start of work, verify the applicable conditions in accordance with TMS 402/602, inspection.

3.2 PREPARATION

3.2.1 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.2.2 Loads

Do not apply uniform loads for at least 36 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.2.3 Concrete Surfaces

Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.4 Bracing

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by OSHA and local codes and submit bracing calculations, sealed by a registered professional engineer. Do not remove bracing in less than 10 days.

3.3 ERECTION

3.3.1 General

a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Lay masonry units in the indicated bond pattern. Lay facing courses level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances is plus or minus 1/2 inch. Adjust each unit to its final position while mortar is still soft and has plastic consistency.

b. Remove and clean units that have been disturbed after the mortar has stiffened, and relay with fresh mortar. Keep air spaces, cavities, chases, expansion joints, and spaces to be grouted free from mortar and other debris. Select units to be used in exposed masonry surfaces from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work.

c. When necessary to temporarily discontinue the work, step (rack) back the masonry for joining when work resumes. Toothing may be used only when specifically approved by the Contracting Officer. Before resuming work, remove loose mortar and thoroughly clean the exposed joint. Cover the top of walls subjected to rain or snow with nonstaining waterproof covering or membrane when work is not in process. Extend the covering a minimum of 2 feet down on each side of the wall and hold securely in place.

d. Ensure that units being laid and surfaces to receive units are free of water film and frost. Lay solid units in a nonfurrowed full bed of mortar. Bevel mortar for veneer wythes and slope down toward the cavity side. Shove units into place so that the vertical joints are tight. Completely fill vertical joints between solid units with mortar, except where indicated at control, expansion, and isolation joints. Place hollow units so that mortar extends to the depth of the face shell at heads and beds, unless otherwise indicated. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Provide means to prevent mortar from dropping into the space below or clean grout spaces prior to grouting.

3.3.1.1 Jointing

Tool mortar joints when the mortar is thumbprint hard. Tool horizontal joints after tooling vertical joints. Brush mortar joints to remove loose and excess mortar.

3.3.1.1.1 Tooled Joints

Tool mortar joints in exposed exterior and interior masonry surfaces concave, using a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Perform tooling so that the mortar is compressed and the joint surface is sealed. Use a jointer of sufficient length to obtain a straight and true mortar joint. No exterior joints are to be left un-tooled.

3.3.1.1.2 Flush Joints

Flush cut mortar joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas. Finish flush cut joints by cutting off the mortar flush with the face of the wall. Point joints in unparged masonry walls below grade tight. For architectural units, such as fluted units, completely fill both the head and bed joints and flush cut.

3.3.1.1.3 Joint Widths

a. Provide 3/8 inch wide mortar joints in concrete masonry, except for prefaced concrete masonry units.

b. Maintain mortar joint widths within tolerances permitted by TMS 402/602

3.3.1.2 Cutting and Fitting

Use full units of the proper size wherever possible, in lieu of cut units. Locate cut units where they would have the least impact on the architectural aesthetic goals of the facility. Perform cutting and fitting, including that required to accommodate the work of others, by masonry mechanics using power masonry saws. Concrete masonry units are to be wet cut. If wet cutting is not possible dry cutting may be performed

provided that OSHA compliant respirators are used by employees. . Before being placed in the work, dry wet-cut units to the same surface-dry appearance as uncut units being laid in the wall. Provide cut edges that are clean, true and sharp.

a. Carefully make openings in the masonry so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Provide reinforced masonry lintels above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

b. Do not reduce masonry units in size by more than one-third in height and one-half in length. Do not locate cut products at ends of walls, corners, and other openings.

3.3.1.3 Unfinished Work

Rack back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved by the Contracting Officer. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.3.1.4 Control Joints

Provide control joints in concrete masonry as indicated. Construct by raking out mortar within the head jointusing special control-joint units using sash jamb units with control joint keyusing open end stretcher units placed with the closed end at the joint in accordance with the details shown on the Drawings. Form a continuous vertical joint at control joint locations, including through bond beams, by utilizing half blocks in alternating courses on each side of the joint. Interrupt the control joint key in courses containing continuous bond beam reinforcement. Do not interrupt the horizontal reinforcement and grout at the control joint.

Where mortar was placed in the joint, rake both faces of the control joints to a depth of 3/4 inch.

3.3.1.5 Decorative Architectural Units

Place decorative masonry units with the patterned face shell properly aligned in the completed wall.

3.3.2 Reinforced, Single Wythe Concrete Masonry Units Walls

3.3.2.1 Concrete Masonry Unit Placement

a. Fully bed units used to form piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout in mortar under both face shells and webs. Provide mortar beds under both face shells for other units. Mortar head joints for a distance in from the face of the unit not less than the thickness of the face shell.

b. Solidly grout foundation walls below grade.

c. Stiffen double walls at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of each wall

within the double wall. Adequately reinforce walls and partitions for support of wall-hung plumbing fixtures when chair carriers are not specified.

d. Submit drawings showing elevations of walls exposed to view and indicating the location of all cut CMU products.

3.3.2.2 Preparation for Reinforcement

Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be grouted. Remove mortar protrusions extending 1/2 inch or more into cells before placing grout. Position reinforcing bars accurately as indicated before placing grout. Where vertical reinforcement occurs, fill cores solid with grout in accordance with paragraph PLACING GROUT in this Section.

3.4 INSTALLATION

3.4.1 Bar Reinforcement Installation

3.4.1.1 Preparation

Submit detail drawings showing bar splice locations. Identify bent bars on a bending diagram and reference and locate such bars on the drawings. Show wall dimensions, bar clearances, and wall openings. Utilize bending details that conform to the requirements of ACI SP-66. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, resubmit the approved shop drawings with the additional openings shown along with the proposed changes. Clearly highlight location of these additional openings. Provide wall elevation drawings with minimum scale of 1/4 inch per foot. Submit drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings.

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, and other coatings that might destroy or reduce its bond prior to placing grout. Do not use bars with kinks or bends not shown on the approved shop drawings. Place reinforcement prior to grouting. Unless otherwise indicated, extend vertical wall reinforcement to within 2 inches of tops of walls.

3.4.1.2 Positioning Bars

a. Accurately place vertical bars within the cells at the positions indicated on the drawings. Maintain a minimum clearance of 1/2 inch between the bars and masonry units. Provide minimum clearance between parallel bars of 1/2 inch between the bars and masonry units for coarse grout and a minimum clearance of 1/4 inch between the bars and masonry units for fine grout. Provide minimum clearance between parallel bars of 1 inch or one diameter of the reinforcement, whichever is greater. Vertical reinforcement may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement or by other means to prevent displacement beyond permitted tolerances. As masonry work progresses, secure vertical reinforcement to prevent displacement beyond allowable tolerances.

b. Wire column and pilaster lateral ties in position around the vertical reinforcing bars. Place lateral ties in contact with the vertical reinforcement and do not place in horizontal mortar bed joints.

c. Position horizontal reinforcing bars as indicated. Stagger splices in adjacent horizontal bars, unless otherwise indicated.

d. Form splices by lapping bars as indicated. Do not cut, bend or eliminate reinforcing bars. Foundation dowel bars may be field-bent when permitted by TMS 402/602.

3.4.1.3 Splices of Bar Reinforcement

Lap splice reinforcing bars as indicated. When used, provide welded or mechanical connections that develop at least 125 percent of the specified yield strength of the reinforcement.

3.4.2 Placing Grout

3.4.2.1 General

Fill cells containing reinforcing bars with grout. Solidly grout hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces. Solidly grout cells under lintel bearings on each side of openings for full height of openings. Solidly grout walls below grade, lintels, and bond beams. Units other than open end units may require grouting each course to preclude voids in the units.

Discard site-mixed grout that is not placed within 1-1/2 hours after water is first added to the batch or when the specified slump is not met without adding water after initial mixing. Discard ready-mixed grout that does not meet the specified slump without adding water other than water that was added at the time of initial discharge. Allow sufficient time between grout lifts to preclude displacement or cracking of face shells of masonry units. Provide a grout shear key between lifts when grouting is delayed and the lower lift loses plasticity. If blowouts, flowouts, misalignment, or cracking of face shells occurs during construction, tear down the wall and rebuild.

3.4.2.2 Horizontal Grout Barriers

Embed horizontal grout barriers in mortar below cells of hollow units receiving grout.

3.4.2.3 Grout Holes and Cleanouts

3.4.2.3.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 16 inches on centers where grouting of hollow unit masonry is indicated. Fom such openings not less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

3.4.2.3.2 Cleanouts for Hollow Unit Masonry Construction

For hollow masonry units. provide cleanout holes at the bottom of every grout pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet 4 inches. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout.

Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Provide cleanouts not less than 3 by 3 inch by cutting openings in one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Do not cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.4.3 Joint Reinforcement Installation

Install joint reinforcement at 16 inches on center unless otherwise indicated. Lap joint reinforcement not less than 6 inches. Install prefabricated sections at corners and wall intersections. Place the longitudinal wires of joint reinforcement in mortar beds to provide not less than 5/8 inch cover to either face of the unit.

3.5 APPLICATION

3.5.1 Interface with Other Products

3.5.1.1 Built-In Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout, unless otherwise indicated.

3.5.1.2 Door and Window Frame Joints

On the exposed interior and exterior sides of exterior frames, rake joints between frames and abutting masonry walls to a depth of 3/8 inch.

3.5.1.3 Bearing Plates

Set bearing plates for beams, joists, joist girders and similar structural members to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Provide bedding mortar and non-shrink grout s specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.5.2 Tolerances

Lay masonry plumb, true to line, with courses level within the tolerances of TMS 402/602, Article 3.3 F.

3.6 FIELD QUALITY CONTROL

3.6.1 Tests

3.6.1.1 Field Testing of Mortar

Perform mortar testing at the following frequency: once per day. For each required mortar test, provide a minimum of three mortar samples. Perform initial mortar testing prior to construction for comparison purposes during construction.

Prepare and test mortar samples for mortar aggregate ratio in accordance with ASTM C780 Appendix A4. Prepare and test mortar compressive strength specimens in accordance with ASTM C780 Appendix A6.

3.6.1.2 Field Testing of Grout

a. Perform grout testing at the following frequency: once per day. For each required grout property to be evaluated, provide a minimum of three specimens.

b. Sample and test conventional and self-conslidating grout for compressive strength and temperature in accordance with ASTM C1019.

c. Evaluate slump in conventional grout in accordance with ASTM C1019.

d. Evaluate slump flow and visual stability index of self-consolidating grout in accordance with ASTM C1611/C1611M.

3.6.2 Special Inspection

Perform special inspections and testing in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

3.7 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs and splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, rake out defects in joints of masonry to be exposed or painted, fill with mortar, and tool to match existing joints. Immediately after grout work is completed, remove scum and stains that have percolated through the masonry work using a low pressure stream of water and a stiff bristled brush. Do not clean masonry surfaces, other than removing excess surface mortar, until mortar in joints has hardened. Leave masonry surfaces clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Do not use metal tools and metal brushes for cleaning.

3.7.1 Dry-Brushing Concrete Masonry

Dry brush exposed concrete masonry surfaces at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.8 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane to protect from moisture intrusion when work is not in progress. Continue covering the top of the

unfinished walls until the wall is waterproofed with a complete roof or parapet system. Extend covering a minimum of 2 feet down on each side of the wall and hold securely in place. Before starting or resuming work, clean top surface of masonry in place of loose mortar and foreign material.

-- End of Section --

SECTION 05 05 20

POST-INSTALLED CONCRETE AND MASONRY ANCHORS
05/22, CHG 1: 08/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 355.2	(2007) Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
ACI 355.4	(2011) Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4) and Commentary

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A193/A193M	(2024a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A615/A615M	(2024) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM E488/E488M	(2022) Standard Test Methods for Strength of Anchors in Concrete Elements
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2024) International Building Code

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

1.2 APPLICABILITY

This guide specification covers the requirements for all anchors that are

post-installed into hardened concrete, concrete masonry, or brick. This guide specification does not cover through bolts, powder or pneumatic actuated nails, or cast in anchors. Refer to Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS for requirements of through bolts, powder or pneumatic actuated nails, or cast in anchors.

1.3 DEFINITIONS

1.3.1 Anchor

"Anchor" includes steel elements post-installed into hardened concrete, concrete masonry, or brick and used to transmit applied loads.

1.3.2 Periodic Special Inspections

"Periodic Special Inspection" as used herein means that, as a minimum, the Post-Installed Anchor Special Inspector must perform inspections in accordance with this specification.

1.3.3 Continuous Special Inspections

"Continuous Special Inspection" as used herein means that the Post-Installed Anchor Special Inspector observes the drilling and cleaning of holes, the injection of adhesive into the holes, and the insertion of anchors into the holes. When applicable for the type of installation, or as indicated in the project drawings, "Continuous Special Inspection" also includes observation of measures to secure the anchor during the adhesive curing period.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Installer Qualifications; G

Post-Installed Anchor Special Inspector Qualifications; G

SD-03 Product Data

Mechanical Anchors in Concrete; G

Adhesive Anchor System in Concrete; G

Non-Shrink, Non-Metallic Grout; G

SD-06 Test Reports

Post-Installed Anchor Special Inspections Report; G

SD-07 Certificates

Post-Installed Anchor Certification; G

SD-08 Manufacturer's Instructions

Manufacturer's Printed Installation Instructions; G

Non-Shrink, Non-Metallic Grout; G

Manufacturer's Safety Data Sheets

1.5 QUALITY ASSURANCE

Perform all work in accordance with EM 385-1-1 and all manufacturer's instructions and recommendations. To protect personnel from overexposure to toxic materials, conform to the applicable manufacturer's Safety Data Sheets (SDS) or local regulation. Submit the SDS for epoxies and other potentially hazardous materials.

1.5.1 Qualifications

The submittals must identify individuals who will be working on this contract and their relevant experience and training. Do not make changes in approved personnel without prior approval of the Contracting Officer.

1.5.1.1 Installer Qualifications

Each worker engaged in the installation of post-installed anchors must have satisfactorily completed an applicable certification program or equivalent instruction program through the manufacturer or manufacturer's representative for all anchoring products they will install. A manufacturer's representative must train all installers per the installation instructions as listed in the ICC-ES Evaluation Report for the anchor being installed. Training must consist of a review and performance test of the complete installation process, including but not limited to:

(1) Hole drilling procedure

(2) Hole preparation & cleaning technique

(3) Adhesive injection technique & dispenser training / maintenance

(4) Anchor/threaded rod preparation and installation

(5) Rebar dowel preparation and installation

(6) Proof loading/torquing

(7) Installation in horizontal and upward orientations

Submit certification for each worker showing that they have completed the above training within three years prior to onsite work. Certification must include organization or manufacturer's name, instructor's name and qualifications, trainee's name, list of instruction received, date of instruction, and confirmation of successful performance tests.

1.5.1.2 Post-Installed Anchor Special Inspector Qualifications

The Contractor must retain the services of a third party Special Inspector independent of the installing contractor and manufacturer. The individual(s) who perform special inspections for post-installed anchors must meet all Installer Qualification requirements and have a minimum of 3

years of experience as a Special Inspector on previous projects involving similar scope of work. Submit resumes, pertinent information, past experience, and training.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Packing, Shipping, Handling, and Unloading

Deliver products to job site in manufacturer's or distributor's original packaging undamaged, complete with installation instructions. Inspect materials delivered to site for damage. Unload and store with minimal handling.

1.6.2 Storage

Protect, store, and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration. Do not allow chemical materials to freeze. Remove materials that have not be stored in accordance with the manufacturer's recommendations, including expired materials, from the job site.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Post-Installed Anchors

Provide anchors of the type, effective embedment, and diameter indicated on contract drawings. Minimum spacing and concrete edge distances must be as shown on contract drawings. Design values listed must be as tested according to ASTM E488/E488M for the substrate type, substrate moisture condition, concrete aggregate type (normal weight or lightweight concrete), and concrete/masonry strength. If more than one type of anchor is to be used on a project, clearly indicate on the submittal where each type of anchor will be used.

2.1.1.1 Post-Installed Anchor Certification

Submit product information with recommended design values and physical characteristics for each type anchor shown on the drawings.

Provide certified test reports showing compliance with specified performance characteristics and physical properties. Anchors must have one of the following certifications:

(1) ICC-ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria

(2) Third party Evaluation Report in conformance with ACI 355.2 or ACI 355.4, as applicable. Third party must be accredited under ISO/IEC 17025 by a recognized accreditation body conforming to the requirements of ISO/IEC 17011 in accordance with ACI 355.4."

2.1.1.2 Manufacturer's Printed Installation Instructions

Submit manufacturer's instructions for each anchor type shown on the drawings.

2.1.1.3 Mechanical Anchors in Concrete

Anchors must have been tested and qualified for performance in cracked and uncracked concrete in accordance with ACI 355.2.

Anchors must be galvanized in accordance with ASTM A153/A153M or stainless steel in accordance with ASTM A193/A193M unless otherwise indicated.

2.1.1.4 Adhesive Anchor System in Concrete

Use an adhesive to bond steel anchors to concrete. The adhesive must be a moisture insensitive, structural adhesive. Anchors must have been tested and qualified for performance in cracked and uncracked concrete, horizontal and overhead applications, and long term creep in accordance with ACI 355.4.

Threaded rod anchors must meet the requirements of ASTM F1554 Grade 36. Threaded rods must be galvanized in accordance with ASTM A153/A153M or stainless steel in accordance with ASTM A193/A193M unless otherwise indicated. Reinforcing bars must meet the requirements of ASTM A615/A615M Grade 60.

Adhesive anchors must have the below characteristic bond strengths for uncracked and cracked concrete in 2500 psi concrete with maximum short term temperatures of 130 degrees F and maximum long term temperatures of 110 degrees F:

ANCHOR	Tau,uncr (characteristic bond strength, uncracked concrete)	Tau,cr (characteristic bond strength, cracked concrete)
	(psi)	(psi)
0.75" diameter threaded rod	1500	900
#6 reinforcing bar	1500	1000

2.2 EQUIPMENT

Assemble at the site of the work, sufficient equipment that is dependable, appropriate and adequate to accomplish the work specified. Maintain the equipment in good working condition.

PART 3 EXECUTION

3.1 ANCHORING AND REINFORCING

Install anchors in accordance with the spacing and edge clearances indicated on the drawings. Anchor capacity is also highly dependent on proper installation. Follow all manufacturer and Evaluation Report installation instructions.

3.1.1 Drilling and Installing Mechanical Anchors

Drill holes for anchors using drilling equipment and bits suitable for the intended purpose, in accordance with Manufacturer's published installation instructions. Diameter of holes must be as recommended by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes must be

drilled perpendicular to the concrete surface. Deviations more than 6 degrees from perpendicular are not acceptable. Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength. Mechanical anchors must not be installed in concrete that is less than 7 days old.

Clean holes, install anchors and set anchors in place in accordance with the manufacturer's recommendations. Protect threads and anchor from damage during anchor installation. Ensure proper embedment and placement in accordance with contract documents and all other work. Aim wedges away from any concrete edges that are less than 9 inches from centerline of hole.

Tighten nuts against smooth washers to the manufacturer's recommended torque, using a calibrated torque wrench. Following attainment of 10 percent of the specified torque, 100 percent of the specified torque must be reached within 7 or less complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor must be removed and replaced unless otherwise directed by the Engineer of Record.

3.1.2 Drilling and Installing Adhesive Anchors

Drill holes for anchors using drilling equipment and bits suitable for the intended purpose, in accordance with Manufacturer's Printed Installation Instructions and Evaluation Report installation instructions. Diameter of holes must be as recommended by the anchor manufacturer. Unless otherwise shown on the drawings, all holes must be drilled perpendicular to the concrete surface. Deviations more than 10 degrees from perpendicular are not acceptable. Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength. Adhesive anchors must not be installed in concrete that is less than 21 days old.

Clean holes, place grout, and install anchors in accordance with anchor manufacturer's recommendations. Remove excess adhesive after the anchor has been set in place. Remove spills on adjacent surfaces. Protect threads and anchor from damage during anchor installation. Ensure proper embedment and placement in accordance with contract documents and all other work. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

Adhesives must be stored at temperatures prescribed by the manufacturer and must not be used beyond the expiration date.

3.1.3 Unused or Repairs to Drilled Holes

Any holes made for anchors that are not used must be filled with non-shrink, non metallic grout suitable for the orientation and size of hole and have a minimum compressive strength of 4000 psi. Repair must completely fill hole and be flush with existing concrete or masonry. Place in accordance with manufacturer's recommended instructions. Final anchor positions must not be within1 inch of repair patches.

3.2 EMBEDDED ITEMS

Existing reinforcing bars or other embedded items in the structure may conflict with specified anchor locations. Existing reinforcing and embedded items must not be damaged during installation of post-installed

anchors.

The contractor must review the project drawings and must use Radar detection systems (such as Hilti Ferroscan), X-Ray, or other appropriate means to accurately locate the position of existing reinforcing bars and embedded items at the locations of the anchors in the field. Scanning method must provide enough accuracy and precision to locate the space between rebar. Structural integrity of existing concrete or masonry must not be impaired by investigating method.

Create a template at each anchor connection location prior to fabricating holes in connection plates. Template must be made by locating existing reinforcing with an approved reinforcement detection system.

3.3 TESTS AND INSPECTIONS

3.3.1 Mechanical Anchors

For mechanical anchors, periodic special inspections are required. Inspections must be in accordance with ICC IBC and the Evaluation Report.

Mechanical Anchors must be inspected during installation, to verify anchor type, anchor dimensions, base material type, drill bit, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, base material thickness, base material age, effective embedment, tightening torque, adherence to the manufacturer's printed installation instructions, and any additional items recommended in the Evaluation Report.

For mechanical anchors whose strength is dependent on a minimum installation torque, the Special Inspector must torque test the anchors with a calibrated torque wrench. Perform torque testing immediately on the first three anchors of each type and size, for each installer, and a minimum of 5 percent of randomly selected anchors. Anchor selection will be determined by the Post-Installed Anchor Special Inspector.

For mechanical anchors whose strength is not dependent on a minimum installation torque, the Special Inspector must perform proof loading on the first three anchors of each type and size, for each installer and a minimum of 5 percent of randomly selected anchors. Anchor selection will be determined by the Post-Installed Anchor Special Inspector. Perform confined tension proof load testing in accordance with ASTM E488/E488M. Use incremental loading for tensile test. Maintain proof load for a minimum of 10 seconds. Consider anchors to have failed if displacement exceeds 0.1 inch D/10, where D is the nominal anchor diameter, or if any of the failure modes listed in ASTM E488/E488M occur.

Proof loads must be 50 percent of the tension capacity of the anchor.

3.3.2 Adhesive Anchors

For adhesive anchors, periodic special inspection are required as a minimum. Where adhesive anchors are used to resist sustained tension in horizontal or upwardly inclined orientations, or where the findings of the Evaluation Report for the adhesive anchor product require it, continuous special inspection is needed. Inspections must be in accordance with ICC IBC and the Evaluation Report.

Adhesive anchors must be inspected during installation, to verify anchor type, anchor dimensions, base material type, base material age, drill bit,

hole dimensions, hole cleaning procedures, anchor spacing, edge distances, base material thickness, effective embedment, tightening torque, adhesive mixing, filling of the hole with adhesive, adherence to the manufacturer's printed installation instructions, and any additional items recommended in the Evaluation Report.

The Special Inspector must perform proof loading on the first three anchors of each type and size, for each installer, and a minimum of 5 percent of randomly selected anchors. Anchor selection will be determined by the Post-Installed Anchor Special Inspector. Perform confined tension proof load testing in accordance with ASTM E488/E488M. Use incremental loading for tensile test. Maintain proof load for a minimum of 10 seconds. Consider anchors to have failed if displacement exceeds 0.1 inch D/10, where D is the nominal anchor diameter, or if any of the failure modes listed in ASTM E488/E488M occur.

Adhesive anchors and capsule anchors must not be torque tested.

Proof loads must be 50 percent of the tension capacity of the anchor.

3.3.3 Action Required from Failed Tests/Inspections

Immediately report failed anchor locations and test results to the Contracting Officer. Anchors that fail to meet proof/torque load or installation requirements must be regarded as malfunctioning. Do not re-use holes unless specifically allowed by manufacturer's published instructions and approved by the Post-Installed Anchor Special Inspector.

If any of the tested anchors fail to achieve the specified torque or proof load within the limits of the contract documents, test a minimum of two adjacent anchors for each anchor that fails.

Continuously special inspect and proof load/torque test any replacement anchors.

Fill unused anchor holes and patch failed anchor locations in accordance with this specification. Prior to performing the repair, the Contractor must submit to the Contracting Officer for approval, the proposed fill and patch materials.

Additional tests, repairs, delays, or modification of work to accommodate failed tests will be at no cost to the Government.

3.3.4 Post-Installed Anchor Special Inspections Report

Report the results of all inspections daily. Submit report as an electronic PDF file to the Contracting Officer for review by the Engineer of Record. The report must include the following:

(1) Exact locations of the inspected and tested work

(2) Inspector's name

(3) Date of inspection

(4) Summary of work completed during the inspection period

(5) Test results

(6) Statement by the Special Inspector that clearly identifies the tested anchors as being acceptable or rejected.

(7) Statement by the Special Inspector confirming that the materials and installation procedures conform with the approved contract documents and the manufacturer's published installation instructions.

3.4 DUST CONTROL

Control dust resulting from demolition to prevent the spread of dust and avoid creation of a nuisance in the surrounding area. Do not use water when it will result in, or create, hazardous or objectionable conditions such as ice, flooding, or pollution.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS
08/24, CHG 1: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

ANSI/AISC 303	(2022) Code of Standard Practice for Structural Steel Buildings and Bridges

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1	(2012; R 2021) Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B18.6.2	(2020) Square Head Set Screws and Slotted Headless Set Screws (Inch Series)
ASME B18.6.3	(2024) Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)
ASME B18.21.1	(2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.21.2M	(1999; R 2014) Lock Washers (Metric Series)
ASME B18.22M	(1981; R 2017) Metric Plain Washers

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.3	(2020) Safety Requirements for Powder-Actuated Fastening Systems American National Standard for Construction and Demolition Operations

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2025) Structural Welding Code - Steel

AWS D1.2/D1.2M	(2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2022; E 2022) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A276/A276M	(2025) Standard Specification for Stainless Steel Bars and Shapes
ASTM A307	(2023) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A500/A500M	(2023) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A554	(2021) Standard Specification for Welded Stainless Steel Mechanical Tubing
ASTM A653/A653M	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A786/A786M	(2015; R 2021) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A924/A924M	(2022a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A992/A992M	(2022) Standard Specification for

	Structural Steel Shapes
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209/B209M	(2021a) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C1513	(2024) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; R 2018) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM F593	(2024) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
MASTER PAINTERS INSTITUTE (MPI)	
MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM MBG 531	(2017) Metal Bar Grating Manual
SOCIETY FOR PROTECTIVE COATINGS (SSPC)	
SSPC PA 1	(2024) Shop, Field, and Maintenance Coating of Metals
SSPC SP 3	(2024) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Floor Gratings, Installation Drawings; G

Bollards/Pipe Guards; G

Embedded Angles and Plates, Installation Drawings; G

Pit Access Hatches, Installation Drawings; G

Installation Drawings; G

Structural System, Fabrication Drawings; G

SD-03 Product Data

Floor Gratings; G

Pit Access Hatches; G

Certified Mill Test Reports for Chemistry and Mechanical Properties; G

1.3 QUALIFICATION OF WELDERS

Qualify procedures and personnel according to the following:

a. AWS D1.1/D1.1M Structural Welding Code - Steel.

b. AWS D1.2/D1.2M Structural Welding Code - Aluminum.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.5 MISCELLANEOUS REQUIREMENTS

1.5.1 Fabrication Drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in ANSI/AISC 303.

1.5.2 Installation Drawings

Submit templates, erection, and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation in relation to the facility construction.

PART 2 PRODUCTS

2.1 SUSTAINABLE DESIGN REQUIREMENTS

2.1.1 Recycled Content

Provide products with recycled content.

2.2 MATERIALS

Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals). Coordinate color and finish with the material to which fastenings are applied. Submit the manufacturer's certified mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied materials.

2.2.1 Structural Carbon Steel

Provide in accordance with ASTM A992/A992M or ASTM A36/A36M.

2.2.2 Stainless Steel Bars and Shapes

ASTM A276/A276M, Type 316L, unless indicated to be Type 304.

2.2.3 Structural Tubing

Provide in accordance with ASTM A500/A500M. ASTM A554 GR MT-316L for stainless steel.

2.2.4 Steel Pipe

Provide in accordance with ASTM A53/A53M, Type E or S, Grade B. ASTM A554 GR MT-316L for stainless steel.

2.2.5 Fittings for Steel Pipe

Provide standard malleable iron fittings in accordance with ASTM A47/A47M.

2.2.6 Gratings

a. Provide metal bar type grating in accordance with NAAMM MBG 531.

2.2.7 Floor Plates

a. Provide patterned floor plate in accordance with ASTM A786/A786M. Provide steel plate not less than 14 gauge.

2.2.8 Anchor Bolts

Provide in accordance with ASTM F1554. Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

2.2.8.1 Expansion Anchors, Sleeve Anchors and Adhesive Anchors

Provide type, diameter and embedment as indicated.

2.2.8.2 Lag Screws and Bolts

Provide in accordance with ASME B18.2.1, type and grade best suited for the purpose.

2.2.8.3 Toggle Bolts

Provide in accordance with ASME B18.2.1.

2.2.8.4 Bolts, Nuts, Studs and Rivets

Provide in accordance with ASME B18.2.2 or ASTM A307 Grade A. ASTM F593 Group 2 Condition A Type 316L for stainless steel.

2.2.8.5 Powder Actuated Fasteners

Follow safety provisions in accordance with ASSP A10.3.

2.2.8.6 Screws

Provide in accordance with ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513. ASTM F593 Type 316L for stainless steel.

2.2.8.7 Washers

Provide plain washers in accordance with ASME B18.22M, ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers in accordance with ASME B18.21.2M, ASME B18.21.1. Provide hot dipped zinc coating when connecting galvanized steel members or stainless steel Type 316L for stainless steel members.

2.2.9 Aluminum Alloy Products

Provide in accordance with ASTM B209/B209M for sheet plate, ASTM B221M, ASTM B221M, ASTM B221 for extrusions, and ASTM B26/B26M or ASTM B108/B108M for castings. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.3 FABRICATION FINISHES

2.3.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Provide galvanizing in accordance with ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M, or ASTM A924/A924M, Z275 G90.

2.3.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.3.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint in accordance with ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat, with a torch, surfaces to which stick or paste material will

be applied. Heat to a temperature sufficient to melt the metals in the stick or paste. Spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.3.4 Shop Cleaning and Painting

2.3.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete must be free of dirt and grease prior to embed. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints. Shop coat these surfaces with rust prevention.

2.3.4.2 Pretreatment, Priming and Painting

Apply pre-treatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.

2.3.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.3.6 Aluminum Surfaces

2.3.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.3.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with an anodized finish. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations. Provide in accordance with AA DAF45. Provide a polished satin finish on items to be anodized.

2.4 FLOOR GRATINGS

Design aluminum grating in accordance with NAAMM MBG 531 for bar type gratings, or in accordance with manufacturer's charts for plank grating.

a. Design floor gratings to support a stress live load of 60 pounds per square foot for the spans indicated, with maximum deflection of L/240.

b. In accordance with NAAMM MBG 531, band edges of grating with bars of

the same size as the bearing bars. Weld banding in accordance with the manufacturer's standard for trim unless otherwise indicated. Design tops of bearing bars, cross or intermediate bars to be in the same plane and to match grating finish.

c. Anchor gratings to structural members with bolts, toggle bolts, or expansion shields and bolts.

d. Provide slip resistant surface finishes.

2.5 BOLLARDS/PIPE GUARDS

Provide galvanized and prime coated steel pipe in accordance with ASTM A53/A53M as indicated. Anchor posts in concrete as indicated and fill solidly with concrete.

2.6 MISCELLANEOUS PLATES AND SHAPES

Submit installation drawings for and provide items that do not form a part of the structural steel framework, such as lintels, sill angles, and miscellaneous mountings and frames.

Provide angles and plates in accordance with ASTM A36/A36M, for embedment as indicated. Hot dip galvanize embedded items exposed to the elements in accordance with ASTM A123/A123M unless noted otherwise.

2.7 PIT ACCESS HATCHES

Provide aluminum sheets not less than 14 gauge with 1 inch beaded flange, welded and ground at corners. Provide waterproof hatch complete with perimeter seal to prevent water and insect migration.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated in accordance with manufacturer's instructions. Verify all field dimensions prior to fabrication. Include materials and parts necessary to complete each assembly, whether indicated or not. Miss-alignment and miss-sizing of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Joints exposed to weather must be watertight.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is true and accurate in shape, size, and profile. Make angles and lines continuous and straight. Make curves consistent, smooth and unfaceted. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Unless otherwise indicated and approved, provide a smooth finish on exposed surfaces. Provide countersunk rivets where exposed. Provide coped and mitered corner joints aligned flush and without gaps. Do not weld, cut or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are bolted or screwed field connections.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage as necessary, whether indicated or not, for fastening

miscellaneous metal items securely in place. Include slotted inserts, expansion shields, powder-driven fasteners, toggle bolts (when approved for concrete), through bolts for masonry, headed shear studs, machine and carriage bolts for steel, through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals), that generally match in color and finish the surfaces to which they are applied. Conceal fastenings where practicable. Provide all fasteners flush with the surfaces they fasten, unless indicated otherwise.

3.4 BUILT-IN WORK

Where necessary and not otherwise indicated, form built-in metal work for anchorage with concrete or masonry. Provide built-in metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation. Provide welded headed shear studs in accordance with AWS D1.1/D1.1M, Clause 7, except as otherwise specified. Provide in accordance with the safety requirements of EM 385-1-1.

3.6 DISSIMILAR METALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect in accordance with ASTM D1187/D1187M, asphalt-base emulsion. Clean surfaces with metal shavings from installation at the end of each work day.

3.7 PREPARATION

3.7.1 Material Coatings and Surfaces

Remove rust preventive coating just prior to field erection, using a remover approved by the metal manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.7.2 Environmental Conditions

Do not clean or paint surfaces when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer. Metal surfaces to be painted must be dry for a minimum of 48 hours prior to the application of primer or paint.

3.8 PIT ACCESS HATCH (SCUTTLES)

Construction and accessories as follows:

a. Provide cover and frame with mounting flanges for securing to concrete.

b. Provide hatches completely assembled, with pintle hinges, compression

spring operators enclosed in telescopic tubes, positive snap latches with turn handles on inside and outside, and neoprene seals. Provide fasteners for padlocking from the outside. Provide covers with automatic hold-open arms complete with grip handle to permit one hand release. Cover action must be smooth through its entire range of motion with an operating pressure of approximately 30 pounds.

3.9 INSTALLATION OF BOLLARDS/PIPE GUARDS

Set bollards/pipe guards vertically in concrete piers. Fill hollow cores with concrete having a compressive strength of 2500 psi.

3.10 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

Install at the required alignment and elevation as indicated. Provide with connections and fasteners or welds.

3.11 REPAIRS

a. Touchup Painting:

(1) Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC PA 1 for touching up shop-painted surfaces.

b. Galvanized Surfaces:

(1) Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

-- End of Section --

SECTION 05 59 10

ROLLING COVER FOR AVIATION REFUELING VAULTS
11/22

PART 1 GENERAL

This specification covers the factory fabrication, assembly, testing, and shipping requirements for custom fabricated rolling covers having steel or aluminum shells as indicated in the vault schedule on the vault drawings. Covers are to be field installed on variously sized new and/or existing hydrant fueling system vaults and tanks.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA ADM	(2020) Aluminum Design Manual

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B4.1	(1967; R 1994; R 2004; R 2009; R 2020) Preferred Limits and Fits for Cylindrical Parts
ASME B46.1	(2020) Surface Texture, Surface Roughness, Waviness and Lay
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2025) Structural Welding Code - Steel
AWS D1.2/D1.2M	(2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum
AWS D1.6/D1.6M	(2017) Structural Welding Code — Stainless Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A240/A240M	(2025a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure

	Vessels and for General Applications
ASTM A276/A276M	(2025) Standard Specification for Stainless Steel Bars and Shapes
ASTM A307	(2023) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A554	(2021) Standard Specification for Welded Stainless Steel Mechanical Tubing
ASTM A563	(2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A992/A992M	(2022) Standard Specification for Structural Steel Shapes
ASTM A1085/A1085M	(2015) Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B695	(2021) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM F436/F436M	(2024) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F593	(2024) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	(2024) Standard Specification for Stainless Steel Nuts
ASTM F1136/F1136M	(2011) Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
ASTM F2329/F2329M	(2015; R 2023) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
ASTM F2833	(2011; R 2017) Standard Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type

1.2 ADMINISTRATIVE REQUIREMENTS

Submit manufacturer's catalogue cuts and dimensional sheets. Include a description of the item, materials of construction, and dimensions. Provide data sufficient to indicate compliance with specifications. Mark

items pertaining to specifications with a heavy black arrow.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Assembly Tests; G

Acceptance Testing; G

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Wheel Assemblies; G

Materials List; G

Welding; G

Welding of Aluminum; G

Steel Welding Repairs; G

SD-07 Certificates

Welder Qualifications

Welding of Aluminum

1.4 QUALITY ASSURANCE

1.4.1 Welder Qualifications

Submit certification stating that the welders, welding operators, and tack welders, who will perform structural steel welding, have been qualified for the particular type of work to be done in accordance with the requirements of AWS D1.1/D1.1M or AWS D1.6/D1.6M prior to commencing fabrication. The certificate must list the qualified welders by name, specify the code and procedures for which they are qualified, and provide the date of qualification. Prior qualification will be accepted if welders have performed satisfactory work under the code for which they have been qualified within the preceding three months. Welders will be required to repeat the qualifying tests when their work indicates a reasonable doubt as to proficiency. Those welders passing the requalification tests will be recertified. Those welders not passing will be disqualified until they have passed the requalification tests. All expenses in connection with qualification and requalification must be borne by the Contractor.

1.4.2 Workmanship

Workmanship must be of the highest grade and in accordance with the best modern practices to conform with the specifications for the item of work being furnished. Welding must be continuous along the entire area of contact, except where tack welding is permitted. Exposed connections of work in place must not be tack welded. Exposed welds must be ground smooth. Exposed surfaces of work in place must have a smooth finish.

1.4.3 Detail Drawings

Submit detail drawings for metalwork and machine work prior to fabrication. Submit a materials list for fabricated items with the detail drawings. Detail drawings for metalwork and machine work must include catalog cuts, templates, fabrication and assembly details, and type, grade, and class of material, as appropriate. Also include a sketch showing final wheel to axle mounting (i.e., washers, nuts, and spacers). Elements of fabricated items inadvertently omitted on contract drawings must be detailed by the fabricator and indicated on the detail drawings. Drawings must include all dimensional and tolerance data for each size of vault being fabricated.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Bolts and Cap Screws

All bolts for connection of carbon steel members must be steel and must conform to ASTM A307, Grade A, Hex.

Use ASTM F593 Group 2 Condition A Type 316L stainless steel bolts for connections of stainless steel or aluminum members.

2.1.2 Nuts

Nuts for use in connection of carbon steel bolts must conform to ASTM A563, Grade A, Hex, and must be of the same finish as the fasteners they are used with.

Provide ASTM F594 Type 316L stainless steel nuts for use in connections with stainless steel bolts.

2.1.3 Washers

Flat washers must conform to the requirements of ASTM F436/F436M Type 1 for carbon steel. ASTM A276/A276M Type 316L for stainless steel.

2.1.4 Hollow Structural Shapes (HSS)

Carbon steel HSS must conform to ASTM A1085/A1085M. ASTM A554 Grade MT-316L for stainless steel HSS.

2.1.5 Structural Steel

Carbon steel must conform to ASTM A36/A36M or ASTM A992/A992M. ASTM A240/A240M or ASTM A276/A276M Type 316L for stainless steel.

2.1.6 Rolling Cover Shell

Cover shell material must be as indicated on the drawings and specified as follows:

2.1.6.1 Aluminum

Aluminum sheets and strips must comply with ASTM B209, alloy and temper best suited for the purpose.

2.1.7 Wheel Assemblies

2.1.7.1 Wheels

Provide heavy duty industrial type wheels that are the product of a company regularly engaged in the production of wheels. The wheels must have solid rubber tires that are molded onto spoked or solid centers that are either cast, forged, or machined. The rubber must have a hardness rating of 80-95 Shore A durometer. Tires must not stretch or work loose from the metal center. The wheels must have roller bearings and must be pressure lubricated from a grease fitting when available. The wheels must work in a temperature range of -40 to +180 degrees F. The entire wheel assembly must be symmetrical and must spin concentrically around the bearing. Provide wheels with stainless steel metal centers when possible. Otherwise, finish metal centers with either an epoxy paint, a powder coating, or manufacture galvanized. The diameter of the carrier wheels must be 6 inches and the diameter of the side wheels must be 3-1/4 inches. The fabricator must use appropriate washers and spacers to lock the inner bearing bushing to the axle. Provide wheels with load capacities that are appropriate for the application. Wheels must be similar or equal to the following:

a. 6 inches Dia. x 2 inches wide

b. 3-1/4 inches Dia. x 1-1/2 inches wide

2.1.7.2 Axles

The axle assembly must be stainless steel and must be eccentrically machined. A slotted adjustment cam plate must be attached to the axle by welding, as indicated on the drawings. Eccentric offset must be a minimum of 1/4-inch. Diameter, tolerance, and finish of the mating axle shaft must be coordinated with the wheel manufacturer's diameters and tolerances for a close fit. Submit shop drawings showing all fits and tolerances. Material, weld, and nut must all be a 300 series stainless steel.

2.2 FABRICATION

2.2.1 General

Material must be straight before being laid off or worked. If straightening is necessary, it must be done by methods that will not impair the metal. Sharp kinks or bends must be cause for rejection of the material. Material with welds will not be accepted, except where welding is definitely specified, indicated, or otherwise approved. Bends must be made by approved dies, press brakes, or bending rolls. Where heating is required, precautions must be taken to avoid overheating or warping the metal, and it must be allowed to cool in a manner that will not impair the original properties of the metal. Proposed flame cutting of material

other than structural steel must be subject to approval and must be indicated on detail drawings. Shearing must be accurate, and all portions of the work must be neatly finished. Corners must be square and true unless otherwise shown on the drawings. Re-entrant cuts must be filleted to a minimum radius of 3/4 inch unless otherwise approved. Finished members must be free of twists, bends, and open joints. Bolts, nuts, and screws must be tight.

2.2.2 Dimensional Tolerances

Dimensions must be measured by a calibrated steel tape of approximately the same temperature as the material being measured. The overall dimensions of an assembled structural unit must be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown on the drawings, an allowable variation of 1/32 inch is permissible in the overall length of component members with both ends milled. Component members without milled ends must not deviate from the dimensions shown by not more than 1/16 inch for members 30 feet or less in length and by more than 1/8 inch for members over 30 feet in length.

2.2.3 Steel

Structural steel may be cut, when approved, by mechanically guided or hand-guided torches as long as an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Surfaces and edges to be welded must be prepared in accordance with AWS D1.1/D1.1M. Where structural steel is not to be welded, chipping or grinding will not be required, except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Hand-guided cuts, which are to be exposed or visible, must be chipped, ground, or machined to sound metal.

2.2.4 Aluminum

Laying out and cutting of aluminum must be in accordance with AA ADM.

2.2.5 Bolted Connections

2.2.5.1 Bolted Steel Connections

Bolts, nuts, and washers must be of the type specified or indicated. Beveled washers must be used where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Bolt holes must be accurately located, smooth, perpendicular to the member, and cylindrical. Holes for bolts must be drilled or subdrilled and reamed in the shop and must not be more than 1/16 inch larger than the diameter of the bolt, unless otherwise approved, indicated on the drawings, or specified below. Poor matching of holes will be cause for rejection. Drifting occurring during assembly must not distort the metal or enlarge the holes. Reaming to a larger diameter of the next standard size bolt will be allowed for slight mismatching.

2.2.5.2 Bolted Aluminum Connections

Punching, drilling, reaming, and bolting for bolted aluminum connections must conform to the requirements of AA ADM.

2.3 MACHINE WORK

Tolerances, allowances, and gauges for metal fits between plain, non-threaded, cylindrical parts must conform to ASME B4.1 for the class of fit shown or required, unless otherwise shown on approved detail drawings. Where fits are not shown, they must be suitable as approved. Tolerances for machine-finished surfaces designated by non-decimal dimensions must be within 1/64 inch, unless otherwise indicated on the drawings. Sufficient machining stock must be allowed to ensure true surfaces of solid material. Assembled parts must be accurately machined, and all like parts must be interchangeable. All drilled holes must be accurately located.

2.3.1 Finished Surfaces

Surface finishes indicated or specified herein must be in accordance with ASME B46.1. Values of required roughness heights are arithmetical average deviations expressed in microinches. These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements must be determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of ASME B46.1. Values of roughness width and waviness height must be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified, the finish selected must be the most suitable for that particular surface. Provide the class of fit required and indicate it on the detail drawings with a symbol, which conforms to ASME B46.1 when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks, or checks, which will make the part unsuitable for the intended use, will be cause for rejection.

2.3.2 Unfinished Surfaces

All work must be laid out to secure proper matching of adjoining unfinished surfaces, unless otherwise directed. Where there is a large discrepancy between adjoining unfinished surfaces, it must be chipped and ground smooth or machined to secure proper alignment. Unfinished surfaces must be true to the lines and dimensions shown and must be chipped or ground free of all projections and rough spots. Depressions or holes not affecting the strength or usefulness of the parts must be filled in an approved manner.

2.4 WELDING

Submit the Welding Procedure Specification (WPS).

2.4.1 Welding of Structural Steel

Welding must be in accordance with AWS D1.1/D1.1M or AWS D1.6/D1.6M. Welding procedures which are considered prequalified as specified in AWS D1.1/D1.1M or AWS D1.6/D1.6M will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification must be required for these joints.

2.4.2 Welding of Aluminum

Welding of aluminum must conform to AA ADM or AWS D1.2/D1.2M, Sections 1 through 5. The welding process and welding operators must be prequalified

as required by AWS D1.2/D1.2M, Section 3 or AA ADM, in accordance with the methods described in ASME BPVC SEC IX. Submit a certified report giving the results of the aluminum welding qualification tests. Also, submit a complete schedule of the welding process for each aluminum fabrication to be welded prior to commencing fabrication.

2.4.3 Welding Inspection

Maintain an approved inspection system and perform required inspections in accordance with Section 01 45 35 SPECIAL INSPECTIONS. Welding must be subject to inspection to determine conformance with the requirements of AWS D1.1/D1.1M or AWS D1.6/D1.6M, the approved welding procedures, and provisions stated in other sections of these specifications.

2.4.3.1 Visual Examination

All completed welds must be cleaned and carefully examined for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity or reinforcement, and other surface defects to ensure compliance with the requirements of AWS D1.1/D1.1M, Section 5 and Section 10, Part D or AWS D1.6/D1.6M, Section 7 and Section 8.

2.4.4 Steel Welding Repairs

Defective welds must be repaired in accordance with AWS D1.1/D1.1M or AWS D1.6/D1.6M, Section 7. Defective weld metal must be removed to sound metal by use of air carbon arc or oxygen gouging. The surfaces must be thoroughly cleaned before welding. Welds that have been repaired must be retested by the same methods used in the original inspection. Costs for repairs and retesting must be borne by the Contractor. Submit repair procedure prior to doing repair.

2.5 MISCELLANEOUS PROVISIONS

2.5.1 Galvanizing for Carbon Steel

ASTM F2329/F2329M, ASTM F1136/F1136M, ASTM F2833 or ASTM B695 for threaded parts.

ASTM A123/A123M for structural steel members, as applicable. Unless specified otherwise, provide hot-dipped galvanization after fabrication where practical. Hot-dipped galvanizing must be applied in a manner and of a thickness and quality conforming to ASTM A123/A123M.

Where zinc coatings are destroyed by cutting, welding, or other causes, the affected areas must be regalvanized. Coatings 2 ounces or heavier must be regalvanized with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating.

2.5.2 Cleaning of Stainless Steel

Oil, paint, and other foreign substances must be removed from stainless steel surfaces after fabrication. Cleaning must be done by vapor degreasing or by the use of cleaners of the alkaline, emulsion, or solvent type.

2.6 SHOP TESTING

2.6.1 Wheel Assembly Testing

The first wheel assembly must be tested for correct fit and operation in the presence of the Contracting Officer's Technical Representative (COTR), unless otherwise waived in writing. The wheel must rotate concentrically and smoothly on the bearings. The cam adjuster must provide at least 1/8 inch of adjustment in each vertical direction. Waiving of tests will not relieve the Contractor of responsibility for any fault in operation, workmanship, or material that occurs before the completion of the contract or guarantee.

2.6.2 Assembly Tests

Each rolling cover, including the shell, carrier, frame, and temporary brackets, must be assembled in the shop to determine the correctness of the fabrication and matching of the component parts. Tolerances must not exceed those shown on the drawings. Each cover assembly must be closely checked to ensure that all necessary clearances have been provided and that binding does not occur in any moving part. Assembly in the shop must be done on a straight and level floor or platform; the frame must be mounted on temporary supports in a level position. The carrier must move smoothly and with minimal effort. Misalignment, poor operation, or disclosed defects must be immediately remedied by the Contractor without cost to the Government. Assembly, testing, and disassembly work must be performed in the presence of the Contracting Officer, unless waived in writing. Provide ten working days notice, in writing, of the first and each proceeding rolling cover assembly to the COTR.

2.7 PREPARATION FOR SHIPPING

Before disassembly for shipment, each rolling cover subassembly must be match-mark stamped (or as otherwise approved) to facilitate correct reassembly in the field. The location of stampings must be indicated by circling with a ring of white chalk after the shop finish has been applied or as otherwise directed. Each subassembly must be wood crated, slatted, skid mounted, or otherwise packaged such that abrasion does not occur during shipment.

PART 3 EXECUTION

3.1 ASSEMBLY

All parts to be assembled must be thoroughly cleaned. Packing compounds, rust, dirt, grit, and other foreign matter must be removed. Holes and grooves for lubrication must be cleaned. Enclosed chambers or passages must be examined to make sure that they are free from damaging materials. Where units or items are shipped as assemblies, they will be inspected prior to installation. Pipe wrenches, cold chisels, or other tools likely to cause damage to the surfaces of rods, nuts, or other parts must not be used for assembling and tightening parts. Bolts and screws must be tightened firmly and uniformly but care must be taken not to overstress the threads. When a half nut is used for locking a full nut, the half nut must be placed first and followed by the full nut. Threads of all bolts, nuts, and screws must be lubricated with a lubricant before assembly. Threads of corrosion-resisting steel bolts and nuts must be coated with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted.

3.2 PROTECTION OF FINISHED WORK

3.2.1 Lubrication After Assembly

After assembly, all wheels must be pressure lubricated or oiled.

3.2.2 Aluminum

Aluminum in contact with structural carbon steel in the area of the cover shell fastener angle clips must be protected against galvanic or corrosive action by being given a coat of zinc-chromate primer and a coat of aluminum paint.

3.3 ACCEPTANCE TESTING

The rolling cover must be field tested to ensure proper wheel adjustments to eliminate binding and track misalignment. In addition, demonstrate to the Contracting Officer that the cover and cover tracks are level. The rolling cover must be rolled the full distance of the tracks. The test must be repeated a sufficient number of times (minimum of three) to demonstrate proper operation. Misalignment, poor operation, or disclosed defects must be immediately remedied without cost to the Government. Provide all personnel necessary to conduct the tests. Testing must be performed in the presence of the Contracting Officer. Notify the Contracting Officer, in writing, at least 7 days prior to testing operations.

-- End of Section --

SECTION 07 11 13

BITUMINOUS DAMPPROOFING
08/23

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D1227/D1227M	(2013; R 2019; e1) Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D1668/D1668M	(1997a; R 2014; E 2014) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Asphalt Primer; G

Fibrated Emulsion-Based Asphalt; G

Glass Fabric Reinforcement; G

Saturated Felt; G

Geotextile Fabric; G

SD-07 Certificates

Materials

1.3 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing manufacturer's original labels. Labels must include date of manufacture, contents of each container, performance standards that apply to the contents and recommended shelf life. While in storage, do not allow water based bituminous damproofing to freeze.

PART 2 PRODUCTS

2.1 ASPHALT PRIMER

ASTM D41/D41M.

2.2 EMULSION-BASED ASPHALT DAMPPROOFING

2.2.1 Fibrated Emulsion-Based Asphalt

Provide cold-applied fibrated emulsion-based asphalt dampproofing conforming to ASTM D1227/D1227M Type II, Class 1, asbestos-free, manufactured of refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers. For spray or brush application, emulsion must contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion must contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

2.3 GLASS FABRIC REINFORCEMENT

Woven, open mesh asphalt-saturated flexible fiberglass fabric conforming to ASTM D1668/D1668M Type I.

2.4 SURFACE PROTECTION

2.4.1 Saturated Felt

ASTM D226/D226M, Asphalt Saturated, Type I, 15 pound.

2.4.2 Geotextile Fabric

Where indicated, provide non-woven geotextile fabric composed of polypropylene fibers manufactured into a non-raveling fabric with uniform thickness and strength. Geotextile fabric shall have a minimum weight of 16 oz./sq. yd.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Remove or cut form ties and repair surface defects as required in Section 03 30 00 CAST-IN-PLACE CONCRETE. Clean concrete and masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with ASTM D4263. If test indicates moisture, allow a minimum of seven additional days after test completion for curing. If moisture still exists, redo test until substrate is dry.

3.1.1 Metal Surfaces

Ensure metal surfaces are dry and free of rust, scale, loose paint, oil,

grease, dirt, frost and debris.

3.2 APPLICATION

Use cold-application method. Prime surfaces to receive fibrous asphaltic dampproofing unless recommended otherwise by dampproofing materials manufacturer. Apply dampproofing after priming coat is dry, but prior to any deterioration of primed surface, and when ambient temperature is above 40 degrees F.

3.2.1 Surface Priming

Prime surfaces to receive fibrous asphalt dampproofing with asphalt primer. Apply primer when ambient temperature is above 40 degrees F and at rate of approximately one gallon per 100 square feet, fully covering entire surface to be dampproofed.

3.2.2 Cold-Application Method

3.2.2.1 Emulsion-Based Asphalt

Do not perform emulsion-based asphalt dampproofing work in temperatures below 40 degrees F. Emulsions must have a smooth and uniform consistency at time of application. Apply dampproofing materials in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 12 mils thick without voids or defects. Recoat any dull or porous spots. Seal dampproofing materials tightly around pipes and other items projecting through dampproofing. Apply materials at rates as follows:

a. Primer: 1/2 gallon per 100 square feet, cold-applied.

b. Fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.

3.3 GLASS FABRIC REINFORCEMENT

Reinforce all edges and corners with one layer of glass fabric reinforcement embedded in the first coat of dampproofing. Extend a minimum of 300 mm on each side of edges and corners.

3.4 PROTECTIVE COVERING

Protect dampproofed surfaces against which backfill will be placed with one layer of saturated felt, unless indicated to be geotextile fabric. Embed felts or geotextile fabric in the second coating of dampproofing within 24 hours of installation of the second coat (while coating is tacky) to ensure adhesion. Lap and bond edges and ends not less than 6 inches. .

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07 84 00

FIRESTOPPING
05/10, CHG 1: 08/13

PART 1 GENERAL

1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.

b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; do not allow firestopping material to interfere with the required movement of the joint.

c. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2024) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2024) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E699	(2009) Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
ASTM E814	(2024) Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E1399/E1399M	(1997; R 2022) Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2024) Standard Test Method for Fire-Resistive Joint Systems

ASTM E2174	(2024) Standard Practice for On-Site Inspection of Installed Firestop Systems
ASTM E2307	(2025) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	(2024) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

FM GLOBAL (FM)

FM 4991	(2013) Approval of Firestop Contractors
FM APP GUIDE	(updated on-line) Approval Guide https://www.approvalguide.com/

UL SOLUTIONS (UL)

UL 723	(2018; Reprint Jun 2025) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL 1479	(2015; Reprint Apr 2025) UL Standard for Safety Fire Tests of Penetration Firestops
UL 2079	(2015; Reprint Jun 2025) Tests for Fire Resistance of Building Joint Systems
UL Fire Resistance	(2014) Fire Resistance Directory

1.3 SEQUENCING

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Locate cast-in-place firestop devices and install in place before concrete placement. Install pipe, conduit or cable bundles through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material must be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping System; G

SD-03 Product Data

Firestopping Materials; G

SD-06 Test Reports

Inspection; G

SD-07 Certificates

Inspector Qualifications

Firestopping Materials

Installer Qualifications; G

1.5 QUALITY ASSURANCE

1.5.1 Installer

Engage an experienced Installer who is:

a. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or

b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer must be a trained representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. Obtain and submit installer's written certification of training, and retain proof of certification for duration of firestop installation.

1.5.2 Inspector Qualifications

The inspector must meet the criteria contained in ASTM E699 for agencies involved in quality assurance and must have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector must be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector must not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

PART 2 PRODUCTS

2.1 FIRESTOPPING SYSTEM

Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, submit a manufacturer's engineering judgment, derived from similar UL system designs or other tests for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

2.2 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.2.1 Fire Hazard Classification

Provide material that has a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Provide an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.2.2 Toxicity

Provide material that is nontoxic and carcinogen free to humans at all stages of application or during fire conditions and does not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

2.2.3 Fire Resistance Rating

Firestop systems must be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems must also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.2.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SUMMARY, must provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479. Provide fire resistance ratings as follows:

2.2.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = 2 hour Rating of wall or partition being penetrated.

2.2.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SUMMARY, and gaps such as those between floor slabs and curtain walls must be the same as the construction in which they occur. Provide construction joints and gaps with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Provide curtain wall joints with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints must meet the cycling requirements of ASTM E1399/E1399M or UL 2079. Provide a minimum class II movement capability for all joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly.

2.2.4 Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. Provide certification of compliance with UL 1479 for all intumescent firestop materials used in through penetration systems.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

3.3 INSPECTION

For Navy projects, install one of each type of penetration and have it inspected and accepted by the AHJ Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer prior to the installation of the remainder of the penetrations. At this inspection, the manufacturer's technical representative of the firestopping material must be present. For all projects, do not cover or enclose the remainder of the firestopped areas until inspection is complete and approved by the Contracting Officer. The inspector must inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL listed printed numbers.

3.3.1 Inspection Standards

Inspect all firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results to be submitted.

3.3.2 Inspection Reports

Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATINGS
02/21

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

1.1.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.1.1.1 Exterior Painting

Includes new surfaces of the buildings and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.1.1.2 Interior Painting

Includes new surfaces of the buildings and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.1.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, anodized aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

1.1.3 Mechanical and Electrical Painting

Includes field coating of interior surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

1.1.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes.

1.1.4 Miscellaneous Painting

1.1.4.1 Lettering Building

Provide lettering as scheduled on the drawingsblock type, water-type decalcomania, finished with a protective coating of spar varnish. Samples must be approved before application.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100	(2017; Suppl 2020) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASTM INTERNATIONAL (ASTM)

ASTM D235	(2022) Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4444	(2013; R 2018) Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters
ASTM D6386	(2022) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron

	and Steel Product and Hardware Surfaces for Painting
ASTM F1869	(2023) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

Intelligence Bulletin 65	(2013) Occupational Exposure to Carbon Nanotubes and Nanofibers

MASTER PAINTERS INSTITUTE (MPI)

MPI 2	(2012) Aluminum Heat Resistant Enamel (up to 427 C and 800 F
MPI 3	(2016) Primer, Alkali Resistant, Water Based
MPI 9	(2016) Alkyd, Exterior Gloss (MPI Gloss Level 6)
MPI 11	(2016) Latex, Exterior Semi-Gloss, MPI Gloss Level 5
MPI 19	(2012) Primer, Zinc Rich, Inorganic
MPI 21	(2012) Heat Resistant Coating, (Up to 205°C/402°F), MPI Gloss Level 6
MPI 22	(2012) Aluminum Paint, High Heat (up to 590° C/1100° F)
MPI 23	(2015) Primer, Metal, Surface Tolerant
MPI 39	(2018) Primer, Latex, for Interior Wood
MPI 42	(2012) Textured Coating, Latex, Flat
MPI 50	(2015) Primer Sealer, Latex, Interior
MPI 51	(2016) Alkyd, Interior, (MPI Gloss Level 3)2
MPI 59	(2016) Floor Paint, Alkyd, Low Gloss
MPI 60	(2016) Floor Paint, Latex, Low Gloss
MPI 72	(2016) Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7)
MPI 76	(2016) Primer, Alkyd, Quick Dry, for Metal
MPI 77	(2015) Epoxy, Gloss
MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal

MPI 94	(2016) Alkyd, Exterior, Semi-Gloss (MPI Gloss Level 5)
MPI 95	(2015) Primer, Quick Dry, for Aluminum
MPI 101	(2016) Primer, Epoxy, Anti-Corrosive, for Metal
MPI 107	(2016) Primer, Rust-Inhibitive, Water Based
MPI 108	(2015) Epoxy, High Build, Low Gloss
MPI 120	(2020) Epoxy, High Build, Self Priming, Low Gloss
MPI 134	(2015) Primer, Galvanized, Water Based
MPI 139	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 3)
MPI 145	(2016) Latex, Interior, Institutional Low Odor/VOC, (MPI Gloss Level 3)
MPI 149	(2016) Primer Sealer, Interior, Institutional Low Odor/VOC
MPI 151	(2016) Light Industrial Coating, Interior, Water Based (MPI Gloss Level 3)
MPI 153	(2016) Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)
MPI 161	(2016) Light Industrial Coating, Exterior, Water Based (MPI Gloss Level 3)
MPI 163	(2016) Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5)
MPI 177	(2020) Epoxy, Semi-Gloss (MPI Gloss Level 5)
MPI ASM	(2019) Architectural Painting Specification Manual
MPI GPS-1-14	(2014) Green Performance Standard GPS-1-14
MPI GPS-2-14	(2014) Green Performance Standard GPS-2-14
MPI MRM	(2015) Maintenance Repainting Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC Glossary	(2011) SSPC Protective Coatings Glossary
SSPC PA 1	(2024) Shop, Field, and Maintenance Coating of Metals

SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 2	(2018) Hand Tool Cleaning
SSPC SP 3	(2024) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
SSPC VIS 4/NACE VIS 7	(1998; E 2000; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting
SSPC-SP WJ-1/NACE WJ-1	(2012) Clean to Bare Substrate, Waterjet Cleaning of Metals
SSPC-SP WJ-2/NACE WJ-2	(2012) Very Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-3/NACE WJ-3	(2012) Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-4/NACE WJ-4	(2012) Light Cleaning, Waterjet Cleaning of Metals

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(2018) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants

1.3 DEFINITIONS

1.3.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third-party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.3.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing must be accomplished by an MPI testing lab.

1.3.3 Coating

SSPC Glossary; (1) A liquid, liquefiable, or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer; (2) Generic term for paint, lacquer, enamel.

1.3.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.3.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five levels are generically defined under the Assessment sections in the MPI MRM, MPI Maintenance Repainting Manual.

1.3.6 EXT

MPI short term designation for an exterior coating system.

1.3.7 INT

MPI short term designation for an interior coating system.

1.3.8 Loose Paint

Paint or coating that can be removed with a dull putty knife.

1.3.9 mil / mils

The English measurement for 0.001 in or one one-thousandth of an inch.

1.3.10 MPI Gloss Levels

MPI system of defining gloss. Seven gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degree angle	Units at 80 degree angle
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.3.11 MPI System Number

The MPI coating system number in each MPI Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN).

1.3.12 Paint

SSPC Glossary; (1) Any pigmented liquid, liquefiable, or mastic composition designed for application to a substrate in a thin layer that is converted to an opaque solid film after application. Used for protection, decoration, identification, or to serve some other functional purposes; (2) Application of a coating material.

1.3.13 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.3.14 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

1.4 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs, including carpets, textiles, unprimed gypsum wallboard, acoustical ceiling panels,.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Samples of specified materials may be taken and tested for compliance with

specification requirements.

SD-02 Shop Drawings

Piping Identification

SD-03 Product Data

Coating; G

Product Data Sheets

SD-07 Certificates

Qualification Testing laboratory for coatings; G

Indoor Air Quality for Paints and Primers

SD-08 Manufacturer's Instructions

Mixing

Manufacturer's Safety Data Sheets

SD-10 Operation and Maintenance Data

Coatings, Data Package 1; G

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

1.6.1.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.6.1.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.6.1.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.6.1.4 Asbestos Content

Provide asbestos-free materials.

1.6.1.5 Mercury Content

Provide materials free of mercury or mercury compounds.

1.6.1.6 Silica

Provide abrasive blast media containing no free crystalline silica.

1.6.1.7 Human Carcinogens

Provide materials that do not contain ACGIH 0100 confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6.1.8 Carbon Based Fibers / Tubes

Materials must not contain carbon based fibers such as carbon nanotubes or carbon nanofibers. Intelligence Bulletin 65 ranks toxicity of carbon nanotubes on a par with asbestos.

1.6.2 Coating Contractor's Qualification

Submit the name, address, telephone number, and e-mail address of the Contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address and telephone number of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.6.3 Approved Products List

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of Contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire Contract and each coating system is to be from a single manufacturer. Provide all coats on a particular substrate from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

1.6.4 Paints and Coatings Indoor Air Quality Certifications

Provide paint and coating products certified to meet indoor air quality requirements by MPI GPS-1-14, MPI GPS-2-14 or provide certification by other third-party programs. Provide current product certification documentation from certification body.

Provide certification of Indoor Air Quality for Paints and Primers. Submit required indoor air quality certifications in one submittal package.

1.6.5 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph SAMPLING PROCEDURE. Test each chosen product as specified in the paragraph TESTING PROCEDURE. Remove products from the job site which do not conform, and replace with new products that conform to the referenced specification. Test replacement products that failed initial testing as specified in the paragraph TESTING PROCEDURE at no cost to the Government.

1.6.5.1 Sampling Procedure

Select paint at random from the products that have been delivered to the job site for sample testing. The Contractor must provide one quart samples of the selected paint materials. Take samples in the presence of the Contracting Officer, and label, and identify each sample. Provide labels in accordance with the paragraph PACKAGING, LABELING, AND STORAGE.

1.6.5.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph QUALIFICATION TESTING laboratory for coatings. Include the backup data and summary of the test results within the qualification testing lab report. Provide a summary listing of all the reference specification requirements and the result of each test. Clearly indicate in the summary whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If MPI is chosen to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

1.7 PACKAGING, LABELING, AND STORAGE

Provide paints in sealed containers that legibly show the Contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's

formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Furnish pigmented paints in containers not larger than 5 gallons. Store paints and thinners in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to absorb VOC emissions. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.8 SAFETY AND HEALTH

Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. Include in the Activity Hazard Analysis the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.8.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Safety Data Sheets (SDS) or local regulation.

b. 29 CFR 1910.1000.

c. ACGIH 0100, threshold limit values.

Submit manufacturer's Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

1.9 ENVIRONMENTAL REQUIREMENTS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation.

1.9.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Less than 5 degrees F above dew point;

b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Do not, under any circumstances, violate the manufacturer's application recommendations.

1.9.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit Product Data Sheets for specified coatings and solvents. Provide preprinted cleaning and maintenance instructions for all coating systems. Submit Manufacturer's Instructions on Mixing: Detailed mixing instructions, minimum and maximum application temperature and humidity, pot life, and curing and drying times between coats.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, reinstall removed items by workmen skilled in the trades. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule cleaning so that dust and other contaminants will not fall on wet, newly painted surfaces. Spot-prime exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas. Refer to MPI ASM and MPI MRM for additional more specific substrate preparation requirements.

3.2.1 Substrate Repair

a. Repair substrate surface damaged during coating removal;

b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and

c. Clean and prime the substrate as specified.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Existing and New Ferrous Surfaces

a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2. Brush-off blast remaining surface in accordance with SSPC 7/NACE No.4; Water jetting to SSPC-SP WJ-4/NACE WJ-4 may be used to remove loose coating and other loose materials. Use inhibitor as recommended by coating manufacturer to prevent premature rusting. Protect shop-coated ferrous surfaces from corrosion by treating and touching up corroded areas immediately upon detection.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/NACE No.3 / SSPC-SP WJ-3/NACE WJ-3.

3.3.2 Final Ferrous Surface Condition:

3.3.2.1 Tool Cleaned Surfaces

Comply with SSPC SP 2 and SSPC SP 3. Use as a visual reference, photographs in SSPC VIS 3 for the appearance of cleaned surfaces.

3.3.2.2 Abrasive Blast Cleaned Surfaces

Comply with SSPC 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. Use as a visual reference, photographs in SSPC VIS 1 for the appearance of cleaned surfaces.

3.3.2.3 Waterjet Cleaned Surfaces

Comply with SSPC-SP WJ-1/NACE WJ-1, SSPC-SP WJ-2/NACE WJ-2, SSPC-SP WJ-3/NACE WJ-3 or SSPC-SP WJ-4/NACE WJ-4. Use as a visual reference, photographs in SSPC VIS 4/NACE VIS 7 for the appearance of cleaned surfaces.

3.3.3 Galvanized Surfaces

a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. Completely remove coating by brush-off abrasive blast if the galvanized metal has been passivated or stabilized. Do not "passivate" or "stabilize" new galvanized steel to be coated. If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D6386, Appendix X2, and remove by one of the methods described therein.

b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC-SP WJ-3/NACE WJ-3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Water jet to SSPC-SP WJ-3/NACE WJ-3 degree of cleanliness. Spot abrasive blast rusted areas as described for steel in SSPC SP 6/NACE No.3, and

waterjet to SSPC-SP WJ-3/NACE WJ-3 to remove existing coating.

3.3.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.3.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D235. Wipe dry with clean, dry cloths.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Concrete and Masonry

a. Curing: Allow concrete, stucco and masonry surfaces to cure at least 30 days before painting, and concrete slab on grade to cure at least 90 days before painting.

b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil: Wash new surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.

c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F1869. In all cases follow manufacturer's recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.4.2 Gypsum Board, Plaster, and Stucco

3.4.2.1 Surface Cleaning

Verify that plaster and stucco surfaces are free from loose matter and that gypsum board is dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint is water-based.

3.4.2.2 Repair of Minor Defects

Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

3.4.2.3 Allowable Moisture Content

Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D4263. Verify that new plaster to be coated has a maximum moisture content of 8 percent, when measured in accordance with ASTM D4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5 APPLICATION

3.5.1 Coating Application

a. Comply with applicable federal, state and local laws enacted to ensure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

b. At the time of application, paint must show no signs of deterioration. Maintain uniform suspension of pigments during application.

c. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Use rollers for applying paints and enamels of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

d. Only apply paints, except water-thinned types, to surfaces that are completely free of moisture as determined by sight or touch.

e. Thoroughly work coating materials into joints, crevices, and open spaces. Pay special attention to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

f. Apply each coat of paint so that dry film is of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Completely hide all blemishes.

g. Touch up damaged coatings before applying subsequent coats. Broom clean and clear dust from interior areas before and during the application of coating material.

h. Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. Upon completion of painting, remove protective covering from sprinkler heads.

i. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.

j. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil or two component gloss polyurethane (MPI 72) in exterior applications.

k. Provide labeling on the surfaces of all feed and cross mains to show the pipe function such as "Sprinkler System", "Fire Department Connection", "Standpipe". For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 in in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75 in in height and visible from the floor.

l. All fire suppression system valves must be marked with permanent tags indicating normally open or normally closed.

m. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

n. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Cover each preceding coat or surface completely by ensuring visually perceptible difference in shades of successive coats.

o. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

p. Thermosetting Paints: Apply topcoats over thermosetting paints (epoxies and urethanes) within the overcoat window recommended by the

manufacturer.

q. Floors: For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.

3.5.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. Verify that the written permission includes quantities and types of thinners to use.

When thinning is allowed, thin paints immediately prior to application with not more than one pint of suitable thinner per gallon. The use of thinner does not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning cannot cause the paint to exceed limits on volatile organic compounds. Do not mix paints of different manufacturers.

3.5.3 Two-Component Systems

Mix two-component systems in accordance with manufacturer's instructions. Follow recommendation by the manufacturer for any thinning of the first coat to ensure proper penetration and sealing for each type of substrate.

3.5.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table for Exterior Applications	
MPI Division	Substrate Application
MPI Division 5	Exterior Metal, Ferrous and Non-Ferrous Paint Table

Table for Interior Applications	
MPI Division	Substrate Application
MPI Division 3	Interior Concrete Paint Table
MPI Division 5	Interior Metal, Ferrous and Non-Ferrous Paint Table
MPI Division 6	Interior Wood Paint Table
MPI Division 9	Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film

thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness, where specified, refers to the minimum dry film thickness.

c. Coatings for Surfaces Not Specified Otherwise: Coat unspecified surfaces the same as surfaces having similar conditions of exposure.

d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

(1) One coat of primer.

(2) One coat of undercoat or intermediate coat.

(3) One topcoat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.6 COATING SYSTEMS FOR METAL

Apply coatings of Tables in MPI Division 5 for Exterior and Interior.

a. Apply specified ferrous metal primer to steel surfaces on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat. Overcoat these items with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.7 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in MPI Division 3, 4 and 9 for Exterior and Interior.

3.8 COATING SYSTEMS FOR WOOD AND PLYWOOD

a. Apply coatings of Tables in MPI Division 6 for Exterior and Interior.

b. Prior to erection, apply two coats of specified primer to treat and

prime wood and plywood surfaces which will be inaccessible after erection.

c. Apply stains in accordance with manufacturer's printed instructions.

3.9 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101. Place stenciling in clearly visible locations. On piping not covered by MIL-STD-101, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.10 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.11 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers. Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. When such a service is not available, contact local recyclers to reclaim the materials. Set aside extra paint for future color matches or reuse by the Government. Where local options exist for leftover paint recycling, collect all waste paint by type and provide for delivery to recycling or collection facility for reuse by local organizations.

3.12 PAINT TABLES

3.12.1 Exterior Paint Tables

3.12.1.1 MPI Division 5: Exterior Metal, Ferrous and Non-Ferrous Paint Table

A. Steel / Ferrous Surfaces

(1) New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT

MPI EXT 5.1Q-G5 (Semigloss	MPI REX 5.1D-G5 (Semigloss)	MPI 23	MPI 94	MPI 94	5.25 mils
Topcoat: Coating to match adjacent surfaces.					

(2) New Steel that has been blast-cleaned to SSPC SP 6/NACE No.3

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1D-G5 (Semigloss)	MPI REX 5.1D-G5 (Semigloss)	MPI 79	MPI 94	MPI 94	5.25 mils
Topcoat: Coating to match adjacent surfaces.					

(3) Existing steel that has been spot-blasted to SSPC SP 6/NACE No.3

(a) Surface previously coated with alkyd or latex

Waterborne Light Industrial Coating				
Existing, previously coated with alkyd or latex	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1C-G5 (Semigloss)	MPI 79	MPI 163	MPI 163	5 mils
Topcoat: Coating to match adjacent surfaces.				

(b) Surfaces previously coated with epoxy

Waterborne Light Industrial Coating				
Existing, previously coated with epoxy	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1L-G5 (Semigloss)	MPI 101	MPI 163	MPI 163	5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
Existing, previously coated with epoxy	Primer	Intermediate	Topcoat	System DFT

MPI REX 5.1H-G6 (Gloss)	MPI 101	MPI 108	MPI 72	8.5 mils
Topcoat: Coating to match adjacent surfaces.				

(4) New steel blast cleaned to SSPC SP 10/NACE No. 2

Waterborne Light Industrial					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1R-G5 (Semigloss)	MPI EXT 5.1R-G5 (Semigloss)	MPI 101	MPI 108	MPI 163	8.5 mils
Topcoat: Coating to match adjacent surfaces.					

(5) Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations

Epoxy					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1S-G5 (Semi Gloss)	MPI EXT 5.1S-G5 (Semi Gloss)	MPI 120	MPI 177	MPI 177	5.25 mils
Topcoat: Coating to match adjacent surfaces. Load Non-Skid Additive at manufacturer's recommendations.					

B. Exterior Galvanized Surfaces

(1) New Galvanized surfaces

Waterborne Primer / Latex				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
EXT 5.3H-G5 (Semigloss)	MPI 134	MPI 11	MPI 11	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Primer / Waterborne Light Industrial Coating

New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3J-G5 (Semigloss)	MPI 134	MPI 163	MPI 163	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Epoxy Primer / Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3K-G5 (Semigloss)	MPI 101	MPI 163	MPI 163	5 mils
Topcoat: Coating to match adjacent surfaces.				

(2) Galvanized surfaces with slight coating deterioration; little or no rusting

Waterborne Light Industrial Coating				
Galvanized Surfaces with slight coating deterioration	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3J-G5 (Semigloss)	MPI 134	N/A	MPI 163	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Galvanized surfaces with severely deteriorated coating or rusting

Waterborne Light Industrial Coating				
Galvanized surfaces with severely deteriorated coating or rusting	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3L-G5(Semigloss)	MPI 101	MPI 108	MPI 163	8.5 mils
Topcoat: Coating to match adjacent surfaces.				

C. Exterior Surfaces, Other Metals (Non-Ferrous)

(1) Aluminum, aluminum alloy and other miscellaneous non-ferrous metal

items not otherwise specified except hot metal surfaces, roof surfaces, and new prefinished equipment

Alkyd				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.4F-G5 (Semigloss)	MPI 95	MPI 94	MPI 94	5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.4F-G5 (Semigloss)	MPI 95	MPI 163	MPI 163	5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1D-G5 (Semigloss)	MPI 79	MPI 94	MPI 94	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Light Industrial Coating				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1C-G3(Eggshell)	MPI 79	MPI 161	MPI 161	5 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces.				

D. Exterior Hot Surfaces

(1) Hot metal surfaces subject to temperatures up to 400 degrees F

Heat Resistant Enamel

New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2A	MPI 21	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(2) Ferrous metal subject to high temperature, up to 750 degrees F

Inorganic Zinc Rich Coating				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2C	MPI 19	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

Heat Resistant Aluminum Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2B	MPI 2	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(3) New surfaces made bare subject to temperatures up to 1100 degrees F

(1) New surfaces made bare cleaning to SSPC SP 10/NACE No. 2 subject to temperatures up to 1100 degrees F

Heat Resistant Coating					
New	Existing	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2D	MPI REX 5.2D	MPI 22	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.					

3.12.2 Interior Paint Tables

3.12.2.1 MPI Division 3: Interior Concrete Paint Table

A. New Concrete, vertical surfaces, not specified otherwise

High Performance Architectural Latex

New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1C-G3 (Eggshell)	MPI RIN 3.1J-G3 (Eggshell)	MPI 3	MPI 139	MPI 139	4 mils
Topcoat: Coating to match adjacent surfaces.					

B. Concrete Ceilings, Uncoated

Latex Aggregate				
New, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1N-G1 (Flat)	N/A	N/A	MPI 42	Per Manufacturer
Texture - Fine. Surface preparation, number of coats, and primer in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.				

C. New Concrete in toilets, not otherwise specified except floors

Waterborne Light Industrial Coating					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1L-G3(Eggshell)	MPI RIN 3.1C-G3(Eggshell)	MPI 3	MPI 151	MPI 151	4.8 mils
Topcoat: Coating to match adjacent surfaces.					

Chlorinated Rubber					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
Chlorinated Rubber	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer
Note: Primer may be reduced for penetration per manufacturer's instructions.					

Epoxy

New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1F	MPI RIN 3.1E	MPI 77	MPI 77	MPI 77	4 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

Latex Floor Paint					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.2A-G2 (Flat)	MPI RIN 3.2A-G2 (Flat)	MPI 60	MPI 60	MPI 60	5 mils

Alkyd Floor Paint					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.2B-G2 (Flat)	MPI RIN 3.2B-G2 (Flat)	MPI 59	MPI 59	MPI 59	5 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

Epoxy					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.2C-G6 (Gloss)	MPI RIN 3.2C-G6 (Gloss)	MPI 77	MPI 77	MPI 77	5 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

3.12.2.2 MPI Division 5: Interior Metal, Ferrous and Non-Ferrous Paint Table

A. Interior Steel / Ferrous Surfaces

(1) Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, Surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT

MPI INT 5.1R-G3 (Eggshell)	MPI 76	MPI 139	MPI 139	5 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Metal in toilets, and other high-humidity areas not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G3 (Eggshell)	MPI 76	MPI 51	MPI 51	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

(5) Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.4F-G3 (Eggshell)	MPI 95	MPI 139	MPI 139	5 mils
Topcoat: Coating to match adjacent surfaces.				

B. Hot Surfaces

(1) Hot metal surfaces subject to temperatures up to 400 degrees F

Heat Resistant Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2A	MPI 21	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(2) Ferrous metal subject to high temperature, up to 750 degrees F

Inorganic Zinc Rich Coating

New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2C	MPI 19	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

Heat Resistant Aluminum Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2B (Aluminum Finish)	MPI 2	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(3) New and Existing Surfaces made bare subject to temperatures up to 1100 degrees F

(1) New surfaces made bare cleaning to SSPC SP 10/NACE No. 2 subject to temperatures up to 1100 degrees F:

Heat Resistant Coating					
New	Existing	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2D	MPI RIN 5.2D	MPI 22	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.					

3.12.2.3 MPI Division 6: Interior Wood Paint Table

A. Interior Wood and Plywood

(1) New plywood not otherwise specified

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4S-G3 (Eggshell)	MPI 39	MPI 139	MPI 139	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

3.12.2.4 MPI Division 9: Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

A. Interior New and Wallboard not otherwise specified
Institutional Low Odor / Low VOC Latex, New

Institutional Low Odor / Low VOC Latex				
New	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2M-G3 (Eggshell)	MPI 149	MPI 145	MPI 145	4 mils
Topcoat: Coating to match adjacent surfaces.				

B. Interior New Wallboard in toilets, and other high humidity areas not otherwise specified

Waterborne Light Industrial Coating					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2L-G5(Semigloss)	MPI RIN 9.2L-G5 (Semigloss)	MPI 50	MPI 153	MPI 153	4 mils
Topcoat: Coating to match adjacent surfaces.					

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09 96 00

HIGH-PERFORMANCE COATINGS
11/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

MASTER PAINTERS INSTITUTE (MPI)

MPI ASM	(2019) Architectural Painting Specification Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment List

SD-03 Product Data

Epoxy Coatings; G

SD-04 Samples

Color Chips; G

SD-07 Certificates

Epoxy Coatings; G

Manufacturer's Printed Instructions

1.3 QUALITY CONTROL

Comply with Master Painters Institute (MPI) Standards indicated and listed in "MPI Approved Products List." Comply with the requirements in "MPI Architectural Painting Specification Manual" before any project is started.

Submit an equipment list consisting of a list of proposed equipment to be used in performance of construction work.

Submit three color chips 3-inch by 4-inch or manufacture's pull-down of

each finish color and gloss as scheduled.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver special coating materials to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Provide new and unopened containers.

Store special coating materials in tightly closed containers in a covered, well-ventilated area where they are not exposed to excessive heat, fumes, sparks, flame, or direct sunlight. Protect water-based coatings against freezing.

Store solvents, thinners, and equipment cleaners with the same care as the coating materials with ambient temperatures continuously maintained at a minimum 45 degrees F.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

Submit manufacturer's catalog data including manufacturer's name and identification. Include detailed data analysis of each special coating material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Also provide manufacturer's data concerning application, thinning, and average coverage per gallon

2.2 MATERIALS

2.2.1 Epoxy Coatings

Conform to MPI ASM, No. 116 for epoxy coatings and epoxy block filler, as modified.

Resins for finish coats are based on a polyamide-cured, epoxy-resin material. Apply finish coats with a dry-film thickness of not less than 4 mils per coat. Finish color and gloss as indicated and selected from the manufacturer's standards.

2.2.1.1 Concrete Surface Coatings

Apply a epoxy coating system in conformance with MPI ASM, No. 77 for vertical concrete surfaces. Apply an epoxy slip-resistant deck coating system in conformance with MPI ASM, No. 82 to floor surface. Apply a prime coat to fill concrete surface pores with a total dry-film thickness of not less than 2 mils.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Surface Preparation

Protect adjacent materials and equipment against damage from spillage, dripping, and spatter of coating materials. Leave clean building materials and equipment with all damaged surfaces corrected. Provide "WET PAINT" signs to indicate newly painted surfaces.

Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Contracting Officer, and leave in an undamaged condition. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

Provide forced ventilation for interior spaces during application and drying of coatings to prevent the buildup of toxic or explosive concentrations of solvent vapors.

Provide fire extinguishers of the required quantity and correct type to combat flammable liquid fires.

Dispose of rags that are used to wipe up coating materials, solvents, and thinners by drenching with water and placing them in a covered metal container.

3.1.2 Cleaning

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Clean application equipment promptly and thoroughly with a suitable solvent after each use and stored in a clean, covered, well-ventilated container.

3.1.3 Concrete Surfaces

Conform to MPI ASM for substrates indicated. Remove plates, machined surfaces, and similar items already in place that are not to be coated. Provide surface-applied protection before surface preparation and coating where removal is impractical or impossible. After completing coating operations, reinstall items that were removed.

Clean dirt, oil, grease, and incompatible paints from substrates to ensure bonding. Coordination of shop-applied prime coats with high-performance coatings is critical. Remove incompatible primers. Reprime substrate with compatible primers as required to produce coating systems indicated.

3.1.3.1 Concrete Substrates

Remove release agents, curing compounds, efflorescence, and chalk. Maximum allowable moisture content of concrete is 12 percent. Measure moisture content with an electronic moisture meter.

Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 inch to 12 inch.

Comply with SSPC 7/NACE No.4 (NACE No. 4), "Brush-Off Blast Cleaning" for abrasive cleaning.

3.1.4 Coating Material Preparation

Mix and prepare coating materials in accordance with the coating manufacturer's printed instructions for applying the particular material

and coat. Keep materials which are not in actual use in closed containers.

Coating materials that have been mixed with an automatic shaker are allowed to stand to let air bubbles escape, then given a final hand mixing before application. Stir materials so as to produce a mixture of uniform density. Stir at frequent intervals during application to prevent skinning. Do not stir film which may form on the surface of the material. Remove film and strain, if necessary.

3.1.4.1 Thinning

Thinning is done in accordance with coating manufacturer's printed directions for the particular material and coat.

3.1.4.2 Tinting

Ensure prime and intermediate coats of paint are slightly different tints from the finish coat to facilitate identification of each coat. Tinting is done by the coating manufacturer and clearly identified as to color and coat.

3.2 APPLICATION

Do not perform exterior painting in damp or rainy weather. Painting is not allowed below 50 degrees F or above 95 degrees F. Apply paint in accordance with the coating manufacturer's recommendations, and as specified.

Ensure coating application is done by skilled applicators. Apply coatings to clean and properly prepared surfaces. Apply coatings with clean, high-quality application equipment. Allow sufficient time between coats to ensure complete drying and curing. Sand and dust surfaces between coatings, as required, to produce a surface free of visible defects. Lightly sand high gloss coatings and clear finishes between coats to ensure bond of following coats.

Apply coats to the surfaces in an even film. Cloudiness, spotting, holidays, laps, application marks, runs, sags, and other similar surface imperfections are not acceptable. Remove defective coating applications and re-coat as directed.

Ensure coating lines such as wainscots are sharp, true, and well-defined. Tape may be used to establish coating lines, providing tape is removed before ragging or sawtooth edges form.

Ensure surfaces, including edges, corners, crevices, welds, and other similar changes in surface plane, meet the dry-film thickness not less than specified.

3.2.1 Brush Application

Use clean, proper size brushes for high-quality application of the specified coating materials. Brush out slow-dry coatings. Brush out quick-dry coatings only enough to spread out evenly.

3.2.2 Roller Application

Use clean roller covers of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

Ensure roller application is equivalent in all respects to the same coats applied by high-quality brush application.

3.2.3 Spray Application

Spray application of coatings is limited to finish coats on metal frame works, siding, decking, wire mesh, and other surfaces where hand work would be inferior. Apply spray coatings as equivalent in all respects to the same coats applied by high quality brush application. Permit each spray coat to cure before the succeeding coat is applied. Do not double back with application equipment, for the purpose of building up film thickness of two coats in one operation.

Cover surfaces adjacent to sprayed areas to prevent damage from overspray, coating rebound, and spray drift.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Test

Government may take dry-film tests from time to time on finished surfaces. Apply additional coatings to surfaces where there is less than the minimum specified dry-film thickness.

3.3.2 Repairing

Remove damaged and unacceptable portions of completed work and replace with new work to match adjacent surfaces at no additional cost to the Government.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09 96 53.13

SILICONE ELASTOMERIC COATINGS
11/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D412	(2016; R 2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D1653	(2013; R 2021) Standard Test Methods for Water Vapor Transmission of Organic Coating Films
ASTM D6904	(2022) Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment List

SD-03 Product Data

Silicone Elastomeric Coating

Primer

Sealants

SD-04 Samples

Color Selection Guide

1.3 QUALITY ASSURANCE

Submit an equipment list consisting of a list of proposed equipment to be used in performance of construction work.

1.3.1 Pre-application Meeting

Pre-application meeting scheduling shall be coordinated with the Contracting Officer. The meeting shall be attended by the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of the wall system, related window/door assembly work, mechanical and electrical work, other trades interfacing with the wall work, and representative of the wall materials manufacturer. Before beginning wall work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of wall work.

After approval of submittals and before performing wall system installation work, hold a pre-application conference to review the following:

a. Drawings and specifications and submittals related to the wall work.

b. Wall system components installation.

c. Procedure for the wall manufacturer's technical representative's onsite inspection and acceptance of the wall substrate, the name of the manufacturer's technical representatives, the frequence of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative.

d. Contractor's plan for coordination of the work of the various trades involved in proving the wall system and other components impacting the walls.

e. Quality control plan for the wall system installation.

f. Property protection measures.

g. Safety requirements.

1.3.2 Silcone Elastomeric Wall Coating System Mock-up

Provide a mockup of the silicone elastomeric wall coating system. Apply product in an area designated by the Contracting Officer in an area of not less that 50 square feet. Include all components specified as representative of the complete system. Notify the Contracting Officer a minimum of 48 hours prior to test the application. Select a test area representative of conditions to be covered including window or door openings, flashings, and penetrations, as applicable.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver special coating materials to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Provide new and unopened containers.

Store special coating materials in tightly closed containers in a covered, well-ventilated area where they are not exposed to excessive heat, fumes, sparks, flame, or direct sunlight. Protect water-based coatings against freezing.

Store solvents, thinners, and equipment cleaners with the same care as the

coating materials with ambient temperatures continuously maintained at a minimum 45 degrees F.

1.5 ENVIRONMENTAL REQUIREMENTS

Application is not recommended when the temperature is below 20 degrees F or if frost or moisture is present on the surfaces to be coated.

Application not recommended to surfaces above 120 degrees F. The time to complete cure of this product is dependent upon temperature and humidity. Under basic conditions 72 degrees F and 50 percent RH this material can attain a tack-free surface in 1-2 hours. As temperatures drop towards freezing, application should proceed with caution due to the possibility of moisture (dew, frost) on surfaces to be coated as well as longer curing times relative to application of a second or touchup coat (recoat), (and vice versa as temperatures increase).

When spraying coating in windy conditions, take precautionary measures to avoid excessive overspray. It is suggested to withhold spraying when wind speeds exceed 10 mph.

Contact product technical services for additional time-related precautionary measure when application is proceeding under winter temperatures and conditions.

1.6 WARRANTY

Provide silicone elastomeric wall coating system material and workmanship warranties meeting specified requirements. Provide revision or amendment to manufacturer's standard warranty as required to comply with the specified requirements.

Furnish the silicone elastomeric wall coating manufacturer's 15-year standard wall system materials and installation workmanship warranty, including flashing, components, trim, and accessories necessary for a watertight wall system construction. Make warranty directly to the Government, commencing at the time of Government's acceptance of the wall work.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

Submit manufacturer's catalog data including manufacturer's name and identification. Include detailed data analysis of each special coating material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Also provide manufacturer's data concerning application, thinning, and average coverage per gallon

2.2 MATERIALS

2.2.1 Silicone Elastomeric Coating

One-component, elastomeric, silicone, high-solids, UV resistant, wall coating shall have the following values when tested for specfied test methods.

Typical Properties - Supplied		
Density	WPSTM P14	11.5 lb/gal
Solids by Volume	WPSTM C19	72 percent
Solids by Weight	WPSTM C19	76 percent
Tack Free Time	WPSTM E86	Less than 2 hours
Skin Over Time		30 minutes
Viscosity	WPSTM C560	15,000 centipoise
Total VOC	EPA Method 24	34 g/L
Typical Properties - Cured		
Tensile Strength	ASTM D412	245 psi
Elongation	ASTM D412	395 percent
Vapor Permeance (10 Mils DFT)	ASTM D1653	8.40 perms
Resistance to Wind Driven Rain	ASTM D6904	Pass

Submit manufacturer's color selection guide. Color to be selected and approved by Contracting Officer

2.3 PRIMER

Primers shall be as recommended by the coating manufacturer for the substrate to be covered. Submit literature including material description, physical properties, recommended storage conditions, Material Safety Data Sheets, and shelf life expiration date.

2.4 SEALANTS

Sealants shall be as recommended by the coating manufacturer. Submit literature including material description, physical properties, recommended storage conditions, Material Safety Data Sheets, and shelf life expiration date.

PART 3 EXECUTION

3.1 EXAMINATION

Exam surfaces and correct defects that may adversely affect the wall system application or performance.

3.2 PREPARATION

3.2.1 Surface Preparation

Protect adjacent materials and equipment against damage from spillage, dripping, and spatter of coating materials. Leave clean building

materials and equipment with all damaged surfaces corrected. Provide "WET PAINT" signs to indicate newly painted surfaces.

Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Contracting Officer, and leave in an undamaged condition. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

Provide forced ventilation for interior spaces during application and drying of coatings to prevent the buildup of toxic or explosive concentrations of solvent vapors.

Provide fire extinguishers of the required quantity and correct type to combat flammable liquid fires.

Dispose of rags that are used to wipe up coating materials, solvents, and thinners by drenching with water and placing them in a covered metal container

3.2.2 Cleaning

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Clean application equipment promptly and thoroughly with a suitable solvent after each use and stored in a clean, covered, well-ventilated container.

3.2.3 Concrete Surfaces

Clean dirt, oil, grease, and incompatible paints from substrates to ensure bonding. Coordination of shop-applied prime coats with silicone elastomerics coatings is critical. Remove incompatible primers. Reprime substrate with compatible primers as required to produce coating systems indicated.

Allow concrete to cure for a minimum of 30 days before coating.

Fill cracks and holes with approved patching materials and sand smooth. All cracks greater than hairline width, approximately 1/16 inch, must be ground out and patch with sealant or an appropriate concrete patching compound approved by coating manufacturer. Structural cracks of any thickness must be repaired with approved material and stabilized to prevent movement.

3.2.3.1 Concrete Substrates

Remove release agents, curing compounds, efflorescence, and chalk. Maximum allowable moisture content of concrete is 12 percent. Measure moisture content with an electronic moisture meter.

Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 inch to 12 inch.

Comply with SSPC 7/NACE No.4 (NACE No. 4), "Brush-Off Blast Cleaning" for abrasive cleaning.

3.3 APPLICATION

Do not perform application of silicone elastomeric wall coating in damp or rainy weather. Apply coating in accordance with the coating manufacturer's recommendation, and as specified in damp or rainy weather.

Ensure coating application is done by skilled applicators. Ensure surfaces to receive coating are clean, dry, structurally sound, and free of frost and frozen materials. As temperatures drop towards freezing, application should proceed with caution due to the possibility of moisture (dew, frost) on surfaces to be coated as well as longer curing times relative to application of a second or touchup coat (recoat). Apply coating with clean, high-quality application equipment.

Apply uniform, pinhole-free coating in 2 separate coats at spreading rate required to achieve a total minimum dry film thickness of 0.010 inch (10 mils/254 microns). Apply coating in accordance with manufacturer's instructions.

a. Each application should be applied at a wet thickness of 0.07 inches (7 mils/190 microns) per coat. Wet coating thickness may be estimated by using a wet film thickness gauge. Square foot application rates are theoretical (Maximum 240 ft2/gallon per coat on a smooth surface) and are for estimation purposes only. A mockup must be applied to determine the actual coverage rate needed to provide a pinhole free film at the recommended dry film thickness.

b. The second coat may be applied when the first coat is tack free to the touch. A tack free condition will usually take at least one hour at 70 to 80 degrees F. (Cooler temperatures will require more time. Complete cure of the coating will typically take 3 to 7 days and can be indicated by absence of odor.

c. Apply architectural coating from top to bottom of substrate. Work down vertical surface and cover rundown in process. Avoid excessive overlapping.

d. Apply architectural coating free of cloudiness, spotting, laps, brush marks, roller tracks, and other surface imperfections. Cut in color breaks and terminations with sharp lines.

e. Apply additional coats as required to provide cured film with uniform coverage, finish, color, and appearance.

Do not dilute coating without consulting with coating manufacturer. Keep containers closed when not in use to avoid contamination. Apply primer, if required, on wood and metallic surfaces in accordance with manufacturer's instructions. Allow primer to dry before applying coating.

Avoid over spray of coating. Over spray and misapplied coating should be removed immediately in accordance with manufacturer's instructions while it is still uncured. Repair or replace surfaces damaged by overspray or misapplied coating as determined by Contracting Officer.

3.3.1 Brush Application

Use clean, proper size brushes for high-quality application of the specified coating materials. Brush out slow-dry coatings. Brush out quick-dry coatings only enough to spread out evenly.

3.3.2 Roller Application

Use clean roller covers of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

Ensure roller application is equivalent in all respects to the same coats applied by high-quality brush application.

3.3.3 Spray Application

Apply spray coatings as equivalent in all respects to the same coats applied by high quality brush application. Permit each spray coat to cure before the succeeding coat is applied. Do not double back with application equipment, for the purpose of building up film thickness of two coats in one operation.

Cover surfaces adjacent to sprayed areas to prevent damage from overspray, coating rebound, and spray drift.

3.4 FIELD QUALITY CONTROL

3.4.1 Field Test

Government may take dry-film tests from time to time on finished surfaces. Apply additional coatings to surfaces where there is less than the minimum specified dry-film thickness.

3.4.2 Repairing

Remove damaged and unacceptable portions of completed work and replace with new work to match adjacent surfaces at no additional cost to the Government.

3.5 CLEANING

Remove temporary coverings and protection of surrounding areas and surfaces.

3.6 PROTECTION

Protect applied coating from rain or damage until fully cured.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09 97 13.27

HIGH PERFORMANCE COATING FOR STEEL STRUCTURES
02/21, CHG 1: 08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C920	(2018; R 2024) Standard Specification for Elastomeric Joint Sealants
ASTM D1200	(2010; R 2014) Viscosity by Ford Viscosity Cup
ASTM D1640/D1640M	(2014) Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
ASTM D3276	(2015; E 2016) Standard Guide for Painting Inspectors (Metal Substrates)
ASTM D3925	(2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D4285	(1983; R 2018) Indicating Oil or Water in Compressed Air
ASTM D7127	(2017) Standard Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces using a Portable Stylus Instrument
ASTM E11	(2024) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2015) Quality Management Systems-Requirements

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC AB 2	(2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive
SSPC AB 3	(2023; R 2023) Ferrous Metallic Abrasive
SSPC Guide 6	(2021) Guide for Containing Surface Preparation Debris Generated During Paint

	Removal Operations
SSPC Guide 12	(2023) Guide for Illumination of Industrial Painting Projects
SSPC PA 1	(2024) Shop, Field, and Maintenance Coating of Metals
SSPC PA 2	(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC QP 5	(2022) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC QS 1	(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC SP COM	(2016; E 2017) Surface Preparation Commentary for Steel and Concrete Substrates
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(1993; Rev B; Am 1 1994; Am 2 1996; Notice 1 2021) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/19	(2009; Rev C; Notice 1 2023) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
MIL-DTL-24441/31	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White, Formula 152, Type IV

MIL-PRF-85285	(2024; Rev F; Am 1 2024) Topcoat, Aircraft and Support Equipment
MIL-STD-161	(2025; Rev J) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1926.59	Hazard Communication

1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the paragraph where used, and denoted by capital letters.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-05, Design Data

Containment System

SD-06 Test Reports

Joint Sealant Qualification Test Reports

Coatings Qualification Test Reports

Metallic Abrasive Qualification Test Reports

Coating Sample Test Reports

Abrasive Sample Test Reports; G

Inspection Report Forms

Daily Inspection Reports

Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

SD-07 Certificates

Contract Errors, Omissions, and Other Discrepancies

Corrective Action Procedures

Coating Work Plan; G

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications Of Individuals Performing Abrasive Blasting

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coating Inspection Company

Qualifications of QC Specialist Coating Inspector

Qualifications of Testing Laboratory for Coatings

Qualifications of Testing Laboratory for Abrasive

Qualifications of Coating Contractors

Joint Sealant Materials

Coating Materials

Coating System Component Compatibility

Non-metallic Abrasive

Metallic Abrasive

SD-08 Manufacturer's Instructions

Joint Sealant Instructions

Coating System Instructions

SD-11 Closeout Submittals

Disposal of Used Abrasive; G

Inspection Logbook; G

1.4 QUALITY ASSURANCE

1.4.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the Coating Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution. Schedule time (Float) should be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

1.4.2 Corrective Action (CA)

CA shall be included in the Quality Control Plan.

1.4.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated. Develop Corrective Action Request (CAR) forms for initiating CA, and for tracking and documenting each step.

1.4.2.2 Implement Corrective Action

The Contractor shall take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These procedures shall apply to non-compliance in the work, and to non-compliance in the QC System. Corrective actions shall be appropriate to the effects of the non-compliance encountered. Each CAR shall be serialized, tracked in a Log to completion and acceptance by the Contracting Officer, and retained in project records. The Corrective Action Log, showing status of each CAR, shall be submitted to the Contracting Officer monthly. A CAR may be initiated by either the Contractor or the Contracting Officer. The Contracting Officer must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

1.4.3 Coating Work Plan

This work plan shall be considered as part of the Quality Control Plan.

Provide procedures for reviewing contract documents immediately after award to identify errors, omissions, and discrepancies so that any such issues can be resolved prior to project planning and development of detailed procedures.

Provide procedures for verification of key processes during Initial Phase to ensure that contract requirements can be met. Key processes shall include surface preparation, coating application and curing, inspection, and documentation, and any other process that might adversely impact orderly progression of work.

Provide procedures for all phases of coating operations, including planned work, rework, repair, inspection, and documentation. Address mobilization and setup, surface preparation, coating application, coating initial cure, tracking and correction of noncompliant work, and demobilization. Coordinate work processes with health and safety plans and confined space entry plans. For each process, provide procedures that include appropriate work instructions, material and equipment requirements, personnel qualifications, controls, and process verification procedures. Provide procedures for inspecting work to verify and document compliance with contract requirements, including inspection forms and checklists, and acceptance and rejection criteria.

Provide procedures for correcting noncompliant work. Detailed procedures are required in advance to avoid delays in meeting overcoat windows as well as to avoid delays in production. Provide procedures for repairing defects in the coating film, such as runs, drips, sags, holidays, overspray, as well as how to handle correct coating thickness noncompliance, any other areas of repair or rework that might be adversely affected by delays in preparing and approving new procedures.

If a procedure is based on a proposed or approved request for deviation,

the deviation shall be referenced. Changes to procedures shall be noted by submittal number and date approved, clearly delineating old requirements and new requirements, so that the records provide a continuous log of requirements and procedures.

1.4.4 Design Data

1.4.4.1 Containment System

Submit complete design drawings and calculations for the scaffolding and containment system, including an analysis of the loads which will be added to the structure by the containment system and waste materials. A registered engineer shall approve calculations and scaffold system design.

1.4.5 Test Reports

1.4.5.1 Joint Sealant Qualification Test Reports

Submit test results from independent laboratory of representative samples of joint sealant material. Samples must have been tested within the last three years. Submit results as required in paragraph QUALITY ASSURANCE PROVISIONS of ASTM C920. Note that testing in accordance with QUALITY ASSURANCE PROVISIONS is a pre-qualification requirement.

1.4.5.2 Coatings Qualification Test Reports

Submit test results from independent laboratory of representative samples of each coating material. U.S. Department of Defense laboratories are considered to be independent laboratories for purposes of compliance with "QUALIFICATION INSPECTION" requirements herein. Samples must have been tested within the last three years. Submit results for epoxy materials as required in paragraph QUALIFICATION INSPECTION of MIL-DTL-24441, and as revised by paragraph COATING SYSTEM herein. Submit results for polyurethane materials as required in paragraph QUALIFICATION INSPECTION of MIL-PRF-85285, and as revised by paragraph COATING SYSTEM herein. Note that requirement for QUALIFICATION INSPECTION is a pre-qualification requirement, and involves the same testing required for listing in the Qualified Products List of the respective material. See appropriate Military Specification for specific test requirements.

1.4.5.3 Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of SSPC AB 3. Submit test results from independent laboratory of representative samples of each abrasive to be used on the jobsite. Samples must have been tested within the last three years. Note that this testing is for the purpose of prequalifying the abrasive.

1.4.5.4 Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from independent laboratory of daily and weekly Quality Control testing required by SSPC AB 2, as modified in paragraph ABRASIVE.

1.4.6 Qualifications

1.4.6.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of

the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

1.4.6.2 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party PCS. Submit documentation that specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS shall remain certified during the entire project, and the Contracting Officer shall be notified of any change in certification status within 10 days of the change. The PCS shall not be the designated coating inspector.

1.4.6.3 Qualifications of Coating Inspection Company

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by SSPC to the requirements of SSPC QP 5 prior to contract award, and shall remain certified while accomplishing any coating inspection functions. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in coating inspection company certification status.

1.4.6.4 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to SSPC QP 5, Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

1.4.6.5 Qualifications Of Individuals Performing Abrasive Blasting

Submit name, address, and telephone number of each person that will be performing abrasive blasting. Submit documentation that each blaster is qualified by SSPC to the SSPC C-7 Dry Abrasive Blaster Qualification Program. Each blaster shall remain qualified during the entire period of abrasive blasting, and the Contracting Officer shall be notified of any change in qualification status.

1.4.6.6 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that persons performing analyses are qualified.

1.4.6.7 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that persons performing analyses are qualified.

1.4.6.8 Qualifications of Coating Contractors

All Contractors and Subcontractors that perform surface preparation or coating application shall be certified to either ISO 9001 or SSPC QP 1 and SSPC QS 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting Contractors and painting Subcontractors must remain so certified for the duration of the project. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status.

1.4.6.9 Joint Sealant Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.6.10 Coating Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.6.11 Coating System Component Compatibility

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products, including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system. When all coating materials are manufactured by one manufacturer, this certification is not required.

1.4.6.12 Non-metallic Abrasive

Provide manufacturer's certification that the materials are currently approved by the Naval Sea Systems Command and listed on the Qualified Products Lists (QPL) for the specified materials.

1.4.6.13 Metallic Abrasive

Provide manufacturer's certification of conformance to contract requirements and provide copies of test results.

1.4.7 Protective Coating Specialist (PCS)

The PCS shall be considered a QC Specialist and shall report to the QC

Manager, as specified in Section 01 45 00 QUALITY CONTROL. The PCS shall approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

1.4.8 Pre-Application Meeting

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, coating inspector, and PCS shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: corrective action requirements and procedures, coating work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

1.5 PRODUCT DATA

1.5.1 Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed application procedures, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

1.5.2 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

1.6 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, and as modified in this Section. Maintain temperature in storage spaces between 40 and 85 degrees F, and air temperature more than 5 degrees F above the dew-point at all times. Inspect materials for damage prior to use and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer.

If materials are approaching shelf life expiration and an extension is desired, samples may be sent to the manufacturer, along with complete records of storage conditions, with a request for shelf life extension. If the manufacturer finds the samples and storage data suitable for shelf life extension, the manufacturer may issue an extension, referencing the product evaluation and the review of storage records. Products may not be extended longer than allowed in the product specification.

1.7 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions shall be followed throughout mixing, application, and curing of the coatings. During all cleaning, cleanup, surface preparation, and paint

application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH shall approve work procedures and personal protective equipment.

1.8 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D3276, ASTM D3925, ASTM D4285, ASTM D7127, SSPC SP COM, SSPC SP 1, SSPC 7/NACE No.4, SSPC SP 10/NACE No. 2, SSPC PA 1, SSPC PA 2, SSPC Guide 6, SSPC VIS 1, SSPC QP 1, SSPC QS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

PART 2 PRODUCTS

2.1 JOINT SEALANT

TT-S-00230, Type II, Class B

2.2 COATING SYSTEM

Alternate systems or products will not be considered. Provide a complete system (primer, intermediate coat, top coat) material from one supplier.

The entire coating system is intended to be applied in the shop. Alternatively, coating system may be applied in the field and surface preparation may be accomplished in the shop, following all temperature, humidity, and testing requirements listed herein, followed by an application of a hold-primer. Remove all shop-applied primer prior to final field surface preparation and coating system application. Adjust all shop preparation to avoid conflicts with final surface preparation requirements.

Prepare surface and apply the complete coating system in the shop. Follow all temperature, humidity, and testing requirements listed herein.

The Military specification epoxy and polyurethane products specified in this Section do not require approval for listing on the QPL prior to contract award, as indicated in paragraph 3.2 of MIL-DTL-24441 and paragraph 3.1 of MIL-PRF-85285. Testing of products by an independent laboratory to the QUALIFICATION INSPECTION requirements of MIL-DTL-24441 and MIL-PRF-85285prior to contract award is required. See specific submittal requirements in paragraph QUALITY ASSURANCE.

2.2.1 Zinc-Rich Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type III).

2.2.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

2.2.3 Polyurethane Topcoat

Polyurethane coating topcoat of MIL-PRF-85285, Type II, White

SAE AMS-STD-595A color number 17925.

Modify paragraph 3.6.4 of MIL-PRF-85285, Viscosity and Pot Life, as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

Modify paragraph 3.7.1 of MIL-PRF-85285, Drying Time, as follows:

When applied by spray techniques and when tested in accordance with ASTM D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

2.3 COLOR IDENTIFICATION OF FUEL HANDLING AND STORAGE FACILITIES

Piping, conduit, and tank identification shall be in accordance with MIL-STD-161. Mark direction of fluids in accordance with MIL-STD-161. The NATO symbol for JP-8 is F-34.

2.4 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled, a shipping box sized for the samples to to be shipped, and packing material. Mark cans for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

2.5 ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one suitable plastic bag or container for each sample to be collected. Mark containers for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

2.6 TEST KITS

2.6.1 Test Kit for Measuring Chloride, Sulfate and Nitrate Ions on Steel and Coated Surfaces

Provide test kits that meet all of the following requirements:

a. Contains all materials,supplies, tools, and instructions for field testing and on-site quantitative evaluation of chloride, sulfate, and nitrate ions;

b. Extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;

c. Components and solutions are mercury free and environmentally friendly;

d. Contains new materials and solutions for each test extraction;

e. Contains an extraction test container (vessel, sleeve, cell) that creates a sealed, encapsulated environment during salt ion extraction;

f. Contains a test extract container suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;

g. All salt ion concentrations are directly measured in micrograms per square centimeter.

2.6.2 Test Kit for Identifying Amine Blush on Epoxy Surfaces

Provide test kits that meet all of the following requirements:

a. Is a completely self-contained field test kit with all materials, supplies, tools, and instructions to perform tests and indicate the presence of unreacted amines;

b. Uses an identifiable, consistent, uniform, pre-packaged, factory pre-measured indicating solution;

c. Contains no mercury or lead and is environmentally friendly;

d. Contains a solution of an unreacted amine for the purpose of "self checking" the indicator solution;

2.7 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

2.7.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials) except that the gross gamma radioactivity shall not exceed 5 picocuries per gram. Abrasive shall be approved by the Naval Sea Systems Command and listed on the appropriate Qualified Products List (QPL) for the specified materials. Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to

provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive. Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

2.7.2 Metallic Abrasive

2.7.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3 Class 1 (Steel) only. Class 2 (Iron) abrasive shall not be used.

To develop a suitable work mix from new steel abrasive, a minimum of 200 - 400 recycles is required, therefore, it is advantageous for a Contractor to use remanufactured steel grit or grit reclaimed from a previous project. Such grit shall be considered to conform if it can be traced to new grit conforming to SSPC AB 3 Class 1 and it meets all cleanliness requirements of SSPC AB 3 Class 1 when brought to the current jobsite. Submit one representative sample of this work mix to the laboratory for testing, along with samples of new material. Acceptance and use of this work mix shall not be used to justify any deviation from surface preparation requirements.

2.7.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

2.8 WHITE ALUMINUM OXIDE NON-SKID GRIT

Size #60, dust free (washed and dry), minimum 99 percent pure, having the following sieve analysis when tested in accordance with ASTM E11 using a 2.2 pound sample:

Sieve #	Percent Retained
40	0
50	15-40
60	60-85

PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coating Work Plan.

3.1 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

Sample and test materials delivered to the jobsite. Notify Contracting Officer three days in advance of sampling. The QC Manager and either the PCS or coating inspector shall witness all sampling.

3.1.1 Coating Sample Collection

Provide a sample collection kit as required in paragraph COATING SAMPLE COLLECTION AND SHIPPING KIT. From each lot, obtain a one quart sample of each base material, and proportional samples of each activator based on

mix ratio, by random selection from sealed containers in accordance with ASTM D3925. Prior to sampling, mix contents of each sealed container to ensure uniformity. As an alternative to collecting small samples from kits, entire kits may be randomly selected and shipped to laboratory, observing all requirements for witnessing and traceability. For purposes of quality conformance inspection, a lot is defined as that quantity of materials from a single, uniform batch produced and offered for delivery at one time. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph COATING SAMPLE TEST REPORTS.

3.1.2 Abrasive Sample Collection

Provide a sample collection kit as required in paragraph ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT. For purposes of quality conformance inspection, a lot shall consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. Obtain samples of each abrasive lot using the sampling techniques and schedule of MIL-A-22262. The addition of any substance to a batch shall constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph ABRASIVE SAMPLE TEST REPORTS.

3.1.3 Coating Sample Test Reports

Submit test results for each lot of coating material delivered to the jobsite. Test samples of primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

3.1.4 Abrasive Sample Test Reports

Submit test results for each lot of abrasive delivered to the jobsite. Test samples of metallic abrasive to the requirements of paragraph REQUIREMENTS of SSPC AB 3, except paragraph 4.1.5 DURABILITY. Test samples of non-metallic abrasive as required in paragraph QUALITY CONFORMANCE INSPECTION of MIL-A-22262. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

3.2 SURFACES TO BE COATED

Coat exterior surfaces of carbon steel valves, and miscellaneous metal and equipment.

3.3 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

3.4 ENVIRONMENTAL CONDITIONS

3.4.1 Containment

Design and provide a containment system for the capture, containment, collection, storage and disposal of the waste materials generated by the work under this Section, to meet the requirements of SSPC Guide 6, Class 3. Vapor concentrations shall be kept at or below 10 percent of Lower Explosive Limit (LEL) at all times. Containment may be designed as fixed containment for complete structure or portable containment for sections of structure, however, containment shall remain in any one place from beginning of abrasive blasting through initial cure of coating. Waste materials covered by this paragraph shall not include any material or residue from removal of coatings containing lead, chromium, cadmium, PCB, or any other hazardous material.

It is the Contractors responsibility to insure the feasibility and workability of the containment system. The Contractor shall perform his operations and work schedule in a manner as to minimize leakage of the containment system. The containment system shall be properly maintained and shall not deviate from the approved drawings. If the containment system fails to function satisfactorily, the Contractor shall suspend all operations, except those required to minimize adverse impact on the environment or government property. Operations shall not resume until modifications have been made to correct the cause of the failure.

3.5 SURFACE PREPARATION

3.5.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D4285. Test air quality at each startup, but in no case less often than every five operating hours.

3.5.2 Operational Evaluation of Abrasive

Test abrasive for salt contamination and oil contamination as required by the appropriate abrasive specification daily at startup and every five operating hours thereafter.

3.5.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more one foot square steel panels as specified in paragraph SURFACE PREPARATION. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with ASTM D7127. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

3.5.4 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

3.5.4.1 Pre-Preparation Testing for Oil and Grease Contamination

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean in accordance with SSPC SP 1, and recheck for contamination until surfaces are free of oil and grease.

WATER BREAK TEST - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

CLOTH RUB TEST - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

3.5.4.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

3.5.5 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with SSPC SP 10/NACE No. 2. Prepared surfaces shall conform to SSPC VIS 1 and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Reject profile greater than 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with ASTM D7127, using Rmax as the measure of profile height. Record all measurements required in this standard. Measure profile at rate of three test areas for the first 1000 square feet plus one test area for each additional 1000 square feet or part thereof. When surfaces are reblasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Do not attempt to wipe surface clean.

3.5.6 Disposal of Used Abrasive

Dispose of used abrasive off Government property in accordance with

Federal, State, and Local mandated regulations.

3.5.7 Pre-Application Testing For Surface Contamination

3.5.7.1 Pre-Application Testing for Oil and Grease Contamination

Ensure surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION, except that only questionable areas need be checked for beading of water misted onto surface.

3.5.7.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for chloride contamination using the Test Kit described in TEST KIT FOR MEASURING CHLORIDE, SULFATE AND NITRATE IONS ON STEEL AND COATED SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting. One or more readings greater than 3 micrograms per square centimeter of chlorides or 10 micrograms per square centimeter of sulfates or 5 micrograms per square centimeter of nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as discussed in paragraph PRE-PREPARATION TESTING FOR SOLUBLE SALTS CONTAMINATION, allow to dry, and re-test until all required tests show allowable results. Reblast tested and cleaned areas as required. Label all test tubes and retain for test verification.

3.5.7.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Reject contaminated surfaces and retest. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. Provide two additional tests for each failed test or questionable test. Attach test tapes to Daily Inspection Reports.

3.6 MIXING AND APPLICATION OF SEALANT AND COATING SYSTEM

3.6.1 Preparation of Sealant and Coating Materials for Application

Each of the sealant, primer, intermediate, and topcoat materials is a two-component material supplied in separate containers.

3.6.1.1 Mixing Sealant, Primer and Intermediate Coat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time based on its temperature.

3.6.1.2 Mixing Topcoat Material

Do not mix partial kits, or alter mix ratios. Mix polyurethane coating materials in same temperature conditions specified in paragraph DELIVERY AND STORAGE. The polyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or

application will shorten usable pot life. Use a mixer that does not create a vortex. Do not add solvent without specific written recommendation from the manufacturer. No induction time is required, only thorough agitation of the mixed material.

3.6.1.3 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Add all required solvent at time of mixing. Do not add solvent to extend pot life. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. Precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F in hot climates will extend pot life. High humidity at time of mixing and application shortens pot life of the Polyurethane topcoat material. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy primer and intermediate materials	4 hours
Polyurethane topcoat materials	2 hours.

3.6.1.4 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of sealant, primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating or cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.

Maintain air and steel surface temperature between 60 and 100 degrees F during application and the first four hours of cure for epoxy coats and the first eight hours of cure for polyurethane coats. Maintain steel surface temperature more than 5 degrees F above the dew-point of the ambient air for the same period.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coat during appropriate RECOAT WINDOW of preceding coat. If a RECOAT WINDOW is missed, the minimum and maximum primer and intermediate coat thickness may be adjusted to accommodate a FILL COAT, however, requirements for total epoxy coating thickness and total coating thickness will not be modified. Missing more than one RECOAT WINDOW may require complete removal of coating if maximum total coating thickness requirements cannot be achieved.

If coating is not applied during RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, provide GLOSS REMOVAL, apply next coat within 24 hours. If next planned coat is topcoat, apply FILL COAT if required to fill sanding marks. Sanding marks from GLOSS REMOVAL of intermediate coat reflecting through topcoat will be considered as

noncompliant. Apply FILL COAT within 24 hours of GLOSS REMOVAL, then apply topcoat within RECOAT WINDOW of FILL COAT.

RECOAT WINDOWS						
EPOXY OVER EPOXY						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
POLYURETHANE OVER EPOXY						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
POLYURETHANE OVER POLYURETHANE						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

FILL COAT - Where indicated, apply coat of intermediate coat epoxy, at 2

to 3 mils DFT, then apply next specified full coat within recoat window of FILL COAT. A FILL COAT may be used to adjust coating thickness to comply with requirements or to fill sanding marks in intermediate coat.

GLOSS REMOVAL - Where required, hand sand in a linear fashion to remove gloss using 120-200 grit wet/dry sandpaper, followed by solvent wiping with a clean rag soaked with denatured alcohol to remove all dust. GLOSS REMOVAL of primer coat is to scarify surface and shall consist of removal of approximately 1 mil of coating. If steel is exposed during GLOSS REMOVAL, repair in accordance with paragraph PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING. GLOSS REMOVAL of intermediate coat may include removal of up to 3 mils of coating to avoid excess thickness, prior to application of FILL COAT.

3.6.2 Amine Blush Testing of Epoxy Coat Prior to Overcoating

Test epoxy surfaces prior to application of roof joint sealant, epoxy coat, or polyurethane topcoat for amine blush contamination using the Test Kit described in paragraph TEST KIT FOR IDENTIFYING AMINE BLUSH ON EPOXY SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. Remove any identified contamination using an approved procedure.

3.6.3 Application of Coating System and Joint Sealant

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in paragraph PRE-APPLICATION TESTING FOR SURFACE CONTAMINATION, as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and unusual atmospheric events do not occur. Such atmospheric events as a coastal storm blowing onshore can bring unusual chloride contamination. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. For convenience, stripe coat material may be delivered by spray if followed immediately with brush-out and approved procedures include appropriate controls on thickness. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond 15 feet from the structure perimeter . Cover or protect all surfaces that will not be coated. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of enclosures, portable shelters, or other appropriate controls.

Apply coatings at the following specified thickness:

Coat	Minimum DFT (Mils)	Maximum DFT (Mils)
Primer	3	5
Intermediate	3	5
Top	2	3
Total system	8	13

3.6.3.1 Application of Primer

Apply primer coat, maintaining paint supply container height within 3 feet of the paint nozzle for applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

3.6.3.2 Application of Stripe Coat

Apply a stripe coat of intermediate coat epoxy material within RECOAT WINDOW of primer, allowing sufficient dry time to allow application of intermediate coat within RECOAT WINDOW of primer. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

3.6.3.3 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

3.6.3.4 Non-skid for Stairs and Top

Where non-skid is required, apply a second intermediate coat, and immediately follow with application of non-skid grit, broadcast at the rate of 2 pounds per 100 square feet, and backroll. Apply topcoat as specified.

3.6.3.5 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. The polyurethane topcoat may require multiple passes to achieve desired aesthetics and required thickness. Consult manufacturer for thinning and application procedures for anticipated temperature, humidity, and wind conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat. Retain sample of polyurethane topcoat, from the same batch used to coat structure, to make touch-ups that might be required later.

3.6.3.6 Application of Joint Sealant

Apply joint sealant to back-to-back steel joints that are less that 3/8 inches wide and are not seal welded. Apply sealant to top and bottom, or each side, of narrow joints. Apply sealant within 48 hours of application of the topcoat, and touch-up with topcoat after appropriate cure of the sealant.

3.6.3.7 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with SSPC SP 10/NACE No. 2, and feather coating as required to leave 4 inches of each succeeding coat feathered and abraded. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceeding coat. Within four hours of preparation, apply zinc-rich primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system.

3.6.3.8 Structure Occupancy After Coating Application

Use clean canvas or other approved shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

3.7 PROJECT IDENTIFICATION

At the completion of the work, stencil the following information on the tank exterior adjacent to the main manway opening in 3/4 to one inch Helvetica style letters of contrasting color using acrylic stencil paint:

Date exterior coated:
Project Number:
Contractor:
Address:
Coating System
Surface Prep: SSPC SP ____ Profile: _____
Primer: _____ Thickness: ____
Intermediate: _____ Thickness: ____
Topcoat: _____ Thickness: ____
Total Thickness: _____

3.8 FIELD QUALITY CONTROL

For marking of tank surfaces, use chalk for marking bare steel, and water based markers for marking coated surfaces, and remove marks prior to coating. Do not use any wax or grease based markers, or any other markers that leave a residue or stain.

3.8.1 Coating Inspector

The coating inspector shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00 QUALITY CONTROL. The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities as specified in Section 01 45 00 QUALITY CONTROL. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the QC inspection and reporting

requirements specified in Section 01 45 00 QUALITY CONTROL.

3.8.2 Field Inspection

3.8.2.1 Inspection Requirements

Perform field inspection in accordance with ASTM D3276 and the approved Coating Work Plan. Document Contractor's compliance with the approved Coating Work Plan.

Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation to document a particular process or condition, as follows:

a. Location or area;
b. Purpose (required or special);
c. Method;
d. Criteria for evaluation;
e. Results;
f. Determination of compliance;
g. List of required rework;
h. Observations.

Collect and record Environmental Conditions as described in ASTM D3276 on a 24 hour basis, as follows:

a. During surface preparation, every two hours or when changes occur;

b. During coating application and the first four days of initial cure, every hour, or when changes occur;

c. Note location, time, and temperature of the highest and lowest surface temperatures each day;

d. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed.

Document Contractors compliance with the approved Coating Work Plan.

3.8.2.2 Inspection Report Forms

Develop project-specific report forms as required to report measurements, test results, and observations being complete and and conforming to contract requirements. This includes all direct requirements of the contract documents and indirect requirements of referenced documents. Show acceptance criteria with each requirement and indication of conformity of each inspected item. The data may be in any format, but must be legible and presented so that entered data can be quickly compared to the appropriate requirement.

3.8.2.3 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01 45 00 QUALITY CONTROL. Each report shall be signed by the coating inspector and the QC Manager. Submit report within 24 hours of date recorded on the report.

3.8.2.4 Inspection Logbook

A continuous record of all activity related to this Section shall be maintained in an Inspection Logbook on a daily basis. The logbook shall be hard or spiral bound with consecutively numbered pages, and shall be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. The Coating Inspector's Logbook that is sold by NACE is satisfactory. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

3.8.2.5 Inspection Equipment

All equipment shall be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

3.9 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

TABLE 1

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ia - Zinc-rich Epoxy Primer Coat MIL-DTL-24441/19 Formula 159

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent (zinc dust)	---	---	81.5	85.5	---	---
Volatiles, percent	42.8	44.3	8.0	8.4	---	---
Non-volatile vehicle percent	53.7	57.7	8.3	8.7	---	---
Weight, Kilograms/liter	0.87	1.01	3.30	3.40	2.80	2.91
Weight, Pounds/gallon	7.3	8.4	27.5	28.4	23.4	24.4
Flashpoint, Degrees C	35.6	---	37.8	---	---	---
Flashpoint, Degrees F	96	---	100	---	---	---
Consistency, grams	---	---	250	500	150	300
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance, Micrometers	---	---	---	---	300	---
Sag resistance, Mils	---	---	---	---	12	---
VOC, Grams/liter	---	---	---	---	---	304
VOC, Pounds/gallon	---	---	---	---	---	2.5

TABLE 1

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ia - Zinc-rich Epoxy Primer Coat MIL-DTL-24441/19 Formula 159

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.

NOTES: Test methods as specified in MIL-DTL-24441.

TABLE 1

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ib - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatile vehicle percent	17.5	23.5	44.0	49.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	180	245
Weight, Kilograms/liter	1.39	1.45	1.29	1.35	1.34	1.4
Weight, Pounds/gallon	11.6	12.1	10.8	11.3	11.2	11.7
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint, Degrees C	35.5	---	37.8	---	---	---
Flashpoint, Degrees F	96	---	100	---	---	---
Titanium dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance, Micrometers	---	---	---	---	300	---
Sag resistance, Mils	---	---	---	---	12	---
Color of dry film to approximate color of SAE AMS-STD-595A color 27778	---	---	---	---	---	Conform

TABLE 1

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ib - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Contrast ratio, at 75 micrometers, 3 mils DFT	---	---	---	---	.098	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC, Grams/liter	---	---	---	---	---	340
VOC, Pounds/gallon	---	---	---	---	---	2.8

GENERAL NOTES: Test methods as specified in MIL-DTL-24441.Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.

TABLE I

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ic - Polyurethane TopcoatMIL-PRF-85285 Type II (White and Colors)

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Moisture content, percent	---	2	---	---	---	---
Course particles, percent	---	---	---	---	---	.5
Viscosity	---	---	---	---	---	See Note 1
Fineness of grind, Hegman	---	---	---	---	7	---
Drying to touch (See Note 2)	---	---	---	---	---	4
Dry-hard (See Note 2)	---	---	---	---	---	8
VOC, grams per liter	---	---	---	---	---	340
Color	---	---	---	---	delta E+-1.0	
Gloss 60 degree specular gloss						
Gloss	---	---	---	---	---	90
Semi-gloss	---	---	---	---	15	45
Opacity	---	---	---	---	0.95	---
Flexibility	---	---	---	---	---	Conform
Fluid resistance	---	---	---	---	---	Conform
Heat resistance (cure)	---	---	---	---	---	Conform
Solvent resistance (cure)	---	---	---	---	---	Conform
Condition in container	---	---	---	---	---	Conform
Odor	---	---	---	---	---	Conform
Lead percent	---	---	---	---	---	0.06
Cadmium percent	---	---	---	---	---	0.06

TABLE I

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ic - Polyurethane TopcoatMIL-PRF-85285 Type II (White and Colors)

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Chromium percent	---	---	---	---	---	0.00

NOTES:
(1) Modify paragraph 3.6.4 Viscosity and Pot Life, of MIL-PRF-85285 as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford Cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

(2) Modify paragraph 3.7.1 Drying Time, of MIL-PRF-85285.
When applied by spray techniques and when tested in accordance with ASTM D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

GENERAL NOTES:
Test methods as specified in MIL-PRF-85285, except those marked with "*".
Where "Conform" is indicated, refer to specific requirements of MIL-PRF-85285.

-- End of Section --

SECTION 25 05 11.26

CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS
UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI)
08/24

PART 1 GENERAL

Many subparts in this Section contain text in curly braces ("{" and "}") indicating which cybersecurity control and control correlation identifier (CCI) the requirements of the subpart relate to. The text inside these curly braces is for Government reference only and enables coordination of the requirements of this Section with the RMF process throughout the design and construction process. Text in curly braces are not contractor requirements.

This Section refers to Security Requirements Guide (SRGs) and Security Technical Implementation Guide (STIGs). STIGs and SRGs are available online at the DOD Public Cyber Exchange website at https://public.cyber.mil/stigs/downloads/ and an SRG/STIG Applicability Guide and Collection Tool is available at https://public.cyber.mil/stigs/SCAP/. Not all control system components have applicable STIGs or SRGs. The "Control Systems SRG" does not apply to work performed under this Section; all requirements within this section to apply applicable SRGs DO NOT include the "Control Systems SRG".

1.1 CONTROL SYSTEM APPLICABILITY

There are multiple versions of this Section associated with this project. Different versions have requirements applicable to different control systems. This specific Section applies only to the following control systems: Utility Control System to include Advanced Metering Infrastructure (AMI).

1.2 RELATED REQUIREMENTS

This section does not contain sufficient requirements to procure a control system and must be used in conjunction with other Sections which specify control systems. This Section adds cybersecurity requirements to the utility control systems specified in Division 26 and any other Sections, applicable to the utility control system. As these requirements are conditioned on the control system being provided, there may be requirements in this Section that will not apply to this project. All Sections containing utility control systems or advanced metering components are related to the requirements of this Section. Review all specification sections to determine related requirements.

In cases where a requirement is specified in both this Section and in another Section, the more stringent requirement must be met. In cases where a requirement in this Section conflicts with the requirements of another Section such that both requirements cannot be met at the same time, request direction from the Contracting Officer to determine which requirement applies to the project.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by

the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 802.1x	(2010) Local and Metropolitan Area Networks - Port Based Network Access Control

U.S. DEPARTMENT OF DEFENSE (DOD)

DODD 8140.03-M	(2023) Cyberspace Workforce Qualification and Management Program
DTM 08-060	(2008) Policy on Use of Department of Defense (DoD) Information Systems - Standard Consent Banner and User Agreement

1.4 DEFINITIONS

1.4.1 Administrator Account

An administrator account is an account with full permissions to a device, application, or operating system, including the ability to create and modify other user accounts.

Note that the operating system Administrator Account may be different than Administrator Accounts for applications hosted on that operating system. Also, most controllers will not have any support for accounts and will therefore not have an 'Administrator Account'.

1.4.2 Computer

A computer is one of the following:

a. a device running a non-embedded desktop or server version of Microsoft Windows

b. a device running a non-embedded version of MacOS

c. a device running a non-embedded version of Linux

d. a device running a version or derivative of the Android Operating System, where Android is considered separate from Linux

e. a device running a version of Apple iOS

Unless otherwise indicated or clear from context use of the word "device" in this Section includes computers.

1.4.3 Controller

A device other than a computer or Ethernet switch.

1.4.4 Mission Space

A device or media is in mission space if physical access to the device or media is controlled by the organization served by the device. For example, a variable air volume (VAV) box controller in a suspended ceiling is in mission space if the VAV box serves that room; an electrical

switchgear in an electrical room or an air handling unit (AHU) in a mechanical room or on a rooftop may still be considered to be in mission space if the organization (mission) served by that switchgear or AHU controls access to the electrical room, mechanical room or rooftop.

1.4.5 Network

A network is a group of two or more devices that can communicate using a network protocol. Network protocols must provide a method for addressing devices on the network; a communication method that does not provide an addressing scheme is not a networked form of communication. Devices that communicate using a method of communication that does not support device addressing are not using a network. Addresses may be other than IP addresses, and addressing may be at either Open Systems Interconnection (OSI) layer 2 or layer 3.

1.4.6 Network Connected

A component is network connected (or "connected to a network") only when the device has a network transceiver which is directly connected to the network and implements the network protocol. A device lacking a network transceiver (and accompanying protocol implementation) can never be considered network connected. Note that (unlike many IT definitions of "Network Connected") a device connected to a non-IP network is still considered network connected (an IP connection or IP address is not required for a device to be network connected).

1.4.6.1 Wireless Network Connected

Any device that supports wireless network communication is network connected to a wireless network, regardless of whether the device is communicating using wireless. Unless physically disabled, devices with wireless transceivers support wireless, it is not sufficient to disable the wireless in software.

1.4.7 Network Media

The thing that provides the communication channel between the devices on a network. Typically wire, but might include wireless, fiber optic, or even power line (some network protocols allow sending network signals over power wiring).

1.4.8 User Account Support Levels

The support for user accounts is categorized in this Section as one of three levels:

1.4.8.1 FULLY Supported

Device supports configurable individual accounts. Accounts can be created, deleted, modified, etc. Privileges can be assigned to accounts. These devices support user-based (as opposed to role-based) authentication.

1.4.8.2 MINIMALLY Supported

Device supports a small, fixed number of accounts (perhaps only one). Accounts cannot be modified. A device with only a "User" and an "Administrator" account would fit this category. Similarly, a device with two PINs for logon - one for restricted and one for unrestricted rights

would fit here (in other words, the accounts do not have to be the traditional "username and password" structure). These devices typically only support role-based authentication.

Examples of devices which MINIMALLY support accounts are a) a variable frequency drive with a single account which requires a PIN for access to configuration; and b) a room lighting control touchpad interface that has a single account.

1.4.8.3 NOT Supported

Device does not support any Access Enforcement therefore the whole concept of "account" is meaningless.

1.4.9 Manual Local Input

Manual Local Inputs are system analog or binary inputs that are adjustable by a person but are, by intrinsic hardware design, very limited in potential capabilities. Manual Local Inputs do not have touch screens or full keyboards, but may have a few buttons or dials to allow input. Manual Local Inputs do not have full graphic screens or dot-matrix displays, but may have simple lights (LEDs) or 7-segment displays. Manual Local Inputs do not have any sort of menu structure, each button has a single well-defined function.

Examples of Manual Local Inputs are H-O-A switches, simple thermostats, and disconnect switches.

1.4.10 Card Reader

A card reader is an input/output device whose primary function is to assist in two-factor authentication. A card reader must have an interface to read data from a card and may be able to write data to a card. A card reader may have a means (such as buttons, keypad, touchscreen, etc.) for a user to input a PIN or password, as well as a limited display.

1.4.11 User Interface

A User Interface (UI) is something other than a Manual Local Input or Card Reader that allows a person to interact with the system or device. Note that while a Card Reader is not by itself a User Interface, a User Interface may contain a Card Reader in order for it to authenticate its user. Within control systems, there are a wide range of User Interfaces.

Two important distinctions are 1) whether the user interface is Local or Remote, and 2) the effective capabilities of the User Interface to alter data, which is the "privilege" of the user interface (where effective privilege available to a specific user at a specific user interface is the combination of the greatest privilege offered by the user interface and the specific account the user is logged into).

1.4.11.1 Local User Interface

A Local User Interface is a user interface where the physical hardware the user interacts with (keyboard, buttons, display, etc.) is physically part of the device being affected. All of the relevant characteristics of the user interface are embodied within a single device.

Note that a Local UI may be able to access data in a different device,

Local versus Remote in this context refers to the user interface itself; the capability to access data in a different device is covered under "Full User Interface".

1.4.11.2 Remote User Interface

A Remote User Interface implements a Client/Server model where the physical hardware the user interacts with (Client) is physically distinct from the device being affected (Server). Most or all of the security and functionality characteristics of the user interface are defined by the Server, not the Client. The Client and Server communicate via a network connection. A common example of a remote user interface is a web-based interface where the browser (client) is generally on different hardware than the web server (server). A Remote UI remains a Remote UI even if the user happens to be at a Client on the same hardware as the Server. What is important is that a) the Client may be on different hardware than the Server and b) the majority of the security and functional characteristics of the interface are defined at the Server.

Note that this definition of "remote" is consistent with that generally used in the control industry but is not aligned with the NIST 800-53 definition of "Remote", which refers to "outside the system". The term "Remote" here better aligns with the NIST 800-53 definition of "Network" (remote from within the system) Access.

1.4.11.3 Types of User Interface (by capability)

User interfaces are also categorized by their capabilities as being Read Only, Limited, or Full.

1.4.11.3.1 Read-Only User Interface

A Read Only User Interface (also referred to as a View-Only User Interface) is a user interface that only allows for reading data, it does not allow (have the capability to) modify data. A Read Only User Interface may be either Local or Remote. A User Interface that is configured to be Read Only (by some other means than the interface itself, such as using configuration software on a laptop) is a Read-Only Interface. Note a Read Only User Interface may have buttons (or touch screen, etc.) allowing the user to navigate through the presentation of data.

Examples of a Read Only User Interfaces are a) a publicly viewable "energy dashboard" showing weather data and energy usage within a building and b) digital wayfinding signage.

1.4.11.3.2 Limited User Interface

A Limited User Interface is a user interface that - by design - can only alter information local to the user interface. Note that the determination of "alter" includes only direct interactions, it explicitly excludes interactions that might occur as secondary effects. For example, an interface changing the flow setpoint in a pump controller is a direct interaction, the subsequent change in flow (as well as any subsequent downstream changes in valve position) are not direct interactions.

Two examples of LIMITED UIs are: a) a variable speed drive has a Limited Local User Interface which allows the user to change properties within the drive, but does not allow affecting things outside the drive; and b) a

typical home WiFi Router has a Limited Remote User Interface which allows configuration of the Router, but does not allow direct interaction with other devices.

1.4.11.3.3 Full User Interface

A Full User Interface can alter information in devices outside the device with the user interface. For example, a typical Local Display Panel is a Full Local User Interface while a browser-based front end is a Full Remote User Interface.

1.4.11.3.4 View-Only User Interface

See Read-Only User Interface

1.4.11.4 Other User Interface Terminology

In addition to defining whether a user interface is a Hardware Limited, Read-Only, Limited or Full, and whether it is Local or Remote, user interfaces are classified by whether they are writable or privileged.

1.4.11.4.1 Writable User Interface

Any User Interface that is not Read-Only is Writable. (Limited User Interfaces and Full User Interfaces are both writable user interfaces (as they are capable of changing a value)).

1.4.11.4.2 Privileged User Interface

A Privileged UI is a UI that has sufficient capabilities or functionality that it requires specific cybersecurity measures to be put in place to limit its unauthorized use. Ultimately, whether a specific user interface is considered a Privileged User Interface must be determined by usage. Unless otherwise specified, user interfaces can be determined to be privileged or not using the following:

a. Read-Only User Interfaces are not privileged user interfaces.

b. Full User Interfaces are privileged user interfaces.

c. User interfaces that allow for configuration of auditing or allows for modification or deletion of audit logs are privileged user interface.

d. User interfaces that allow for reprogramming a network connected device is a privileged user interface.

e. Except as specified above, a Limited User Interface must be determined to be privileged or not based on the specific capabilities and use case of the user interface. In general however, user interfaces that do not offer significant capabilities above and beyond those available at that location via other means (e.g. such as a disconnect switch, breaker, or hand-off-auto switch, or physical attack) are not privileged.

1.4.12 Wireless Network

Any network that communicates without using wires or fiber optics as the communication media. Wireless networks include: WiFi, Bluetooth, ZigBee, cellular, satellite, long and short wave radio, 2.4 GHz, free space

optical, point-to-point laser, microwave, and IR.

1.4.13 Wired Broadcast Network

Wired Broadcast Networks are any network, such as powerline carrier networks and modem (wired telephony), that use wire-based technologies where there is not a clearly defined boundary for signal propagation.

1.5 ADMINISTRATIVE REQUIREMENTS

1.5.1 Points of Contact

Coordinate with the following Points of Contact as indicated in this Section and as required. Not all projects will require coordination with all Points of Contact. When coordination is required and no Point of Contact is indicated, coordinate with the Contracting Officer (KO).

a. Government Device Access Point of Contact: Contracting Office (KO)

b. Email Address Point of Contact: Contracting Officer (KO)

c. Password Point of Contact: Contracting Officer (KO)

1.5.2 Coordination

Coordinate the execution of this Section with the execution of all other Sections related to control systems as indicated in the paragraph RELATED REQUIREMENTS. Items that must be considered when coordinating project efforts include but are not limited to:

a. If requesting permission for alternate account lock permissions, the Device Account Lock Exception Request must be approved prior to control system device selection and installation.

b. If the Device Audit Record Upload Software is to be installed on a computer not being provided as part of the control system, coordination is required to identify the computer on which to install the software.

c. Cybersecurity testing support must be coordinated across control systems and with the Government cybersecurity testing schedule.

d. Passwords must be coordinated with the indicated contact for the project site.

e. Contractor Computer Cybersecurity Compliance Statements must be provided for each contractor using contractor owned computers.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Device Account Lock Exception Request; G

Contractor Computer Cybersecurity Compliance Statements; G

Contractor Temporary Network Cybersecurity Compliance Statements; G

Cybersecurity Subject Matter Expert Qualifications; G

SD-02 Shop Drawings

Network Communication, Ports, Protocols and Services Report; G

Cybersecurity Network (Riser) Diagram ; G

SD-03 Product Data

Control System Cybersecurity Documentation; G

SD-06 Test Reports

Control System Cybersecurity Testing Procedures; G

Control System Cybersecurity Testing Report; G

SD-07 Certificates

Software Licenses; G

SD-11 Closeout Submittals

Password Change Summary Report; G

Enclosure Keys; G

Software and Configuration Backups; G

Auditing Front End Software; G

Device Audit Record Upload Software; G

System Maintenance Tool Software; G

Control System Scanning Tools; G

Vendor Guide Compliance Result Report; G

Final Control System Inventory Report; G

1.7 QUALITY CONTROL

1.7.1 Cybersecurity Subject Matter Expert Requirements

For the position listed below resumes should be submitted to the Government within 14 days after notice to proceed. All certifications must be in effect prior to being hired. This position may serve across the contract. This position must meet the indicated requirements in Section 01 35 13.04 30 FACILITY-RELATED CONTROL SYSTEMS PROCUREMENT FOR AIR FORCE CONTROL SYSTEMS and this section.

1.7.2 Cybersecurity Subject Matter Expert Qualifications

The individual will oversee all work within this specification and Section

01 35 13.04 30 FACILITY-RELATED CONTROL SYSTEMS PROCUREMENT FOR AIR FORCE CONTROL SYSTEMS in accordance with Requirements for ICS/FRCS Cybersecurity and Engineering (RICE). This position requires that the individual currently meets Information Assurance Technical Level II Certification in accordance with DODD 8140.03-M. Individuals for this position must have a minimum of five years' experience securing DoD Systems and with RiskManagement Framework. They must also have experience with Facility-Related Control Systems cybersecurity implementation such as control system related training or certification.

1.7.3 Cybersecurity Kickoff Meeting

Within 60 calendar days after contract award, the Cybersecurity Subject Matter Expert must schedule a Cybersecurity Kickoff Meeting with the Contracting Officer, System Owner, System Program Manager, and Information Security Manager (ISSM).

1.8 CYBERSECURITY DOCUMENTATION

{For Government Reference Only: This subpart (and its subparts) relates to PL-7; CCI-003071}

1.8.1 Network Communication, Ports, Protocols and Services Report

{For Government Reference Only: This subpart (and its subparts) relates to CA-9, PL-8; CCI-002102, CCI-002103, CCI-002104, CCI-002105, CCI-003072, CCI-003073, CCI-003075 and also the submittal requirements associated with CM-6, CM-7, including CM-7(3), CCI-000388.}

Provide a Network Communication, Ports, Protocols and Services Report. For each networked device, document device identifier and the communication characteristics of the device including communication protocols, services used, encryption employed, and a general description of what information is communicated over the network. For each device using IP communication, document all TCP and UDP ports used. For each device using non-IP communication, document communication protocol and media used. If other control system Sections used on this project include submittals documenting this information, provide copies of those submittals to meet this requirement.

In addition to the requirements of Section 01 33 00 SUBMITTAL PROCEDURES, provide the Network Communication, Ports, Protocols and Services Report as an editable Microsoft Excel file.

1.8.2 Control System Inventory Reports

{For Government Reference Only: This subpart (and its subparts) relates to CM-8(a), SI-17, IA-3; CCI-000389, CCI-000392, CCI-000398, CCI-002773, CCI-002774, CCI-002775, CCI-000777, CCI-000778, CCI-001958}

Provide a Final Control System Inventory Report, using the Inventory Spreadsheet listed under this Section at https://www.wbdg.org/dod/ufgs/ufgs-25-05-11. In the Control System Inventory Reports, document all devices, including networked devices, network infrastructure devices, non-networked devices, input devices (e.g. sensors) and output devices (e.g. actuators). For each device provide all applicable information for which there is a field on the spreadsheet in accordance with the instructions on the spreadsheet.

In addition to the requirements of Section 01 33 00 SUBMITTAL PROCEDURES, provide the Control System Inventory Reports as editable Microsoft Excel files. Provide the Pre-Construction Control System Inventory Report concurrently with the Proposed STIG and SRG Applicability Report

1.8.3 Software and Configuration Backups

{For Government Reference Only: This subpart (and its subparts) relates to CP-10; CCI-000550, CCI-000551, CCI-000552}

For each device on which software is installed under this project or configuration file is changed, provide a recovery image of the final as-built device. This image must allow for bare-metal restore such that restoration of the image is sufficient to restore system operation to the imaged state without the need for re-installation of software. If additional user permissions are required to meet this requirement, coordinate the creation of the image with the identified Government Device Access Point of Contact.

For all controllers, provide a backup of the controller configuration and the source code for all loaded application programs (all software that is not common to every controller of the same manufacturer and model).

If any or all of these are provided under another Section, provide documentation indicating this and referencing those submittals.

1.8.4 Cybersecurity Network (Riser) Diagram

{For Government Reference Only: This subpart (and its subparts) relates to PL-2(a), PL-8; CCI-003051, CCI-003053, CCI-003072, CCI-003073, CCI-003075}

Provide a cybersecurity network (riser) diagram of the complete control system including all network and device hardware. For each device, include the device identifier, device type, and manufacturer. If the control system specifications require a riser diagram submittal, provide a copy of that submittal as the cybersecurity riser diagram. Otherwise, provide a riser diagram in one-line format.

1.8.5 Vendor Guide Compliance Result Report

For every component (device or software) with manufacturer provided cybersecurity documentation, procedure, or method for secure configuration or installation, provide a report documenting how the component was configured and any deviation from the manufacturer instructions.

1.8.6 Control System Cybersecurity Documentation

{For Government Reference Only: This subpart (and its subparts) relates to SA-5(a),SA-5(b),SA-5(c), SA-22(b); CCIs: CCI-003124, CCI-003125, CCI-003126, CCI-003127, CCI-003128, CCI-003129, CCI-003130, CCI-003131, CCI-003374}

Provide a Control System Cybersecurity Documentation submittal containing the indicated information for each device and software application.

1.8.6.1 Default Requirements for Control System Devices

For control system devices where Control System Cybersecurity Documentation requirements are not otherwise indicated in this Section, provide:

a. Documentation that describes secure configuration of the device {For Government Reference Only: relates to CCI-003124}

b. Documentation that describes secure installation of the device {For Government Reference Only: relates to CCI-003125}

c. Documentation that describes secure operation of the device {For Government Reference Only: relates to CCI-003124}

d. Documentation that describes effective use and maintenance of security functions or mechanisms for the device {For Government Reference Only: relates to CCI-003127}

e. Documentation that describes known vulnerabilities regarding configuration and use of administrative (i.e. privileged) functions for the device {For Government Reference Only: relates to CCI-003128}

f. Documentation that describes user-accessible security functions or mechanisms in the device and how to effectively use those security functions or mechanisms {For Government Reference Only: relates to CCI-003129}

g. Documentation that describes methods for user interaction which enables individuals to use the device in a more secure manner {For Government Reference Only: relates to CCI-003130}

h. Documentation that describes user responsibilities in maintaining the security of the device {For Government Reference Only: relates to CCI-003131}

i. Documentation of the published last date of support by the manufacturer or indication that a published date is not available. {For Government Reference Only: relates to CCI-003374}

1.9 SOFTWARE LICENSING

{For Government Reference Only: This subpart (and its subparts) relates to SI-2(a), SI-2(c), SI-7(14); CCI-001227, CCI-002605, CCI-002737}

For all software provided that has not already been licensed to the government or project site, provide a license to the Government for a period of no less than 5 years, and the license must also include the following software updates:

a. Security and bug-fix patches issued by the software manufacturer.

b. Security patches to address any vulnerability identified in the National Vulnerability Database at http://nvd.nist.gov with a Common Vulnerability Scoring System (CVSS) severity rating of MEDIUM or higher.

Provide a single Software Licenses submittal with documentation of the software licenses for all software provided

1.10 CYBERSECURITY DURING CONSTRUCTION

{For Government Reference Only: This subpart (and its subparts) relates to AC-18, CA-3; CCI-000258}

In addition to the control system cybersecurity requirements indicated in this section, meet following requirement throughout the construction process.

1.10.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. Contractor computers connected to the control system, control system network, or a control system component at any point during construction must meet the following requirements:

1.10.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

1.10.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. Computers used on this project must perform a full antivirus scan at least once per day. Computers which have connected to any other network since the last full antivirus scan must perform a full antivirus scan prior to connection to the control system network or to the temporary contractor-installed IP network. Perform an antivirus scan on all removable media (e.g., external hard drives, CDs, DVDs, USB flash drives) prior to connecting to the control system environment.

1.10.1.3 Passwords and Passphrases

The passwords and passphrases for computers, applications, and web-based applications supporting passwords must be changed from their default values. Passwords must be a minimum of fourteen characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.10.1.4 User-Based Authentication

Each user must have a unique account; sharing of a single account between multiple users is prohibited.

1.10.1.5 Demonstration of Compliance

The Government has the right to require demonstration of computer compliance with these requirements at any time during the project.

1.10.1.6 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer

Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at https://www.wbdg.org/dod/ufgs/ufgs-25-05-11. Each Statement must be signed by a cybersecurity representative for the relevant company.

1.10.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks connected to the control system, control system network, or a control system component at any point during construction must meet the following requirements:

1.10.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than those specifically provided or furnished for this project. Any and all access to the network from outside the project site is prohibited.

1.10.3 Government Access to Network

Government personnel must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification.

1.10.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks, when permitted, must not interfere with existing wireless networks, must use WPA2 security and must not broadcast the network name (SSID). Network names (SSID) for wireless networks must be changed from their default values.

1.10.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters, 15 for network switches with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.10.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at https://www.wbdg.org/dod/ufgs/ufgs-25-05-11. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

1.11 CYBERSECURITY DURING WARRANTY PERIOD

All products used on this project must meet the indicated requirements Section 01 35 13.04 30 FACILITY-RELATED CONTROL SYSTEMS PROCUREMENT FOR AIR FORCE CONTROL SYSTEMS, other referenced sections, and this section, but not all products specified here will be required by every project.

PART 2 PRODUCTS

All products used on this project must meet the indicated requirements, but not all products specified here will be required by every project.

PART 3 EXECUTION

3.1 CYBERSECURITY HARDENING AND CONFIGURATION GUIDES

Install, configure, and harden all hardware and software furnished on this project in accordance with manufacturer provided documentation, procedures, or methods for secure configuration or installation. Do not implement specific hardening actions if that action would conflict with required functionality or another requirement of this Section.

3.2 NETWORK REQUIREMENTS

3.2.1 Non-IP Control Networks

When control system specifications require particular communication protocols, use only those communication protocols and only as specified. Do not implement any other communication protocol.

When control system specifications do not indicate requirements for communication protocols, use only those protocols required for operation of the system as specified.

3.2.2 IP Control Networks

3.2.2.1 IP Network Routers

Do not install any device that performs IP routing.

3.2.3 Device Identification and Authentication

{For Government Reference Only: This subpart (and its subparts) relates to IA-3; CCI-000777, CCI-000778, CCI-001958.}

3.2.3.1 Default Requirements for Control System Devices

For control system devices where Device Identification and Authentication requirements are not otherwise indicated in this Section: Devices using Ethernet must support IEEE 802.1x. Devices using HTTP as a control protocol must use HTTPS instead.

3.3 ACCESS CONTROL REQUIREMENTS

3.3.1 User Accounts

{For Government Reference Only: This subpart (and its subparts) relate to AC-2(a), AC-3, AC-6(1), AC-6(10), AC-6(2), AC-6(9), CM-11(2), and IA-2; CCI-002110, CCI-000213, CCI-001558, CCI-002221, CCI-002222, CCI-002223, CCI-002235, CCI-000039, CCI-001419, CCI-002234, CCI-001812, and CCI-000764. }

3.3.1.1 Controllers

For user interfaces provided by controllers, provide access control in

accordance with the User Interface Requirements table for the applicable control system and user interface type.

a. For table entries of "NA": NA means Not Applicable, there are no interfaces in this category.

b. For table entries of "None Required": The user interface is not required to support user accounts.

c. For table entries of "MINIMALLY": The user interface must at least MINIMALLY support user accounts.

d. For table entries of "FULLY": The user interface must at FULLY support user accounts.

e. For table entries of "KEY": The user interface must have physical security in the form of either a key lock on the interface itself or be furnished inside a lockable enclosure. Where this is required for a read only interface, the lockable enclosure must prevent viewing of data on the interface; for other interfaces, this lockable enclosure must prevent using the interface to alter data.

f. For table entries of "Physical Security": For Local FULL interfaces, the interface must be located inside mission space. For Local Limited (not FULL) interfaces, the user interface must either a) be located within mission space or b) be protected by physical security at least as good as the control devices (and equipment controlled by the control devices) affected by the interface. For purposes of this requirement, 'affected' includes controllers with data that can be directly altered by the interface, as well as mechanical and/or electrical equipment directly controlled by those controllers, but does not include other interactions.

g. Entries of the form "X and Y" must meet both the requirement indicated for X and the requirement indicated for Y. For example, an entry of "MINIMALLY and Physical Security" indicates the user interface must both MINIMALLY support accounts and have physical security.

h. Entries of the form "X or Y" must meet either the requirement indicated for X or the requirement indicated for Y.

3.3.1.1.1 Default Requirements for Other Control Systems

For control system devices where User Interface Requirements are not otherwise indicated in this Section, use the Default User Interface Requirements tables.

Default User Interface Requirements for LOW Impact Control Systems	
User Interface Type	**Access Control Requirement**
Local Read Only (see note 1)	None Required
Local Limited, Non-privileged	None Required
Local Limited, Privileged	MINIMALLY

Default User Interface Requirements for LOW Impact Control Systems	
User Interface Type	**Access Control Requirement**
Local Full	MINIMALLY
Remote Read Only	None Required
Remote Limited, Non-Privileged	MINIMALLY
Remote Limited, Privileged AND Remote Full (see note 2)	FULLY
Notes: 1)Local Read Only User Interfaces are always Non-Privileged 2)Remote Full User Interfaces are always Privileged	

3.3.2 Unsuccessful Logon Attempts

{For Government Reference Only: This subpart (and its subparts) relate to AC-7 (a), AC-7 (b); CCI-000043, CCI-000044, CCI-001423, CCI-002236, CCI-002237, CCI-002238}

Except for high availability user interfaces indicated as exempt, devices must meet the indicated requirements for handling unsuccessful logon attempts. If a device cannot meet these requirements, document device capabilities to protect from subsequent logon attempts and propose alternate protections in a Device Account Lock Exception Request submittal. Do not implement alternate protection measures in lieu of the indicated requirements without explicit permission from the Government. If no Device Account Lock Exceptions are requested, provide a document stating that no approval is being requested as the Device Account Lock Exception Request.

3.3.2.1 Devices MINIMALLY Supporting Accounts

For LOW Impact Systems: Devices which MINIMALLY (but not FULLY) support accounts must lock the user account after five consecutive failed login attempts and must unlock the user account after 15 minutes have elapsed without an unsuccessful login attempt or by a successful login to a separate administrator account.

3.3.2.2 High Availability Interfaces Exempt from Unsuccessful Logon Attempts Requirements

There are no high availability interfaces which are exempt from unsuccessful logon attempts requirements.

3.3.3 System Use Notification

{For Government Reference Only: This subpart (and its subparts) relates to AC-8; CCI-000048, CCI-002247, CCI-002243, CCI-002244, CCI-002245, CCI-002246, CCI-000050, CCI-002248}

3.3.3.1 System Use Notification for Remote User Interfaces

Remote user interfaces must display a warning banner meeting the requirements of DTM 08-060 on screen.

3.3.3.2 System Use Notification for Local User Interfaces

Devices which are connected to a network and have a local user interface must display a warning banner meeting the requirements of DTM 08-060 on the user interface screen if capable of doing so and must have a permanently affixed label with an approved banner from DTM 08-060 if unable to display the warning banner on the screen. Where it is impractical (perhaps due to device size) to affix the label to the device, affix the label to the device enclosure.

Labels must be machine printed or engraved, plastic or metal, designed for permanent installation, must use a font no smaller than 14 point, and must provide a high contrast between font and background colors.

3.3.4 Permitted Actions Without Identification or Authentication

{For Government Reference Only: This subpart (and its subparts) relates to AC-14; CCI-000061, CCI-000232}

The control system must require identification and authentication before allowing any actions except read-only actions by a user acting from a user interface which MINIMALLY or FULLY supports accounts.

3.3.5 Enclosures

Prior to final acceptance of the system, lock all lockable enclosures. Submit an Enclosure Keys submittal with all copies of keys for all enclosures and a key inventory list documenting all keys. Label each key with the matching enclosure identifier.

3.4 USER IDENTIFICATION AND AUTHENTICATION

{For Government Reference Only: This subpart (and its subparts) relates to IA-2, IA-2(1),IA-2(12), IA-5 IA-5(b), IA-5(c), IA-5(e), IA-5(g), IA-5(1), IA-5(11); CCI-000764, CCI-000765, CCI-001953, CCI-001954, CCI-001544, CCI-001989, CCI-000182, CCI-001610, CCI-000192, CCI-000193, CCI-000194, CCI-000205, CCI-001619, CCI-001611, CCI-001612, CCI-001613, CCI-001614, CCI-000195, CCI-001615, CCI-000196, CCI-000197, CCI-000199, CCI-000198, CCI-001616, CCI-001617, CCI-000200, CCI-001618, CCI-002041, CCI-002002, CCI-002003. }

This subpart indicates requirements for specific methods of identification and authentication for users and user accounts. Where these requirements conflict apply the following order of precedence: 1) If present, Device Specific Requirements take precedence over any other requirements; and then 2) multifactor authentication requirements take precedence over password requirements.

3.4.1 User Identification and Authentication for All System Types

Unless otherwise indicated, all user interfaces supporting accounts (either FULLY or MINIMALLY) must implement Identification and Authorization via passwords.

3.4.2 User Identification and Authentication for Specific System Types

System specific requirements are in addition to and supersede those indicated for all system types. When no additional requirements are indicated for a specific system type the requirements for all systems still apply to that system type.

3.4.3 User Identification and Authentication for Specific Devices

There are no additional device specific user interface requirements

3.4.4 Implementation of Identification and Authorization Requirements

Identification and Authorization must be met by one of the following methods:

a. Direct implementation in the user interface.

3.4.5 Password-Based Authentication Requirements

3.4.5.1 Passwords for Software and Applications Running on Computers

All software and applications running on computers supporting password-based authentication must enforce the following requirements:

a. Minimum password length of 14 characters

b. Password must contain at least one uppercase character.

c. Password must contain at least one lowercase character.

d. Password must contain at least one numeric character.

e. Password must contain at least one special character. The list of supported special characters must include at least 4 separate characters.

f. Password must have a minimum lifetime of 24 hours.

g. Password must have a maximum lifetime of 60 days. When passwords expire, prompt users to change passwords. Do not lock accounts due to expired passwords.

h. Password must differ from previous five passwords, where differ is defined as changing at least 50 percent of the characters (where location is significant, a character may be reused if it is in a different position).

i. Passwords must be cryptographically protected during storage and transmission.

3.4.5.2 Passwords for Devices Minimally Supporting Accounts

Devices MINIMALLY supporting accounts must support passwords with a minimum length of four characters.

3.4.5.3 Password Configuration and Reporting

For all devices with a password, coordinate the changing of passwords with

the project site following testing of the system but prior to turnover to the Government. Coordinate with Password Point of Contact to determine appropriate project site personnel to complete password changes. Accompany identified personnel to each device with a password and instruct personnel on the process of changing password. Record the time, date and personnel present when each device's password is changed and submit a Password Change Summary Report documenting this information.

Provide the Password Summary Report electronically in both PDF and Microsoft Excel.

3.4.6 Authenticator Feedback

{For Government Reference Only: This subpart relates to IA-6; CCI-000206}

Devices must never show authentication information, including passwords, on a display. Devices that momentarily display a character as it is entered, and then obscure the character, are acceptable. For devices that have STIGs or SRGs related to obscuring of authenticator feedback (CCI-000206), comply with the requirements of those STIGS/SRGs.

3.5 CYBERSECURITY AUDITING

3.5.1 Audit Events, Content of Audit Records, and Audit Generation

{For Government Reference Only: This subpart (and its subparts) relates to AU-2(a), AU-2(c), AU-2(d), AU-3, AU-10, AU-12, AU-14(b), AU-14(1), AU-14(2), AU-14(3), CM-5(1), SC-7 (9); CCI-000123, CCI-001571, CCI-000125, CCI-001485, CCI-000130, CCI-000131, CCI-000132, CCI-001230, CCI-000133, CCI-000134, CCI-001487, CCI-000166, CCI-001899, CCI-000169, CCI-001459, CCI-000171, CCI-000172, CCI-001910, CCI-001914, CCI-001919, CCI-001464, CCI-001462, CCI-001920, CCI-001814, CCI-002400. }

If auditing requirements can be met using existing control system alarm or event capabilities, those existing capabilities may be used to meet these requirements.

3.5.1.1 Default Requirements for Control System Controllers

For control system controllers where Audit Events, Content of Audit Records, and Audit Generation are not otherwise indicated in this Section:

3.5.1.1.1 Controllers Which Do Not FULLY Support Accounts

For each controller which does not FULLY support accounts configure the controller to audit all controller shutdown and startup events and to record for each event the type of event and when the event occurred.

3.5.2 Audit Time Stamps

{For Government Reference Only: This subpart (and its subparts) relates to AU-8; CCI-000159, CCI-001889, CCI-001890.}

Any device (computer or controller) generating audit records must have an internal clock capable of providing time with a resolution of one second. Clocks must not drift more than 10 seconds per day. Configure the system so that each device (computer or controller) generating audit records maintains accurate time to within 1 second. Note that if the control system specifications include requirement for clocks, the most stringent

requirement applies.

3.5.3 Auditing Front End Software

The project site currently has the following software to support control system auditing: none. If there is no existing auditing front end software or the software is not compatible with the provided control systems, provide Auditing Front End Software with audit log import and upload, export, notification, and analysis functionality. The Auditing Front End Software may be provided as a component of the control system front end or as a separate software package, and a single package may serve multiple control systems provided under the same projects if they are sharing a cybersecurity authorization.

When the Auditing Front End Software is neither existing nor installed under the requirements of another Section, furnish the Auditing Front End Software media and license for subsequent Government installation. Submit copies of Auditing Front End Software if this function is not part of the software provided with the control system to meet requirements of other Sections.

3.5.3.1 Import and Upload Requirements

Auditing Front End Software must be capable of importing audit logs from the Device Audit Record Upload Software and of uploading audit logs over the network from all control system devices supporting network upload of audit logs.

3.5.3.2 Export Requirements

Auditing Front End Software must be capable of exporting to a file format supported by Microsoft Excel.

3.5.4 Audit Storage Capacity and Audit Upload

{For Government Reference Only: This subpart (and its subparts) relates to AU-4; CCI-001848, CCI-001849}

The creation of audit records must never interfere with normal device operation. Devices must cease collection of auditing information if required to maintain normal operation.

a. For controllers capable of generating audit records, provide 60 days worth of secure local storage, assuming 10 auditable events per day.

3.5.4.1 Device Audit Record Upload Software

For each device (computer or controller) required to audit events and for which audit logs cannot be uploaded over the network by the Auditing Front End Software, provide and license to the Government software implementing a secure mechanism of uploading audit records from the device and exporting them to the Auditing Front End Software. Where different devices use different software, provide software of each type required to upload audit logs from all devices.

Submit copies of device audit record upload software if this function is not part of the software provided with the control system to meet requirements of other Sections. If there are no devices requiring this software, provide a document stating this in lieu of this submittal.

3.5.5 Response to Audit Processing Failures

{For Government Reference Only: This subpart (and its subparts) relates to AU-5; CCI-000139, CCI-000140, CCI-001490.}

In the case of a failure in the auditing system, computers associated with auditing must provide email notification. In case of an audit failure, if possible, continue to collect audit records by overwriting existing audit records.

3.6 REQUIREMENTS FOR LEAST FUNCTIONALITY

{For Government Reference Only: This subpart (and its subparts), along with the Network Communication, Ports, Protocols and Services Report submittal specified elsewhere in this section, relates to CM-6(a), CM-6(c), CM-7, CM-7(1)(b), SC-41; CCI-000363, CCI-000364, CCI-000365, CCI-001588, CCI-001755, CCI-000381, CCI-000380, CCI-000382, CCI-001761, CCI-001762, CCI-002544, CCI-002545, CCI-002546. }

For devices that have a STIG or SRG related to Requirements for Least Functionality (such as configuration settings and port and device I/O access for least functionality), install and configure the device in accordance with that STIG or SRGs.

3.6.1 Device Capabilities

Do not provide devices with remote user interfaces or with full user interfaces where one was not required. Do not use a networked sensor or actuator where a non-networked sensor or actuator would suffice.

3.6.2 Software

Do not install software that is not specifically required to meet a contract requirement. Remove any previously installed that is not specifically required to meet a contract requirement. Do not implement functionality within software
that is not specifically required to meet contract requirements.

3.7 SYSTEM AND COMMUNICATION PROTECTION

3.7.1 Collaborative Computing

{For Government Reference Only: This subpart relates to SC-15(a), SC-15(b); CCI-001150, CCI-001152.}

Without explicit approval from the project site, control systems must not use collaborative computing technologies.

3.7.2 Denial of Service Protection

{For Government Reference Only: This subpart relates to SC-5, SC-12, SC-7(a); CCI-001093, CCI-002385, CCI-002386, CCI-002430, CCI-001097. }

To the greatest extent practical, implement control logic without reliance on the network. Except when required to meet the requirements of the control system Section (where the requirement can only be met using computer hardware), do not implement control logic in computers.

3.8 SAFE MODE AND FAIL SAFE OPERATION

{For Government Reference Only: This subpart (and its subparts) relates to CP-12, SI-10(3), SI-17; CCI-002855, CCI-002856, CCI-002857, CCI-002754, CCI-002773, CCI-002774, CCI-002775}

For all control system components with an applicable STIG or SRG, configure the component in accordance with all applicable STIGs and SRGs.

3.9 SYSTEM MAINTENANCE TOOL SOFTWARE

{For Government Reference Only: This subpart (and its subparts) relates to MA-3; CCI-000865.}

Submit and license to the Government all software required to operate, maintain and modify the control system such the Government or their agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor, Vendor or Manufacturer. Submit hard copies of user manuals for each software with the software submittal. Provide any hardware keys or dongles, software keys, license numbers, and other information required to enable the Government to access or change the system.

For software provided and licensed to the Government under the requirements of another Section, submit a statement indicating the Section and Submittal under which the software was provided. For software provided to meet the requirements of this Section and not provided and licensed under another Section, submit software and software user manuals on DVD or CD as a Technical Data Package and submit two hard copies of the software user manual for each piece of software.

3.10 DEVICE POWER

{For Government Reference Only: This subpart (and its subparts) relates to PE-11, PE-11(1); CCI-002955, CCI-000961. }

For LOW Impact Systems: Provide emergency power in accordance with the control system and equipment specification Sections.

3.11 VULNERABILITY SCANNING

{For Government Reference Only: This subpart (and its subparts) relates to RA-5 RA-5(a),RA-5(b),RA-5(c),RA-5(d); CCI-001054, CCI-001055, CCI-000156, CCI-001641, CCI-001643, CCI-001057, CCI-001058, CCI-001059. }

All IP devices must be scannable, such that the device can be scanned by industry standard IP network scanning utilities without harm to the device, application, or functionality.

3.11.1 Controllers

Provide controllers that are scannable by standard control system discovery tools or control system browsers and return meaningful status information including the network inputs and outputs for the controller. This information must contain sufficient detail to detect vulnerabilities or exploits of the controller.

Provide all software needed to scan the control system as the Control System Scanning Tools submittal. If the software required to scan the

system is already installed at the project site or is provided under a separate section instead provide a statement indicating this.

3.12 CONTROL SYSTEM CYBERSECURITY TESTING

3.12.1 Control System Cybersecurity Testing Procedures

Prepare and submit Control System Cybersecurity Testing Procedures explaining step-by-step, the actions and expected results that will demonstrate that the control system meets the requirements of this Section. The Control System Cybersecurity Testing Procedures may be submitted as a Technical Data Package.

3.12.2 Control System Cybersecurity Testing Execution

Using the Control System Cybersecurity Testing Procedures verify that the control system meets the requirements of this Section. UNLESS GOVERNMENT WITNESSING OF A TEST IS SPECIFICALLY WAIVED BY THE GOVERNMENT, PERFORM ALL TESTS WITH A GOVERNMENT WITNESS. If testing reveals deficiencies in the system, correct the deficiency and retest until successful.

3.12.3 Control System Cybersecurity Testing Report

Prepare and submit a Control System Cybersecurity Testing Report documenting all tests performed and their results. Include all tests in the Control System Cybersecurity Testing Procedures and any additional tests performed during testing. Document test failures and repairs conducted with the test results. The Control System Cybersecurity Testing Report may be submitted as a Technical Data Package

3.13 FIELD QUALITY CONTROL, CYBERSECURITY VALIDATION SUPPORT

In addition to testing and testing support required by other Sections, provide a minimum of 16 hours of technical support for cybersecurity testing of control systems to support the DoD Risk Management Framework process Cybersecurity assessment of the control system. This support is independent of (and in addition to) the Control System Cybersecurity Testing specified in this section.

3.14 CYBERSECURITY TRAINING

Provide on-site training for 8 hours for 15 Government personnel or Government representatives to show how to operate, maintain, troubleshoot, repair, and reconfigure/reprogram the systems. Include hands-on training during the on-site training. Develop and provide an operator manual with step-by-step instructions (with screenshots) showing how to perform key operational and maintenance/troubleshooting tasks.

Develop and provide a systems administration manual for IT components with step-by-step instructions (w/screenshots) showing how to perform key operational and maintenance/troubleshooting tasks such as user account maintenance, controlled startup/shutdown procedures, backup/restore procedures, software license maintenance, and database maintenance tasks.

Modify the operator and systems administration manuals based on feedback received as a result of the training session.

The Government will provide the training location.

-- End of Section --

SECTION 26 05 48

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
11/23

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-22	(2022; Supp 1 2023; Supp 2 2023) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.22M	(1981; R 2017) Metric Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2025) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2023) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A563	(2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM B695	(2021) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM F436	(2011) Hardened Steel Washers
ASTM F959/F959M	(2017a; R 2023) Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series

ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2024) International Building Code

METAL FRAMING MANUFACTURERS ASSOCIATION (MFMA)

MFMA-4	(2004) Metal Framing Standards Publication

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2023; with Change 4, 2025) Structural Engineering

VIBRATION ISOLATION AND SEISMIC CONTROL MANUFACTURERS ASSOCIATION (VISCMA)

VISCMA 413	(2014) Installing Seismic Restraints for Electrical Equipment

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

Design and provide seismic supports and attachments in accordance with UFC 3-301-01 and ASCE 7-22.

Provide seismic supports and attachments as indicated and in accordance with UFC 3-301-01 and ASCE 7-22.

Components, supports, and attachments must comply with following structural design criteria:

Risk Category: II.
Seismic Design Category: D.
Seismic Design Spectral Response Acceleration Parameter at Short Period (SDS): 2.16 g.
Seismic Design Spectral Response Acceleration Parameter at period of 1 second (SD1): 0.63 g.

Apply the seismic requirements described in this section and on the drawings to the electrical components listed in paragraph ELECTRICAL COMPONENTS.

Electrical components and their supports must be attached or anchored to structure.

1.2.2 Electrical Components

Provide seismic supports and attachments for the following electrical components in accordance with the requirements of this specification:

Components with Importance Factor (Ip) = 1.0:
Control Panels
Transformers
Utility and Service Lines

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Requirements; G

SD-03 Product Data

Equipment Requirements; G

Anchors; G

SD-06 Test Reports

Anchors; G

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

Submit detail drawings of supports and attachments along with calculations, catalog cuts, templates, and erection and installation details, as appropriate, for the items listed in paragraph ELECTRICAL COMPONENTS. Indicate thickness, type, grade, class of metal, and dimensions; and show construction details, reinforcement, anchorage, and installation with relation to the building construction.

Submit calculations and drawings that are stamped and signed by Contractor's registered professional engineer. Design must be based on actual equipment and system layout. Design must include calculated loads and capacity of materials utilized for the connection of the equipment or system to the structure. Analysis must detail anchoring methods. Include drawing for Designated Seismic System Equipment indicating the equipment location in the facility to be used for the installation. Equipment must be rigidly or flexibly mounted as indicated. Roof mounted equipment both vibration isolated and nonisolated, must have support members designed and anchored to building structure.

2.1.1 Rigidly (Base and Suspended) Mounted Equipment

The following specific items of equipment must be constructed and assembled to withstand the seismic forces specified in UFC 3-301-01 . Entirely locate each item of rigid electrical equipment and rigidly attach on one side only of a building expansion joint. Provide items such as

electrical conduit, which cross the building expansion joint with flexible joints that are capable of accommodating displacements equal to the full width of the joint in each orthogonal direction.

Transformers

Equipment furnished under this Contract must be rigidly mounted using cast-in-place anchor bolts or post-installed anchors that are qualified for use in cracked concrete. Cast-in-place anchor bolts must conform to ASTM F1554. For any rigid equipment which is rigidly anchored, provide flexible joints for electrical conduit, cabletray, busway, and raceway, that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.

2.2 SUPPORTS AND ATTACHMENTS

Material used for members listed in this section and on the drawings, must conform with the following:

a. Angles, ASTM A36/A36M.

b. Channels (Struts) with in-turned lips and associated hardware for fastening to channels at discrete points conforming to MFMA-4.

c. Fasteners:

(1) High-strength bolts, ASTM F3125/F3125M, Grade A325, heavy hex.

(2) Nuts, ASTM A563. Use heavy hex nuts for high strength bolts and anchor bolts.

(3) Washers, ASME B18.22M and ASME B18.21.1, except use ASTM F436 washers for high strength bolts.

(4) Galvanized coating, ASTM A153/A153M.

(5) Direct Tension Indicator Washers, ASTM F959/F959M. Provide ASTM B695, Class 55, Type 1 galvanizing. Submit product data for direct tension indicator washers.

(6) Standard bolts, ASTM A307.

d. Anchor bolts:

(1) Cast in anchors: Refer to Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS for requirements.

(2) Post-installed anchors: Refer to Section 05 05 20 POST-INSTALLED CONCRETE AND MASONRY ANCHORS for requirements.

PART 3 EXECUTION

3.1 SUPPORTS AND ATTACHMENTS

Provide supports and attachments with continuous load path to distribute electrical component seismic loads to structure.

Provide supports and attachments for electrical components that conform to UFC 3-301-01 requirements. Install vertical diagonal braces at a

45-degree slope. Where interference is present, the slope may be minimum of 30 degrees or a maximum of 60 degrees per VISCMA 413.

Provide bolted and welded connections for supports and attachments in accordance with UFC 3-301-01.

Provide welding in accordance with AWS D1.1/D1.1M.

3.2 CONDUIT, CABLETRAY, BUSWAY, AND RACEWAY

Provide supports and attachments for conduit, cabletray, busway, and raceway conforming to the requirements of UFC 3-301-01.

3.3 ANCHORS

3.3.1 General

Submit copies of test results to verify the adequacy of the specific anchor and application, as specified. Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices allowing adequate edge distance and embedment depth for restraint anchor bolts. Identify position of reinforcing steel and other embedded items prior to drilling holes for post-installed anchors. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3.3.2 Cast-In-Place Anchors

Use templates to locate cast-in-place bolts accurately and securely in formwork. Provide anchor bolts with an embedded straight length with heavy hex nut and washer as to provide required strength and ductility. Anchor bolts that exceed the normal depth of equipment foundation piers or pads must either extend into concrete floor or the foundation or increase depth of the piers or pads to accommodate bolt lengths.

3.3.3 Post-Installed Anchors

Refer to Section 05 05 20 POST-INSTALLED CONCRETE AND MASONRY ANCHORS for requirements.

3.4 EQUIPMENT SUPPORT REQUIREMENTS

3.4.1 Suspended Equipment

Provide supports and attachments for components supported from structural systems. Provide supports and attachments that consist of angles, rods, wire rope, bars, channels (struts) or pipes arranged as shown in bracing submittals and secured at both ends with not less than 1/2 inch bolts. Provide sufficient supports and attachments to resist seismic forces as specified in UFC 3-301-01 without exceeding capacity of structural components. Provide, for approval, specific force calculations in accordance with UFC 3-301-01 for the project.

Submit details of supports and attachments for acceptance. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight when

hangers are inclined. Where interference is present, the inclined hanger slope may be minimum of 30 degrees or a maximum of 60 degrees per VISCMA 413.

3.4.2 Floor or Pad Mounted Equipment

3.4.2.1 Shear Resistance

Bolt components to floor or pads. Provide bolts to resist seismic forces in accordance with paragraph ANCHORS.

3.4.2.2 Overturning Resistance

Use the ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads to determine if overturning forces need to be considered in the sizing of anchor bolts. Provide calculations to verify the adequacy of the anchor bolts for combined shear and tension. Provide bolts to resist seismic forces in accordance with paragraph ANCHORS.

3.5 SPECIAL INSPECTION FOR COMPONENTS, SUPPORTS, AND ATTACHMENTS

Perform special inspections for seismic-resisting systems, designated seismic systems, components, supports and attachments, and equipment per Section 01 45 35 SPECIAL INSPECTION attachment Schedule of Special Inspections and ICC IBC 1705.13.4; electrical components per ICC IBC 1705.13.6.

Special Inspector must inspect and test items required in Schedule of Special Inspections and Statement of Special Inspection.

Special Inspector must examine Designated Seismic Systems requiring seismic qualification in accordance with ASCE 7-22 and verify the label, anchorage and mounting conform to the certificate of compliance.

Provide a Final Special Inspection Report in accordance with UFC 3-301-01.

-- End of Section --

SECTION 26 05 73

POWER SYSTEM STUDIES
08/23

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1584	(2018; E 2019) Guide for Performing Arc-Flash Hazard Calculations
IEEE 1584.1	(2022) Guide for the Specification of Scope and Deliverable Requirements for an Arc-Flash Hazard Calculation Study
IEEE 3002.2	(2018) Recommended Practice for Conducting Load-Flow Studies and Analysis of Industrial and Commercial Power Systems
IEEE 3002.3	(2018) Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems
IEEE C2	(2023) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70E	(2024) Standard for Electrical Safety in the Workplace

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-560-01	(2017; with Change 3, 2023) Operation and Maintenance: Electrical Safety

1.2 SYSTEM DESCRIPTION

The power system covered by this specification consists of: Apron High Mast lighting.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Field Examination Plan; G

Arc Flash Label Formats; G

SD-06 Test Reports

Field Examination

SD-07 Certificates

System Analyzer; G

SD-11 Closeout Submittals

Model Files; G

Load Flow Study; G

Fault Current Study; G

System Coordination Study; G

Arc Flash Hazard Study; G

1.4 QUALITY ASSURANCE

1.4.1 System Analyzer

The System Analyzer must perform the power system studies. The System Analyzer must be a registered professional electrical engineer with a minimum of 3 years of experience with power system studies. Include a list of three comparable jobs performed by the System Analyzer with specific names and telephone numbers for reference. Include the license number and state of the registered Professional Engineer.

1.4.2 System Verifier

The System Verifier may inspect and record settings, markings, and otherwise document the existing equipment. The System Verifier may also place appropriate hazard labels on equipment. The System Verifier must not make any calibrations or adjustments or place equipment into service. When working with energized equipment, the system verifier must be a Qualified Person per NFPA 70E or working under the direct supervision of a Qualified Person. The System Verifier may communicate with the system owner to determine if the equipment within the studied system has received maintenance and testing in accordance with NETA MTS or NFPA 70B.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 FIELD EXAMINATION

For each pre- and post-study inspection, submit a field examination plan identifying which facilities must be examined to complete the required work. Include a complete information verification procedure, where Qualified Personnel will be required, PPE requirements for "live" equipment examinations, and equipment to be used within the limited approach boundary of the equipment.

3.1.1 General

Perform field inspections of the site and equipment before the first study and after the last study to determine the state and settings of the equipment and to verify the final settings agree with the studies. Perform the post-study inspection(s) after changing settings, after performing acceptance tests, and before placing equipment in service.The post-study inspection may be performed by the testing organization approved in 26 08 00 APPARATUS INSPECTION AND TESTING.

Schedule the field examination by the System Verifier with the Contracting Officer at least 10 business days before conducting examination. Furnish all materials, labor, and equipment necessary to conduct the examination. Maintain a written record of the all equipment examined, equipment location, equipment ratings, settings, personnel involved, and the date the examination was performed. Submit the written record of each field examination.

3.1.2 Safety

Where examination of the equipment requires energized equipment to be opened, provide a Qualified Person to directly supervising any non-Qualified Person within the hazard area. Use PPE, protective barriers, danger signs and other safety devices to protect and warn personnel in the vicinity of "live" equipment being examined.

3.1.3 Application of Arc Flash Labels

Install arc flash warning labels using Qualified Personnel as necessary after the setting and inspection is complete. For new or modified equipment, install labels before the equipment is energized for the first time after installation/modification or setting changes. Schedule the label placement with the Contracting Officer at least 5 business days before label placement. Furnish all materials, labor, and equipment necessary to place the labels. Maintain a written record of the all equipment that received labels, personnel involved, and the date labels were placed.

3.2 POWER SYSTEM STUDIES

Perform power system studies to demonstrate that the equipment selected and system constructed meet the contract requirements for fault current and interrupt ratings, coordination, protection, and Arc Flash Hazard. Submit reports of the studies along with protective device equipment submittals. Apply Arc Flash Hazard labels to equipment after the studies are approved. Update and resubmit the studies after any changes to the equipment or systems which may affect the study results, and re-apply Arc Flash Hazard labels to equipment after the resubmitted studies are approved. The Government is not responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices or labels ordered and/or procured before approval of the study.

Perform power system studies to demonstrate the system operation with regard to ratings, coordination, protection, and Arc Flash Hazard.

3.2.1 Scope of Studies

The scope of the studies must begin at the source bus and extend through outgoing medium voltage feeders, down to the individual protective devices for medium voltage radial taps and outgoing medium voltage feeders, through the secondary side of transformers for main electric supply substations. and the utility service entrance of a building and extend down to load buses/panels where the fault current is 2,000 amperes or less (symmetrical) for distribution buses nominally operating at 208 volt AC and above.

The "source bus" is the source of energy for system being analyzed. This may be the energy feed from a utility, the first bus upstream of the work, generators within the work or upstream of the work, or any other source capable of contributing significant energy into the system being analyzed.

In the systems model for the studies, incorporate all existing and new equipment within the scope of the studies. Incorporate any additional sources or load equipment necessary to accurately model the system's performance.

Where multiple sources of power may be in service in various combinations or where electrical loops are in the system, incorporate into the studies all the modes of operation to evaluate the impact of the modes of operation on the system.

3.2.2 Determination of Facts

Determine and document the time-current characteristics, features, ratings, ampacities, and nameplate data for each existing protective device, electrical equipment, and feeder cables. Obtain the available fault current from the owner of the source bus.

3.2.3 Single Line Diagram

Provide a single line diagram showing the electrical system buses, devices, transformation points, and all sources of load current and fault current, including generator and motor contributions. Provide a diagram from the system model. Each bus, device or transformation point must have a unique identifier. Show the location of switches, breakers, and circuit interrupting devices on the diagram together with available fault data, and the device interrupting rating.

The naming of existing components within the system model and single line diagram must match existing installed equipment names. The naming of new components within the system model and single line diagram must use unique identifiers and be coordinated with the Government.

3.2.4 Load Flow Study

Perform the load flow study in accordance with IEEE 3002.2 to identify initital steady-state conditions for the fault current study. For each operating scenario, provide load flow results on the diagram or in the report. Show or describe the loading factors and assumptions used in each operating mode.

3.2.5 Fault Current Study

Use the results of the load flow study to perform the fault current study in accordance with IEEE 3002.3. Provide balanced three-phase fault, bolted line-to-line fault, and single line-to-ground fault current values at each voltage transformation point and at each power distribution bus. For each location, show in tabular form on the diagram or in the report the maximum and minimum available fault currents of all modes of operation for that location.

Where the available fault current at the source bus is not available, describe how the fault contribution from the source bus was determined and why this method is reasonable for the study.

3.2.6 System Coordination Study

Use the results of the load flow study and fault current study. For normal modes of operation, demonstrate that selectivity has been obtained between the devices within the scope of the project. Demonstrate the equipment, machines, and conductors are protected from damage from overloads and fault conditions. Include a description of the coordination of the protective devices in this project. Provide a written narrative describing which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations; coordination between upstream and downstream devices; and relay settings. Provide recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost damages (addition or reduction). Provide composite coordination plots on a log-log scale. Where recommendations are provided to improve or enhance system reliability, provide separate coordination plots on log-log scale showing the system coordination before and after the implementation of the recommendations. Where coordination has been adjusted to lower arc flash values, include a discussion of the change and the impact on the system within the report.

3.2.7 Arc Flash Hazard Study

Perform the arc flash hazard study in accordance with IEEE 1584.1. Utilize the data from the fault current study to determine the worst case incident energy per IEEE 1584, IEEE C2, and OSHA 29 CFR 1910.269 Appendix E. Use identified modes of operation to determine the worst case arc flash energy. If not included in another study, include a description of the devices and device settings for the operating modes that provided the highest arc flash energy. The use of a "maintenance switch" to temporarily reduce the Arc Flash incident energy for maintenance work is acceptable. Where the adjusting the coordination of devices to obtain lower arc flash values, include a discussion of the change and the impact on the system within the report. Where the arc flash energies exceed 1.2 cal/cm^2 provide recommendations to reduce the arc flash energy to 1.2 cal/cm^2.

Where the AC system voltage is 208 volts or less with an available short-circuit current less than 2000 A, an arc flash hazard study is not required.

3.2.8 Study report(s)

a. Include a narrative describing the studies performed; the bases and methods used; and the desired method of coordinated protection of the power system.

b. Include descriptive and technical data for existing devices and new protective devices proposed. Include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices. For existing devices, included statements on the condition of the equipment based upon field inspections and owner's statements and reports.

c. Document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device numbers and settings;generator resistance and reactance values, and time constants; and existing power system data including time-current characteristic curves and protective device ratings and settings. Identify all assumptions about the protection devices, equipment, and system where data was not available.

d. For each bus in the system, provide fully coordinated composite time-current characteristics (TCC) curves as required to ensure coordinated power system protection between protective devices and equipment. In a tabular format, provide existing and recommended ratings and settings of all protective devices.

e. Provide an arc flash study report in accordance with IEEE 1584.1.

f. Provide the calculations performed for the studies, including computer programs utilized. Provide the name of the software package, developer, and version number.

f. The System Analyzer must stamp the study reports.

3.2.9 Arc Flash Labels

Provide arc flash warning labels on electrical equipment likely to require examination, servicing, or maintenance while energized. Typical types of equipment include pad-mounted transformers, switchgear, switchboards, panelboards, disconnect switches, industrial control panels, meter socket enclosures, and motor control centers that are in other than dwelling occupancies. The arc flash label naming must match the naming used in the system modeling and the single line diagram.

Comply with the label requirements specified in UFC 3-560-01. Obtain approval of arc flash label formats before printing.

a. Provide a 3.5 inch x 5 inch to 4 inch x 6 inch thermal transfer type label of high adhesion polyester for each location device analyzed. The label must remain in place and be legible for at least 5 years in the installed environment.

b. Labels must be machine printed with no field markings. Provide arc flash labels in the following manner. All labels must be based on implemented overcurrent devices and settings.

1. Provide at least one arc flash label for each 480 volt and 208 volt

panelboards.

2. Provide at least one arc flash label for each low voltage (less than 1000 V) switchboard.

3. Where the equipment construction has different hazards levels in different areas, provide a label for each compartment, cubicle, or section separated by barriers

c. Use the worst case hazard of all operating scenarios unless mitigation procedures are used. If mitigation procedures are used, explain the procedures on the label.

3.3 MODELING

Develop a software model of the electrical system identified in the scope of the studies. Use the latest version of EasyPower(TM). Develop the model with accurate, verified information. Model existing electrical equipment, machines, devices, and conductors directly connected to, altered by, or otherwise affected by the work. This includes, but is not limited to generators, transformers, switchgear, switchboards, panelboards, motor control centers, motors, voltage regulators, tap changers, protective relays, circuit breakers, switches, fuses, conductors, capacitors, reactors, grounding system, and control equipment.

Provide the final model files in their native editable formats for future use by the Government. Include device information for devices not in the software vendor's standard distribution.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 08 00

APPARATUS INSPECTION AND TESTING
11/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Acceptance Tests and Inspections; G

SD-07 Certificates

Qualifications of Organization, and Lead Engineering Technician; G

Acceptance Test and Inspections Procedure; G

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation equipment listed in paragraph ACCEPTANCE TESTS AND INSPECTIONS herein. Organization must be independent of the supplier, manufacturer, and installer of the equipment. The organization must be a first tier subcontractor. No work required by this section of the specification may be performed by a second tier subcontractor.

a. Submit name and qualifications of organization. Organization must have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization must have a calibration program, and test instruments

used must be calibrated in accordance with NETA ATS.

b. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments must be performed by an engineering technician, certified by NETA (Level III) or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

1.4.2 Acceptance Tests and Inspections Reports

Submit certified copies of inspection reports and test reports. Include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test reports documenting the results of each test not more than 10 days after test is completed.

1.4.3 Acceptance Test and Inspections Procedure

Submit test procedure reports for each item of equipment to be field tested at least 45 days prior to planned testing date. Do not perform testing until after test procedure has been approved.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 ACCEPTANCE TESTS AND INSPECTIONS

Testing organization will perform acceptance tests and inspections. Test methods, procedures, and test values must be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and paragraph FIELD QUALITY CONTROL of each applicable specification section. Tests identified as optional in NETA ATS are not required unless otherwise specified. Place equipment in service only after completion of required tests and evaluation of the test results have been completed. Supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Notify Contracting Officer at least 14 days in advance of when tests will be conducted by the testing organization. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:

a. Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Medium voltage cables and grounding systems only.

b. Section 26 13 00 SF6/HIGH-FIREPOINT FLUID INSULATED PAD-MOUNTED SWITCHGEAR

3.2 SYSTEM ACCEPTANCE

Final acceptance of the system is contingent upon satisfactory completion

of acceptance tests and inspections.

3.3 PLACING EQUIPMENT IN SERVICE

A representative of the approved testing organization must be present when equipment tested by the organization is initially energized and placed in service.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 12 19

PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS
05/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	(2025a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM D92	(2012a) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D97	(2017b) Standard Test Method for Pour Point of Petroleum Products
ASTM D877/D877M	(2019) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide https://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE C2	(2023) National Electrical Safety Code
IEEE C37.47	(2011) Standard for High Voltage Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches
IEEE C57.12.00	(2021) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.28	(2023) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2023) Standard for Pad-Mounted Equipment

	- Enclosure Integrity for Coastal Environments
IEEE C57.12.34	(2022) Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 10 MVA and Smaller; High Voltage, 34.5 kV Nominal System Voltage and Below; Low Voltage, 15 kV Nominal System Voltage and Below
IEEE C57.12.80	(2010) Standard Terminology for Power and Distribution Transformers
IEEE C57.12.90	(2021) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.98	(2011) Guide for Transformer Impulse Tests
IEEE C62.11	(2020) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 260	(1996; R 2004) Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas
NEMA Z535.4	(2023) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203	(1992) Fish Acute Toxicity Test

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075	(1998) Fate, Transport and Transformation Test Guidelines - OPPTS 835.3100- "Aerobic Aquatic Biodegradation"
EPA 821-R-02-012	(2002) Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment

UL SOLUTIONS (UL)

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pad-mounted Transformer Drawings; G

SD-03 Product Data

Pad-mounted Transformers; G

SD-06 Test Reports

Acceptance Checks and Tests; G

SD-07 Certificates

Transformer Efficiencies; G

SD-09 Manufacturer's Field Reports

Transformer Test Schedule; G

Pad-mounted Transformer Design Tests; G

Pad-mounted Transformer Routine and Other Tests; G

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5; G

1.4.1 Reduced Submittal Requirements

Transformers designed and manufactured by ABB/Hitachi Energy in Jefferson City, MO; by Eaton's Cooper Power Series Transformers in Waukesha, WI; by ERMCO in Dyersburg, TN; or by Howard Industries in Laurel, MS need not submit the entire submittal package requirements of this contract. Instead, submit the following items:

a. A certification, signed by the manufacturer, stating that the manufacturer will meet the technical requirements of this specification.

b. An outline drawing of the transformer with devices identified (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item a).

c. ANSI nameplate data of the transformer (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item b).

d. Manufacturer's published time-current curves in PDF format and in electronic format suitable for import or updating into the EasyPower computer program of the transformer high side fuses (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item e).

e. Provide transformer test schedule and routine and other tests required by submittal item "SD-09 Manufacturer's Field Reports".

f. Provide acceptance test reports required by submittal item "SD-06 Test Reports".

g. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

1.5 QUALITY ASSURANCE

1.5.1 Pad-Mounted Transformer Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. IEEE nameplate data.

c. Elementary diagrams and wiring diagrams.

d. One-line diagram, including switch(es).

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, except of NFPA 70 when more stringent requirements are specified or indicated, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated.

1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.6 MAINTENANCE

1.6.1 Additions to Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein. In addition to requirements of Data Package 5, include the following on the actual transformer(s) provided:

a. An instruction manual with pertinent items and information highlighted

b. An outline drawing, front, top, and side views

c. Prices for spare parts and supply list

d. Routine and field acceptance test reports

e. Fuse curves for primary fuses

f. Actual nameplate diagram

g. Date of purchase

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 26 20 00 INTERIOR

DISTRIBUTION SYSTEM, and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

IEEE C57.12.34, IEEE C57.12.28 and as specified herein. Submit manufacturer's information for each component, device, insulating fluid, and accessory provided with the transformer.

2.2.1 Compartments

Provide high- and low-voltage compartments separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage, Dead-Front

High-voltage compartment contains: the incoming line, insulated high-voltage load-break connectors, bushing well inserts, six high-voltage bushing wells configured for loop feed application, load-break switch handle(s), access to oil-immersed bayonet fuses, tap changer handle, connector parking stands, and ground pad.

Minimum high-voltage compartment dimensions: IEEE C57.12.34, Figures 16 and 17.

a. Insulated high-voltage load-break connectors: IEEE 386, rated 15 kV, 95 kV BIL. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector must have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.

b. Bushing well inserts and feed-thru inserts: IEEE 386, 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise. Provide feed-thru inserts as indicated.

c. Load-break switch

   Radial-feed two-position oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

d. Provide bayonet oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. The bayonet fuse links sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. Include an oil retention valve inside the bayonet assembly housing, which closes when the fuse holder is removed, and an external drip shield to minimize oil spills. Display a warning label adjacent to the bayonet fuse(s) cautioning against removing or inserting fuses unless the transformer has been de-energized and the tank pressure has been released.

   Bayonet fuse assembly: 150 kV BIL.

Oil-immersed current-limiting fuses: IEEE C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified.

e. Surge arresters: IEEE C62.11, rated 15 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap. Provide three arresters for radial feed circuits.

2.2.1.2 Low Voltage

Low-voltage compartment contains: low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.

a. Include the following accessories: drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.

b. Metering: Provide as specified in Section 26 27 14.00 20 ELECTRICITY METERING.

2.2.2 Transformer

a. Less-flammable bio-based liquid-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.

b. Transformer rated as indicated.

c. Transformer voltage ratings: as indicated.

d. Tap changer: externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Indicate which tap setting is in use, clearly visible when the compartment is opened.

e. Minimum tested percent impedance at 85 degrees C:

(1) .50 for units rated 75kVA and below
(2) .87 for units rated 112.5kVA to 300kVA
(3) .03 for 500kVA rated units
(4) .32 for units rated 750kVA and above

f. Comply with the following audible sound level limits:

kVA	DECIBELS (MAX
75	51
112.5	55
150	55
225	55
300	55

500	56
750	57
1000	58
1500	60
2000	61
2500	62

g. Include:

(1) Lifting lugs and provisions for jacking under base, with base construction suitable for using rollers or skidding in any direction.

(2) An insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

(3) Provide transformer top with an access handhole.

(4) kVA rating conspicuously displayed on its enclosure.

2.2.2.1 Specified Transformer Efficiencies

Provide transformer efficiency calculations utilizing the actual no-load and load loss values obtained during the routine tests performed on the actual transformer(s) prepared for this project. Reference no-load losses (NLL) at 20 degrees C. Reference load losses (LL) at 55 degrees C and at 50 percent of the nameplate load. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in the "KVA / Efficiency" table below. The table is based on requirements contained within 10 CFR 431, Subpart K. Submit certification, including supporting calculations, from the manufacturer indicating conformance.

kVA	EFFICIENCY (percent)
15	98.65
30	98.83
45	98.92
75	99.03
112.5	99.11
150	99.16
225	99.23

300	99.27
500	99.35
750	99.40
1000	99.43
1500	99.48
2000	99.51
2500	99.53
above 2500	99.54

2.2.3 Insulating Liquid

a. Less-flammable transformer liquids: NFPA 70 and FM APP GUIDE for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D92 and a dielectric strength not less than 33 kV tested per ASTM D877/D877M. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate.

Provide a fluid that is a biodegradable, electrical insulating, and cooling liquid classified by UL and approved by FM as "less flammable" with the following properties:

(1) Pour point: ASTM D97, less than -15 degree C

(2) Aquatic biodegradation: EPA 712-C-98-075, ultimately biodegradable as designated by EPA.

(3) Trout toxicity: OECD Test 203, zero mortality of EPA 821-R-02-012, pass

2.2.3.1 Liquid-Filled Transformer Nameplates

Provide nameplate information in accordance with IEEE C57.12.00 and as modified or supplemented by this section.

2.2.4 Corrosion Protection

Provide entire transformer assembly, including tank and radiator, base, enclosure, and metering enclosure fabricated of stainless steel conforming to ASTM A240/A240M, Type 304 or 304L. Form enclosure of stainless steel sheets.

Paint entire transformer assembly Munsell 7GY3.29/1.5 green, with paint coating system complying with IEEE C57.12.28 and IEEE C57.12.29 regardless of base, cabinet, and tank material. The Munsell color notation is specified in ASTM D1535.

2.3 WARNING SIGNS AND LABELS

Provide warning signs for the enclosures of pad-mounted transformers having a nominal rating exceeding 600 volts in accordance with NEMA Z535.4

and NEMA 260.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28, such as for pad-mounted transformers, provide self-adhesive warning labels on the outside of the high voltage compartment door(s)with nominal dimensions of 7 by 10 inches with the legend "WARNING HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. Include the work "WARNING" in white letters on an orange background and the words "HIGH VOLTAGE" in black letters on a white background.

2.4 ARC FLASH WARNING LABEL

Provide arc flash warning label for the enclosure of pad-mounted transformers. Locate this self-adhesive warning label on the outside of the high voltage compartment door warning of potential electrical arc flash hazards and appropriate PPE required. Provide label format as indicated.

2.5 GROUNDING AND BONDING

UL 467. Provide grounding and bonding as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.6 CAST-IN-PLACE CONCRETE

Provide concrete associated with electrical work for other than encasement of underground ducts rated for 4000 psi minimum 28-day compressive strength unless specified otherwise. Conform to the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.7 SOURCE QUALITY CONTROL

2.7.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer test schedule for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

(1) Provide a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

(2) Accuracy: Traceable to the National Institute of Standards and Technology.

(3) Instrument calibration frequency schedule: less than or equal to 12 months for both test floor instruments and leased specialty equipment.

(4) Dated calibration labels: visible on all test equipment.

(5) Calibrating standard: higher accuracy than that of the instrument tested.

(6) Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.7.2 Design Tests

IEEE C57.12.00, and IEEE C57.12.90. Section 5.1.2 in IEEE C57.12.80 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for the specified transformer(s), with design tests performed prior to the award of this contract.

a. Tests: certified and signed by a registered professional engineer.

b. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (KNAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.

c. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests includes the primary windings only of that transformer.

(1) IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.

(2) State test voltage levels.

(3) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.

d. Lifting and moving devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with IEEE C57.12.34.

e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

f. Short circuit: "Basically the same design" for the short circuit test means a pad-mounted transformer with the same kVA as the transformer specified.

2.7.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests: performed in accordance with IEEE C57.12.90 by the manufacturer on the actual transformer(s) prepared

for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence as follows:

a. Phase relation

b. Ratio

c. No-load losses (NLL) and excitation current

d. Load losses (LL) and impedance voltage

e. Dielectric

(1) Impulse

(2) Applied voltage

(3) Induced voltage

f. Leak

PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Pad-Mounted Transformer Grounding

Provide a ground ring around the transformer with 4/0 AWG bare copper. Provide four ground rods in the ground ring, one per corner. Install the ground rods at least 10 feet apart from each other. Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.4 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.6 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least 8 inches thick, reinforced with a 6 by 6 inches - W2.9 by W2.9 mesh placed uniformly 4 inches from the top of the slab.

b. Place slab on a 6 inch thick, well-compacted gravel base.

c. Install slab such that top of concrete slab is approximately 4 inches above the finished grade with gradual slope for drainage.

d. Provide edges above grade with 1/2 inch chamfer.

e. Provide slab of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.6.1 Cast-In-Place Concrete

Provide cast-in-place concrete work in accordance with the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.6.2 Sealing

When the installation is complete, seal all entries into the equipment enclosure with an approved sealing method. Provide seals of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7 FIELD QUALITY CONTROL

3.7.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS. Submit reports, including acceptance criteria and limits for each test in accordance with NETA ATS "Test Values".

3.7.1.1 Pad-Mounted Transformers

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.

(3) Inspect anchorage, alignment, and grounding.

(4) Verify the presence of PCB content labeling.

(5) Verify the bushings and transformer interiors are clean.

(6) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(7) Verify correct liquid level in tanks and bushings.

(8) Verify that positive pressure is maintained on gas-blanketed transformers.

(9) Perform specific inspections and mechanical tests as recommended by manufacturer.

(10) Verify de-energized tap changer position is left as specified.

(11) Verify the presence of transformer surge arresters.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.

(2) Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

(3) Perform insulation-resistance tests, winding-to-winding and each winding-to-ground. Calculate polarization index. Verify that the tap changer is set at the specified ratio.

(4) Perform turns-ratio tests at all tap positions.

(5) Perform insulation power-factor or dissipation-factor tests on all windings in accordance with test equipment manufacturer’s

published data.

(6) Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap. In the absence of a power-factor/capacitance tap, perform hot-collar tests.

(7) Measure the resistance of each high-voltage winding in each de-energized tap-changer position. Measure the resistance of each low-voltage winding in each de-energized tap-changer position, if applicable.

(8) Remove and test a sample of insulating liquid for the following: Dielectric breakdown voltage, Acid neutralization number, Specific gravity, Interfacial tension, Color, Visual Condition, Water in insulating liquids (Required on 25 kV or higher voltages and on all silicone-filled units.), and Power factor or dissipation factor.

(9) Perform dissolved-gas analysis (DGA) on a sample of insulating liquid.

3.7.1.2 Grounding System

a. Visual and mechanical inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.7.1.3 Surge Arresters, Medium- and High-Voltage

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect anchorage, alignment, grounding, and clearances.

(4) Verify the arresters are clean.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform an insulation-resistance test on each arrester, phase terminal-to-ground.

(3) Test grounding connection.

3.7.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer 5 working days in advance of the dates and times of checking and testing.

-- End of Section --

SECTION 26 13 00

HIGH-FIREPOINT FLUIDS INSULATED PAD-MOUNTED SWITCHGEAR
05/21, CHG 1: 05/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System
ASTM D6871	(2017) Standard Specification for Natural (Vegetable Oil) Ester Fluids Used in Electrical Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE C2	(2023) National Electrical Safety Code
IEEE C37.60	(2019) High-Voltage Switchgear and Controlgear - Part 111: Automatic Circuit Reclosers for Alternating Current Systems Up to 38 kV
IEEE C37.74	(2014) Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems Up to 38 kV
IEEE C57.12.29	(2023) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments
IEEE C62.11	(2020) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 61099	(2010; ED 2.0) Insulating Liquids -

	Specifications for Unused Synthetic Organic Esters for Electrical Purposes
IEC 62271-111	(2019) High Voltage Switchgear And Controlgear - Part 111: Automatic Circuit Reclosers for Alternating Current Systems up to and including 38 kV

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code
NFPA 70B	(2023) Recommended Practice for Electrical Equipment Maintenance

UL SOLUTIONS (UL)

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING, applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

1.3.1 Switched Way

A switched way is considered a three-phase circuit entrance to the bus through a switch. For single-phase switches, it is a single-phase entrance to the bus through a switch.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchgear Drawings; G

SD-03 Product Data

Electronic Overcurrent Control Curves; G

SF6/High-Firepoint Fluid Insulated Pad-mounted Switchgear; G

Include data on switches and associated accessories with each submittal. Include manufacturer's information for each component, device and accessory provided with the equipment with each submittal.

Insulated High-Voltage Connectors; G

Surge Arresters; G

SD-06 Test Reports

Acceptance Checks and Tests; G

SD-07 Certificates

Paint Coating System; G

SD-09 Manufacturer's Field Reports

Switchgear Design and Production Tests; G

1.5 QUALITY ASSURANCE

1.5.1 Switchgear Drawings

Furnish drawings that include, but are not limited to, the following:

a. Overall dimensions, weights, plan view, and front view

b. Ratings

c. Single-line diagram.

1.5.2 Paint Coating System

Submit IEEE C57.12.29 paint coating system performance requirement tests.

1.5.3 Electronic Overcurrent Control Curves

Provide time-current characteristic curves in PDF format and in electronic format suitable for import or updating into the EasyPower computer program.

1.6 MAINTENANCE

1.6.1 SF6/High-Firepoint Fluid Insulated Pad-mounted Switchgear Operation and Maintenance

Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 2 PRODUCTS

2.1 SF6/HIGH-FIREPOINT FLUID INSULATED PAD-MOUNTED SWITCHGEAR

IEEE C37.74

2.1.1 Ratings and Test Requirements

The voltage rating of the switchgear must be 15.5 kV. Provide the corresponding ratings associated with the required switchgear voltage rating as follows:

Rated Maximum Voltage, kV	15.5

Rated Withstand Impulse Voltage, kV BIL	95
Continuous and Load Interrupting Current, A	600
Short-Time Current, kA rms Sym	12.5
Short-Circuit interrupting Current,kA rms Sym	12.5

2.1.2 Switchgear Construction

Provide switchgear with switch contacts and cable entrance terminations contained in a sealed, dielectric-filled stainless steel tank. Ship switchgear from factory, filled with appropriate levels of less-flammable, high-firepoint biodegradable fluid conforming to ASTM D6871 or IEC 61099. Configure switchgear with load interrupting and fault interrupting switched ways as indicated. Provide switchgear with front accessible terminations suitable for cables entering from below with manual operating provisions either mounted on the rear or capable of hookstick operation per IEEE C37.74. Switch contact positions for switched ways must be visible through viewing windows in the switchgear tank located adjacent to the manual operating provisions. Provide internal fluid level gage in viewable location from switch operating handle. Provide each switched way with three position switch; Open, Closed, Ground.

2.1.2.1 Pad-mounting Provisions

Provide enclosed switchgear suitable for installation on a concrete pad. Fabricate switchgear support frame enclosure base enclosure with type 304 or 304L stainless steel. Enclosure base must include any part of the switchgear enclosure that is within 3 inches of concrete pad. Paint switchgear tank and support frameenclosure including base ASTM D1535 Munsell 7GY3.29/1.5 green. Comply with IEEE C57.12.29 for the paint coating system regardless of equipment material.

2.1.3 Load Interrupting Switched Ways

2.1.3.1 Three-Pole Group Operated Switched Ways

Provide three-pole group operated load interrupting switched ways as indicated.

2.1.3.2 Fault Interrupting Switched Ways

IEEE C37.60, IEC 62271-111. Provide non-fused, non-reclosing, manual reset, vacuum interrupters consisting of vacuum interrupter and a spring assisted operating mechanism. Each fault interrupting switched way must utilize internally mounted current transformers and an electronic overcurrent control to provide three-pole ganged tripping for single-phase and three-phase faults. Provide electronic overcurrent control with provisions for a minimum of ten field changeable overcurrent trip settings.

2.1.4 Dead-Front High-Voltage Bushings

IEEE 386. 15 kV, 95 kV BIL. Provide 600 ampere one-piece deadbreak apparatus bushings for each switched way.

a. Parking stands: Provide a parking stand near each dead-front bushing. Provide insulated standoff bushings for parking of energized load-break connectors on each parking stands.

2.2 INSULATED HIGH-VOLTAGE CONNECTORS

IEEE 386. Provide corresponding connector for each switched way. Provide a grounding eye and test point on each connector.

a. 600 Ampere deadbreak connector ratings: Voltage: 15 kV, 95 kV BIL. Short time rating: 25,000 rms symmetrical amperes. Provide connectors with 200 ampere bushing interface.

b. Provide one set of three grounding elbows. Deliver grounding elbows to the Contracting Officer.

2.3 SURGE ARRESTERS

IEEE C62.11, rated 15 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap, suitable for plugging into inserts. Provide arresters on switched ways as indicated.

2.4 SOURCE QUALITY CONTROL

2.4.1 Switchgear Design and Production Tests

Furnish reports which include results of design and production tests performed according to IEEE C37.74 and IEEE C37.60. Perform manufacturer production tests on each switchgear assembly to ensure that design performance is maintained in production.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.2 GROUNDING

NFPA 70 and IEEE C2, except provide grounds and grounding systems with a resistance to solid earth ground not exceeding 25 ohms. When work, in addition to that indicated or specified, is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION at minimum provide at each corner of switchgear pad.

3.2.2 Switchgear Grounding

Connect #4/0 bare copper conductor ground ring, not less than 24 inches below grade, to the upper end of the ground rods by exothermic welds or

compression connectors. Provide #4/0 bare copper conductors connecting the switchgear grounding provisions to two different ground rods.

3.2.3 Connections

Make joints in grounding conductors and ground ring by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount switch on concrete slab. Provide slab with dimensions at least 12 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Place slab on a 6 inch thick, well-compacted gravel base. Install top of concrete slab approximately 4 inches above finished grade. Provide edges above grade with 1/2 inch chamfer. Provide slab of adequate size to project at least 8 inches beyond equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with switch cable training areas. Provide concrete work as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.4 FIELD QUALITY CONTROL

3.4.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, NFPA 70B, NETA ATS and referenced ANSI standards.

Include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.4.1.1 Switchgear

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate information with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Check for proper anchorage, alignment, required area clearances, and grounding.

(4) Perform mechanical operator tests in accordance with manufacturer's instructions.

(5) Verify that insulating SF6 gas pressure or dielectric fluid level is correct.

(6) Inspect all indicating devices for proper operation.

b. Electrical Tests

(1) Perform contact-resistance tests.

(2) Trip fault interrupters by operation of overcurrent control.

(3) Perform insulation-resistance tests.

(4) Perform an over-potential test on each switched way pole with the switched way in the open position in accordance with the manufacturer's instructions.

(5) Set fault interrupter overcurrent control in accordance with government provided settings. Request settings from government, in writing, a minimum of 30 days prior to scheduling electrical tests.

3.4.1.2 Grounding System

a. Visual and Mechanical Inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.4.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that devices are in good operating condition and properly performing the intended function. Perform each test function not less than three times. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer five working days in advance of the dates and times for checks and tests.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM
05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2023) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA NEIS 1	(2015) Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2022) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA ST 20	(2014) Dry-Type Transformers for General Applications

NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2021) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2023) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code
NFPA 70E	(2024) Standard for Electrical Safety in the Workplace
NFPA 780	(2023) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

ANSI/TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.303	Electrical, General

UL SOLUTIONS (UL)

UL 50	(2024) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Aug 2023) UL Standard for Safety Panelboards
UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment
UL 489	(2025) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2017; Reprint Jun 2024) UL Standard for Safety Attachment Plugs and Receptacles
UL 514A	(2024) UL Standard for Safety Metallic Outlet Boxes
UL 514C	(2014; Reprint Apr 2024) UL Standard for Safety Nonmetallic Outlet Boxes,

	Flush-Device Boxes, and Covers
UL 869A	(2006; Reprint Jun 2020) Reference Standard for Service Equipment
UL 870	(2016; Reprint Nov 2023) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2016; Reprint Sep 2023) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 1449	(2021; Reprint Dec 2022) UL Standard for Safety Surge Protective Devices

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

1.3 RELATED REQUIREMENTS

Section 25 05 11.26 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY CONTROL SYSTEMS TO INCLUDE ADVANCED METERING INFRASTRUCTURE (AMI) applies to this section, with the additions and modifications specified herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards; G

Transformers; G

Wireways; G

Marking Strips Drawings; G

SD-03 Product Data

Receptacles; G

Circuit Breakers; G

Transformers; G

Surge Protective Devices; G

SD-06 Test Reports

Grounding System Test; G

Transformer Tests; G

SD-09 Manufacturer's Field Reports

Transformer Factory Tests

1.5 QUALITY ASSURANCE

1.5.1 Electrician Qualifications

Electrical work must be performed by qualified persons with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated. NECA NEIS 1 is the minimum standard for workmanship.

1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 consecutive hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.6 WARRANTY

Provide equipment items supported by service organizations that are located within 250 miles of the equipment installation in order to render service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 for all materials, equipment, and devices.

2.2 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.2.1 Outlet Boxes for Telecommunications System

Provide the following:

a. Standard type 4 11/16 inches square by 2 1/8 inches deep.

b. Depth of boxes: large enough to allow manufacturers' recommended conductor bend radii.

2.3 CABINETS, JUNCTION BOXES, AND PULL BOXES

UL 50; volume greater than 100 cubic inches, NEMA Type 1 enclosure; sheet steel, hot-dip, zinc-coated. Where exposed to wet, damp, or corrosive environments, NEMA Type 4X stainless steel.

2.4 DEVICE PLATES

Provide the following:

a. UL listed, one-piece device plates for outlets to suit the devices installed.

b. For nonmetallic boxes and fittings, other suitable plates may be provided.

c. Plates installed in wet locations: gasketed and UL listed for "wet locations."

2.5 SWITCHES

2.5.1 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in NEMA 4X Type 304 stainless steel, enclosure per NEMA ICS 6.

2.6 RECEPTACLES

Provide the following:

a. UL 498, general purpose specification grade, grounding-type. Residential grade receptacles are not acceptable.

b. Ratings and configurations: as indicated.

c. Bodies: grey as per NEMA WD 1.

d. Face and body: thermoplastic supported on a metal mounting strap.

e. Dimensional requirements: per NEMA WD 6.

f. Screw-type, side-wired wiring terminals. Do not use back-stabbed conductor terminals.

g. Grounding pole connected to mounting strap.

h. The receptacle: containing triple-wipe power contacts and double or triple-wipe ground contacts.

2.6.1 Weather Resistant Receptacles

Provide receptacles, UL listed for use in "wet locations" with integral GFCI protection. Include cast metal box with gasketed, hinged, lockable and weather resistant while-in-use, polycarbonate, UV resistant/stabilized extra-duty rated hood.

2.6.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak when the current to ground is 6 milliamperes or higher, and tripping per requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.7 PANELBOARDS

Provide panelboards in accordance with the following:

a. UL 67 and UL 50.

b. Panelboards for use as service disconnecting means: additionally conform to UL 869A.

c. Panelboards: circuit breaker-equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the design drawings. If it is not possible to match "specific breaker placement" during construction, obtain Government approval prior to device installation.

f. Use of "Subfeed Breakers" is not acceptable.

g. Main breaker: "separately" mounted "above" branch breakers.

h. Where "space only" is indicated, make provisions for future installation of breakers.

i. Directories: indicate load served by each circuit in panelboard.

2.7.1 Enclosure

Provide panelboard enclosure in accordance with the following:

a. UL 50.

b. Cabinets: painted in accordance with paragraph FIELD APPLIED PAINTING.

c. Outdoor cabinets: NEMA 4x stainless steel with conduit hubs welded to the cabinet a removable steel plate 1/4 inch thick in the bottom for field drilling for conduit connections.

d. Front edges of cabinets: form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.

e. All cabinets: fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 1/8 inch.

f. Holes: provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.

g. Flush doors: mounted on hinges that expose only the hinge roll to view when the door is closed.

h. Each door: fitted with a combined catch and lock latch.

i. Keys: two provided with each lock, with all locks keyed alike.

j. Finished-head cap screws: provided for mounting the panelboard fronts on the cabinets.

2.7.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.7.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided. Where indicated on the

drawings, provide circuit breakers with shunt trip devices. Series rated circuit breakers and plug-in circuit breakers that do not use a retaining bolt are unacceptable.

2.7.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.7.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter

UL 943 and NFPA 70. Provide with auto-monitoring (self-test) and lockout features, "push-to-test" button, visible indication of tripped condition, and ability to detect and trip when current imbalance is 6 milliamperes or higher per requirements of UL 943 for Class A ground-fault circuit interrupter devices.

2.8 TRANSFORMERS

Provide transformers in accordance with the following:

a. NEMA ST 20, general purpose, dry-type, self-cooled, ventilated.

b. Provide transformers in NEMA 1 enclosure for indoor use. For outdoor location provide NEMA 3R, Stainless Steel enclosures.

c. Provide nameplate including, but not limited to, the following information: rated kVA, voltages, impedance, and X/R ratio.

d. Taps for transformers 15 kVA and larger: Two 2.5 percent taps Full Capacity Above Nominal (FCAN) and two 2.5 percent taps Full Capacity Below Nominal (FCBN).

e. Transformer insulation system:

(1) 220 degrees C insulation system for transformers 15 kVA and greater, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C.

(2) 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 80 degrees C under full-rated load in maximum ambient of 40 degrees C.

f. Transformer of 150 degrees C temperature rise is not acceptable.

g. Transformer of 115 degrees C temperature rise: capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating.

h. Transformer of 80 degrees C temperature rise: capable of carrying continuously 130 percent of nameplate kVA without exceeding insulation rating.

i. Transformers: quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.8.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 80 degrees C or 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, energy efficient type. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in 10 CFR 431, Subpart K.

2.9 LOCKOUT REQUIREMENTS

Provide circuit breakers, disconnecting means, and other devices that are electrical energy-isolating capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147, NFPA 70E and 29 CFR 1910.303. Comply with requirements of Division 23, "Heating, Ventilating, and Air Conditioning (HVAC)" for mechanical isolation of machines and other equipment.

2.10 GROUNDING AND BONDING EQUIPMENT

2.10.1 Ground Rods

UL 467. Ground rods: cone pointed copper-clad steel, with minimum diameter of 3/4 inch and minimum length 10 feet. Sectional type rods may be used for rods 20 feet or longer.

2.11 NAMEPLATES AND SIGNS

2.11.1 Manufacturer's Nameplate

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.11.2 Field Fabricated Nameplates

Provide field fabricated nameplates in accordance with the following:

a. ASTM D709.

b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.

c. Each nameplate inscription: identify the function and, when applicable, the position.

d. Nameplates: melamine plastic, 0.125 inch thick, white with black center core.

e. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.

f. Minimum size of nameplates: one by 2.5 inches.

g. Lettering size and style: a minimum of 0.25 inch high normal block style.

2.11.3 Warning Signs

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.12 WIREWAYS

UL 870. Material: steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with hinged-cover NEMA 1 enclosure per NEMA ICS 6.

2.13 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with UL 1449 at the service entrance, panelboards. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Do not install SPD inside a panelboard or switchboard enclosure. However, SPD may be installed in a separate compartment of a switchgear provided that it is supplied by a dedicated circuit breaker. SPD must have the same short-circuit current rating as the protected equipment and must not be installed at a point of system where the available fault current is in excess of that rating. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker. Submit performance and characteristic curves.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-

Phase to phase (L-L)

Each phase to neutral (L-N)

Neutral to ground (N-G)

Phase to ground (L-G)

SPDs at the service entrance: provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G) and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs per NFPA 780 for the lightning protection system.

Maximum L-N, and N-G Voltage Protection Rating:

700V for 208Y/120V, three phase system

1,200V for 480Y/277V, three phase system

Maximum L-G Protection Rating:

700V for 208Y/120V, three phase system

1,200V for 480Y/277V, three phase system

Maximum L-L Voltage Protection Rating:

1,200V for 208Y/120V, three phase system

1,800V for 480Y/277V, three phase system

2.13.1 Warranty

Provide not less than a 5-year warranty and include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period.

2.14 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

a. NEMA 250 corrosion-resistance test and the additional requirements as specified herein.

b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.

c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.

d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.

e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.

f. Equipment located indoors: ANSI Light Gray, and equipment located outdoors: ANSI Light Gray.

g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.15 SOURCE QUALITY CONTROL

2.15.1 Transformer Factory Tests

Submittal: include routine NEMA ST 20 transformer test results on each transformer and also provide the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements

of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches.

3.1.1.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.2 Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so height of center of grip of the operating handle of the switch or circuit breaker at its highest position is maximum 79 inches above floor or working platform or as allowed in Section 404.8 per NFPA 70. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Wall-mounted telecommunications outlets: mounted at height 60 inches above finished floor. Mount other devices as indicated. Measure mounting heights of wiring devices and outletsto center of device or outlet.

3.1.3 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.

3.1.3.1 Marking Strips

Provide marking strips for identification of power distribution, control, data, and communications cables in accordance with the following:

a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.

b. Use permanent ink for the wire numbers

c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.

d. Size marking strips to accommodate the two sets of wire numbers.

e. Assign a device designation in accordance with NEMA ICS 1 to each

device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.

f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.

g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.4 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.5 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.6 Grounding and Bonding

Provide in accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, grounding conductor of nonmetallic sheathed cables, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Bond additional driven rods together with a minimum of 4 AWG soft bare copper wire buried to a depth of at least 12 inches. Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with ANSI/TIA-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.6.1 Ground Rods

Provide ground rods and measure the resistance to ground using the fall-of-potential method described in IEEE 81. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained, provide additional rods, spaced on center. Spacing for additional rods must be a minimum of 10 feet. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add. The contractor must drill a mininum 1 foot diameter hole and fill with conductive soil to install ground rod is required where refusal occurs during standard hammer drill installation in order to obtained required depth.

3.1.6.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or high compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make high compression connections using a hydraulic or electric compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.6.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of transformer neutrals and other electrical equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment. For raised floor equipment rooms in computer and data processing centers, provide a minimum of four, one at each corner, ground buses connected to the building grounding system. Use bolted connections in lieu of thermoweld, so they can be changed as required by additions and alterations.

3.1.6.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.7 Equipment Connections

Provide power wiring and connections to motors and equipment. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under

the section specifying the associated equipment.

3.1.8 Repair of Existing Work

Perform repair of existing work, demolition, and modification of existing electrical distribution systems as follows:

3.1.8.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

3.1.8.2 Existing Concealed Wiring to be Removed

Disconnect existing concealed wiring to be removed from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.8.3 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment includes equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, back to equipment's power source as indicated.

3.1.8.4 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Maintain existing circuits of equipment energized. Restore circuits wiring and power which are to remain but were disturbed during demolition back to original condition.

3.1.9 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 3 feet avoiding 90 degree bends. Do not locate surge protective devices inside a panelboard or switchboard enclosure.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets. Provide nameplate on all equipment in access controlled spaces and areas.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Where

field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test. Where applicable, test electrical equipment in accordance with NETA ATS.

3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

3.5.2 Transformer Tests

Perform the standard tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.3 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 26 27 14.00 20

ELECTRICITY METERING
02/21, CHG 1: 05/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2019) Energy Standard for Buildings Except Low-Rise Residential Buildings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.90.1	(2013) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C57.13	(2016) Standard Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

SD-06 Test Reports

Acceptance Checks and Tests; G

System Functional Verification; G

Building Meter Installation Sheet, per Building; G

Completed Meter Installation Schedule; G

Completed Meter Data Schedule; G

Meter Configuration Template; G

Contractor must fill in the meter configuration template and submit to the Activity for concurrence.

Meter Configuration Report; G

The meter configuration report must be submitted as a Technical Data Package.

SD-10 Operation and Maintenance Data

Electricity Meters and Accessories, Data Package 5; G

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

SD-11 Closeout Submittals

System Functional Verification; G

1.3 QUALITY ASSURANCE

1.3.1 Installation Drawings

Drawings must be provided in hard-copy and electronic format, and must include but not be limited to the following:

a. Wiring diagrams with terminals identified of advanced meter, current transformers, potential transformers, protocol modules, communications interfaces, Ethernet connections. For each typical meter installation, provide a diagram.

1.3.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for one year prior to bid opening. The one-year period must include applications of equipment and materials under similar circumstances and of similar size. The product, or an earlier release of the product, must have been on sale on the commercial market through advertisements, manufacturers catalogs, or brochures during the prior one-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.3.3 Material and Equipment Manufacturing Data

Products manufactured more than 1 year prior to date of delivery to site must not be used, unless specified otherwise.

1.4 MAINTENANCE

1.4.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the actual electricity meters and accessories provided:

a. A condensed description of how the system operates

b. Block diagram indicating major assemblies

c. Troubleshooting information

d. Preventive maintenance

e. Prices for spare parts and supply list

1.5 WARRANTY

The equipment items and software must be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment and software on a regular and emergency basis during the warranty period of the contract.

1.6 SYSTEM DESCRIPTION

1.6.1 System Requirements

Electricity metering, consisting of meters and associated equipment, will be used to record the electricity consumption and other values as described in the requirements that follow and as shown on the drawings. Communication system requirements are contained in a separate specification section as identified in paragraph COMMUNICATIONS INTERFACES.

1.6.2 Selection Criteria

Metering components and software are part of a system that includes the physical meter, data recorder function and communications method. Every building site identified must include sufficient metering components to measure the electrical parameters identified and to store and communicate the values as required.

Contractor must verify that the electricity meter installed on any building site is compatible with the base-wide metering system with respect to the types of meters selected and the method used to program the meters for initial use. Software and meter programming tools are necessary to set up the meters described by this specification. New software tools different from the meter programming methods currently used by base personnel will require an Authority to Operate (ATO) by Command Information Office at the Enterprise level.

PART 2 PRODUCTS

2.1 ELECTRICITY METERS AND ACCESSORIES

Provide meter(s) and connect the meter(s) to the existing AMI DAS. The contractor must use the existing government laptop computers to configure the meter using existing software loaded on the computer. The contractor

will not be allowed to modify any software or add any additional software to the computer. Alternatively, the government will configure the meter(s), which must be compatible with the existing system, using existing software. Contractor must insure that the meter(s) will transmit the specified data to the DAS. The current meters being used by are: ION 8650B.

2.1.1 Physical and Common Requirements

a. Provide metering system components in accordance with the Metering System Schedule shown in this specification. Provide Meter configuration template.

b. Meter must have NEMA 3R stainless steel enclosure for surface mounting with bottom or rear penetrations.

c. Surge withstand capability must conform to IEEE C37.90.1.

d. Use #12 SIS (XHHW, or equivalent) wiring with ring lugs for all meter connections. Color code and mark the conductors as follows:

(1) Red - Phase A CT - C1
(2) Orange - Phase B CT - C2
(3) Brown - Phase C CT - C3
(4) Gray with white stripe - neutral current return - C0
(5) Black - Phase A voltage - V1
(6) Yellow - Phase B voltage - V2
(7) Blue - Phase C voltage - V3
(8) White - Neutral voltage

2.1.2 Potential Transformer Requirements

a. Meter must be capable of connection to the service voltage phases and magnitude being monitored. If the meter is not rated for the service voltage, provide suitable potential transformers to send an acceptable voltage to the meter.

b. Voltage input must be optically isolated to 2500 volts DC from signal and communications outputs. Components must meet or exceed IEEE C37.90.1.

c. Provide one fuse per phase, Class RK type, to protect the voltage input to the meter. Size fuses as recommended by the meter manufacturer. Fusing must either be inside the secondary compartment of the transformer or inside the same enclosure as the CT shorting device.

d. Potential transformers will be used to convert 480 volt inputs to 120 volts for the locations shown on the metering schedule. Potential transformers must be rated indoor or outdoor, as required for the specific application. Voltage rating must provide 120 volts, wye-connected, 3 phase, 4 wire, 60 Hz, insulation class, 600 volts. Potential transformers BIL must be 10 kV and must have an accuracy class of 0.3 at burdens w, x, and y. Thermal rating must be 500 VA.

2.1.3 Current Transformer Requirements

a. Current transformer must be installed with a rating as shown in the schedule.

b. Current transformers must have an Accuracy Class of 0.15 (with a maximum error of plus/minus 0.3 percent at 5.0 amperes) when operating within the specified rating factor.

c. Current transformers must be solid-core, bracket-mounted for new installations using ring-tongue lugs for electrical connections. Current transformers must be accessible and the associated wiring must be installed in an organized and neat workmanship arrangement. Current transformers that are retrofitted onto existing switchgear busbar can be a busbar split-core design.

d. Current transformers must have:

(1) Insulation Class: All 600 volt and below current transformers must be rated 10 KV BIL.

(2) Frequency: Nominal 60 Hz.

(3) Burden: Burden class must be selected for the load.

(4) Phase Angle Range: 0 to 60 degrees.

e. Meter must accept current input from standard instrument transformers (5A secondary current transformers).

f. Current inputs must have a continuous rating in accordance with IEEE C57.13.

g. Provide one single-ratio current transformer for each phase per power transformer with characteristics listed in the following table.

2.1.4 Meter Requirements

Notwithstanding any other provision of this contract, meters must be Schneider Electric Power Logic ION8650B, (64MB)d; no other product will be acceptable. Meters to be provided in accordance to latest Air Force AMRS specification. Contractor to requested lastest version of Air Force AMRS specification from Contracting Officer.

2.1.5 Disconnect Method

a. Provide a 10-pole safety disconnect complete with isolation devices for the voltage and current transformer inputs, including a shorting means for the current transformers.

2.1.6 Installation Methods

a. Building Mounted. Meter base must be mounted on the south side of transformer enclosure.

2.2 COMMUNICATIONS INTERFACES

Meter must have two-way communication with the existing data acquisition system (DAS). Provide a communications interface utilizing Ethernet (RJ-45).

Provide interfacing software if a meter is used that is different than the existing meters at the Activity to ensure compatibility within the

metering system.

Connect to the AMI network utilizing Ethernet (RJ-45).

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations must conform to ASHRAE 90.1 - IP, IEEE C2, NFPA 70 (National Electrical Code), and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.1.1 Configuration Software

The standard meter must include the latest available version of firmware and software. Meter must either be programmed at the factory or must be programmed in the field. Meters must have a password that must be provided to the contracting officer upon project completion. When field programming is performed, turn field programming device over to the Contracting Officer at completion of project. When interfacing software is used for a meter that is different than the existing meters in use at the Activity, turn the software over to the Contracting Officer at completion of the project.

3.2 FIELD QUALITY CONTROL

Perform the following acceptance checks and tests on all installed meters.

3.2.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

a. Meter Assembly

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specifications and approved shop drawings.

(b) Inspect physical and mechanical condition. Confirm the meter is firmly seated in the socket, the socket is not abnormally heated, the display is visible, and the ring and seal on the cover are intact.

(c) Inspect all electrical connections to ensure they are tight. For Class 200 services, verify tightness of the service conductor terminations for high resistance using low-resistance ohmmeter, or by verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.

(d) Record model number, serial number, firmware revision, software revision, and rated control voltage.

(e) Verify operation of display and indicating devices.

(f) Record password and user log-in for each meter.

(g) Verify grounding of metering enclosure.

(h) Set all required parameters including instrument transformer ratios, system type, frequency, power demand methods/intervals, and communications requirements. Verify that the CT ratio and the PT ratio are properly included in the meter multiplier or the programming of the meter. Confirm that the multiplier is provided on the meter face or on the meter.

(i) Provide building meter installation sheet, per building for each facility. See example Graphic E-S1.

(j) Provide the completed meter installation schedule for the installation if multiple meters are to be used. See example Graphic E-S2

(k) Provide the completed meter data schedule for the installation if multiple meters are to be used. See example Graphic E-S3.

(2) Electrical tests.

(a) Apply voltage or current as appropriate to each analog input and verify correct measurement and indication.

(b) Confirm correct operation and setting of each auxiliary input/output feature including mechanical relay, digital, and analog.

(c) After initial system energization, confirm measurements and indications are consistent with loads present.

(d) Make note of, and report, any "Error-Code" or "Caution-Code" on the meter's display.

(3) Provide meter configuration report.

b. Current Transformers

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specification and approved shop drawings.

(b) Inspect physical and mechanical condition.

(c) Verify correct connection, including polarity.

(d) Inspect all electrical connections to ensure they are tight.

(e) Verify that required grounding and shorting connections provide good contact.

(2) Electrical Tests.

Verify proper operation by reviewing the meter configuration report.

c. Potential Transformers

(1) Visual and mechanical inspection.

(a) Verify potential transformers are rigidly mounted.

(b) Verify potential transformers are the correct voltage.

(c) Verify that adequate clearances exist between the primary and secondary circuit.

(2) Electrical Tests.

(a) Verify by the meter configuration report that the polarity and phasing are correct.

3.2.2 System Functional Verification

Verify that the installed meters are working correctly in accordance with the meter configuration report:

a. The correct meter form is installed.

b. All voltage phases are present.

c. Phase rotation is correct.

d. Phase angles are correct.

e. The new meter accurately measures power magnitude and direction, and can communicate as required by paragraph COMMUNICATIONS INTERFACES.

-- End of Section --

SECTION 26 42 13

GALVANIC (SACRIFICIAL) ANODE CATHODIC PROTECTION (GACP) SYSTEM
05/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges

ASTM INTERNATIONAL (ASTM)

ASTM B843	(2018) Standard Specification for Magnesium Alloy Anodes for Cathodic Protection

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

1.2 ADMINISTRATIVE REQUIREMENTS

After award of the contract, but prior to commencement of any work at the site, meet with the Contracting Officer or the Contracting Officer's Representative, Technical Expert and Project Manager. Develop a mutual understanding relative to the administration of the value engineering, the safety program, preparation of the schedule of prices or the earned value report. Review shop drawings, and other submittals, scheduling programming, execution of the work, and clear expectations of the "Interim Department of Defense (DD) Form 1354" submittal. Major subcontractors who will engage in the work must also attend.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G

Dielectric Gasket Kit; G

Test Station Housing; G

Over Voltage Protector (OVP); G

Materials List; G

SD-03 Product Data

Test Station Housing; G

Test Station Terminal Board; G

Calibrated Shunt; G

Insulated Ring Terminals; G

Magnetic Switch; G

Magnetic Switch Key; G

Printed Label; G

Pipe Test Lead; G

Exothermic Weld Mold; G

Exothermic Weld Charge; G

Exothermic Weld Coating; G

Galvanic Anode Ingot; G

Galvanic Anode Backfill; G

Galvanic Anode Test Lead; G

Coupon and Test Lead; G

Dielectric Gasket Kit; G

Dielectric Tubing Union; G

Over Voltage Protector (OVP); G

OVP Mounting Bracket; G

Protective Flange Band; G

SD-06 Test Reports

Final Compliance Test Report; G

As-built Drawings; G

SD-07 Certificates

Qualifications; G

SD-10 Operation and Maintenance Data

Cathodic Protection System; G

Training Course Outline; G

SD-11 Closeout Submittals

Final Compliance Test Report; G

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

Obtain the services of a Cathodic Protection expert to supervise, inspect, and test the installation and performance of the cathodic protection system. The term "Cathodic Protection expert" refers to a person, who by thorough knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control of buried or submerged metallic structures.

1.4.2 Qualifications

The Cathodic Protection expert must be accredited or certified by NACE International, as a CP-4 CP Specialist. The CP-4 must have not less than ten years of experience in the type of CP for buried or submerged metallic structures under this contract. Submit evidence of qualifications of the cathodic protection expert including their name and qualifications certified in writing to the Contracting Officer or the Contracting Officer's Representative, Technical Expert and Project Manager prior to the start of construction. Certification must be submitted giving the name of the firm, the number of years of experience, and a list of not less than five of the firm's installations, three or more years old, that have been tested and found satisfactory, that involve galvanic cathodic protection for underground jet fuel hydrant pipes and PRT systems.

1.4.3 Services of CP Specialist

The CP-4 must make a minimum of four visits to the project site. Once the submittals are approved and the materials delivered, the CP-4 will conduct Trip 1 to verify the materials meet submittal requirements, ensure the contractor understands installation practices and that the contractor is capable and qualified to complete the installation. The CP-4 must witness the complete installation of the first test station assembly including pipe test leads, anodes, reference cell and coupons, and QC testing. The CP-4 shall also provide instructions on coating inspection and repair, maintaining electrical isolation of the underground piping, and the installation of dielectric gaskets, OVPs and protective bands. The CP-4 shall provide instructions on modifications of existing transfer pipe stations.

The CP-4 will be available (but not necessarily be onsite the entire time) during the installation of the CP system to answer questions. The CP-4 must review and sign each QC form generated by the installation contractor. The QC forms must be signed by the CP-4, and must be submitted to the CO or COR for review. The second visit by the CP-4 shall be to conduct QC tests prior to pavement. The CP-4 must verify that the underground fuel pipes installed to date are electrically isolated and properly coated, and that all cathodic protection components are fully functional prior to pavement. The CP-4 shall also provide instructions on

sealing and setting the test station housings prior to paving, and cleaning the housings after pavement. The results of each prepavement test shall be submitted in report form to the CO or COR for review prior to paving. Approval of the prepavement cathodic protection report must be given by the government prior to paving. The third visit is to conduct final QC inspections and to conduct initial testing on all test stations, pipe risers, vaults and pits. Any deficiencies shall be corrected by the contractor, at no cost to the government, prior to testing. Once the QC inspection and repairs are complete, the CP-4 will conduct initial compliance testing. The contractor shall first verify that all dielectric gaskets are effectively isolated, and that the CP components have been installed correctly and are functioning. The CP Specialist shall record native potentials, connect the anodes to the pipes in the test stations, and record initial energized potentials. The CP Specialist shall then issue an initial test report. If there are any deficiencies in material, workmanship, or performance, the contractor shall make corrections and retest at no cost to the government. The cathodic protection systems shall remain in operation for 30 to 45 days. After this period of time, the CP Specialist shall conduct the fourth site visit, and conduct final testing. Each dielectric gasket shall be tested to verify they are electrically isolated. Local potentials shall be recorded at all pipe risers, test stations, vaults, and pits, to include coupon interruption tests. The CP-4 shall also provide 8 hours of cathodic protection training for base personnel. The CP-4 shall submit a final compliance report with all test data, as-built drawings, QC reports, photographs of each completed test station housing and terminal board and dielectric gasket showing OVPs and protective bands, analysis of the data and calculated anode service life.

1.5 DELIVERY, STORAGE AND HANDLING

Storage area for corrosion materials will be designated by the Contracting Officer or the Contracting Officer's Representative, Technical Expert and Project Manager. If materials are not stored in a building, tarps or similar protection must be used to protect material from inclement weather. Resack and add backfill to packaged anodes that are damaged as a result of improper handling or exposure to rain. Notify the CO or COR of any such repairs.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Test Station Housing

2.1.1.1 Flush Mounted

NEMA ICS 6. Aircraft load rated cast iron with terminal board, 8 terminal posts and lockable lid. The unit must be of standard design, manufactured for use as a CP test station, complete with cover, terminal board, shunts, and Type 304 stainless steel hardware. The terminal board must be removable for easy access to wires. Provide traffic valve box capable of withstanding H-20 traffic loads. The cover must have a cast in legend "CP TEST". The cast iron housing shall be 8.375 inches outside diameter, 5.625 inches inside diameter and 5.25 inches deep, H2O rated for airport traffic. The ABS tube shall be 6.125 inches inside diameter with a total length of 24 inches.

2.1.2 Calibrated Shunt for Test Stations

0.1 ohm, 2 ampere, accuracy plus or minus one percent, polycarbonate circuit board type, color coded for value recognition red for 0.1 ohm shunt with nickel-plated brass posts and standard 0.25 inch inch holes on 1 inch centers to fit test station terminal boards.

2.1.3 Test Station Terminal Board

Provide terminal boards for test stations made of Micarta plastic 1/8 inch thick with dimensions 4.7 inches wide by 3 inches high. Insulated terminal boards must have the required number of insulated ring terminals (one insulated ring terminal required for each conductor). Install solderless insulated tinned copper lugs and shunts on the terminal board as indicated. Test station terminal connections will be permanently tagged with a printed label to identify each termination of conductors (e.g. identify the conductors connected to the protected structure, anodes, reference electrodes and coupons), with heat shrink protected labels. Provide a 1.5-inch diameter brass tag for each test station.

2.2 MATERIALS

Submit materials list that has the make, model, description, quantity and applicable specification section for each component in the order given in SD-02, provide a complete list regardless of provider

2.2.1 Galvanic Anodes

2.2.1.1 Dimensions and Weights

Bare anode weight 20 pounds not including core.

2.2.1.2 High Potential Magnesium Anodes

Install a minimum of 24 anodes on the jet fuel piping and PRT systems. This includes anodes for the existing transfer pipe to Pumphouses 3 and 4 at IVV-7.

2.2.1.2.1 Anode Composition

Anodes must be of high-potential magnesium alloy, made of primary magnesium obtained from sea water or brine, and not made from scrap metal. Magnesium anodes must conform to ASTM B843 and to the following analysis (in percent) otherwise indicated:

Aluminum	0.010 percent
Manganese	0.50 to 1.30 percent max
Zinc	0.05 percent max
Silicon	0.05 percent max
Copper	0.02 percent max
Nickel	0.001 percent max

Iron	0.03 percent max
Other impurities	0.05 each or 0.3 percent max total
Magnesium	Remainder

Furnish spectrographic analysis on samples from each heat or batch of anodes used on this project.

2.2.1.2.2 Dimensions and Weights

The following dimensions and weights of anodes;

a. Bare anode weight: 20 pounds.

b. Bare Galvanic Anode Ingot dimensions: 3 inches wide by 2.75 inches high by 59.75 inches long, with 40 feet of #10 AWG stranded copper cable with THWN (Red) insulation Galvanic Anode Test Lead.

2.2.1.2.3 Packaged Anodes

Provide anodes in packaged form with the anode surrounded by specially-prepared quick-wetting backfill and contained in a water permeable cloth or paper sack. Anodes must be centered by means of spacers in the backfill material.

a. The Galvanic Anode Backfill material will have the following composition, unless otherwise indicated:

Material	**Approximate Percent by Weight**
Gypsum	75
Bentonite	20
Sodium Sulfate	5
Total	100

b. The packaged dimensions shall be 5.5 inches in diameter by 66 inches long.

c. The packaged anode weight shall be 70 pounds.

2.2.2 Permanent Reference Electrodes

Permanent reference electrodes must be copper/copper-sulfate specifically manufactured for underground use. The electrode will be prepackaged by the manufacturer with a backfill material as recommended by the manufacturer. Provide electrodes with No. 14 AWG, RHW cable 25 feet in length to extend to the test station without splicing. Reference electrodes will have a minimum 30-year life, stability of plus or minus 5 millivolts under 3 microamp load. The manufacturer must calibrate the PRE to 316 mV plus or minus 10mV referenced to a standard hydrogen electrode (SHE) and provide a calibration certificate detailing the results of the calibration. Procedures for evaluating the accuracy annually must be included in the Operation and Maintenance Manual.

2.2.3 Coupon and Test Lead

Coupons must match the material of the structure, with 1 integrated connection with electrical wire and be designed, manufactured and procured for use as a potential comparison.

a. Coupons shall be 316 stainless steel and shall have an exposed surface area of 10 square centimeters.

b. Each coupon shall be provided with a single #12 AWG stranded copper cable with THHN insulation, 25 feet in length.

c. The "energized" coupons shall have orange cable and the "native" coupons shall have purple cable.

d. Provide a magnetic switch and magnetic switch key for each energized coupon, and two magnetic keys to remain on base.

2.2.4 Dielectric Gasket Kit

Provide full-faced gaskets, isolating sleeves and washers, and stainless steel washers. Provide isolation flange kits rated for operation at the rated pressure and temperature.

2.2.4.1 Gaskets

ASME B16.21. Full face G-10 material,150 ANSI, 1/8-inch thick, with duplex twin Viton seals.

2.2.4.2 Isolating Washers and Sleeves

Provide double 1/8-inch thick G-10 dielectric washers. Sleeves shall be G-10 and shall be of sufficient length to pass through both dielectric washers and both stainless steel washers.

2.2.4.3 Backer Washers

316 Stainless steel, to fit over sleeve and within the bolt facing on the flange.

2.2.5 Dielectric Tubing Union

The Swagelok dielectric tubing unions shall be 316 stainless steel, polyamide-imide isolation, pressure rating 5000 psig, size to match tubing on PRT tank.

2.2.6 Over Voltage Protector (OVP)

The OVPs shall be solid state designed to protect dielectric gaskets from multiple electronic surges. Spark gap arrestors and similar mechanical devices are not permitted.

2.2.6.1 Electronic Ratings

The OVPs shall be constructed within a nickel-plated copper housing, suitable for class 1 division 1 exposure per ANSI. The environmental rating of the housings shall be NEMA 6P, IP68.

a. The threshold voltage rating shall be -3/+1 DCV.

b. The AC fault current rating shall be 3700 amperes at 30 cycles.

c. The lightning surge current rating shall be 100,000 amperes crest.

2.2.6.2 OVP Mounting Bracket

The bracket shall be constructed of nickel-plated copper, and shall be of the type that mount on the flange bolts. The brackets shall match the individual flange bolt hole diameters.

2.2.6.3 Protective Flange Band

The flange protector bands are designed to keep debris and moisture from entering between the flange faces, and from accidental grounding across the flanges.

The protective bands shall be constructed of 22 gauge 316 stainless-steel bands with a 3/16-inch thick closed cell EPDM lining and stainless-steel worm gear. The band can be cut to fit around valves.

The bands shall be furnished with manufacturer's recommended inhibitive gel to be applied to the flange surfaces prior to installing the bands.

2.2.7 Exothermic Weld Mold, Exothermic Weld Charge, and Exothermic Weld Coating

Electrical connections to fuel pipes must be made using exothermic welds in strict accordance with the manufacturer's recommendations.

a. Exothermic weld molds shall be graphite and shall be designed to connect #10 AWG stranded copper cable to horizontal 8-inch 10-inch and 12-inch diameter pipes.

b. The weld charge shall be 15 grams and shall be of the correct alloy to connect a stranded copper cable to a stainless steel pipe.

c. The liquid coating epoxy used to coat the girth welds shall be used to coat the exothermic welds.

2.3 ACCESSORIES

2.3.1 Electrical Connection to Structures

2.3.1.1 Exothermic Welds

Electrical connections to fuel pipes must be made using exothermic welds in strict accordance with the manufacturer's recommendations.

a. Exothermic weld molds shall be graphite and shall be designed to connect #10 AWG stranded copper cable to horizontal 8-inch, 10-inch and 12-inch diameter pipes.

b. The weld charge shall be 15 grams and shall be of the correct alloy to connect a stranded copper cable to a stainless steel pipe.

c. The liquid coating epoxy used to coat the girth welds shall be used

to coat the exothermic welds.

PART 3 EXECUTION

3.1 SAFETY PRECAUTIONS AND HAZARDOUS LOCATIONS

Any personnel performing operations that will generate heat, sparks, or flame in hazardous locations must first perform adequate safety precautions. A trained responsible person must ensure the area is safe to perform the operation. Required actions include ensuring adequate ventilation before work starts, air monitoring, and a fire watch must be provided and remain for 30 minutes after the operation is completed. A minimum of 20 pound ABC type fire extinguisher must be available and must be inspected before each use. Equipment being used must be inspected and used in accordance with manufacturer recommendations. Combustibles that are in the work area(s) must be moved or if they cannot be moved, be covered with fire retardant welding blankets. When performing exothermic welding, properly sized charges and inspection of the structure condition must be accomplished to ensure a safe operation.

3.2 INSTALLATION

3.2.1 Excavation and Trenching

Perform trenching and backfilling in accordance with Section 31 00 00 EARTHWORK. Extend pipe trench as needed to achieve 5-foot separation between anodes and fuel pipe.

3.2.2 Anode Excavation

a. Lay anodes horizontally at bottom of trench offset from pipe as shown on drawing.

3.2.3 Anode Installation

Do not lift or support anode by the lead wire. Where applicable, remove manufacturer's plastic wrap/bag from the anode. Exercise care to preclude damaging the cloth bag and the lead wire insulation. Lay anodes horizontally at bottom of pipe trench offset from pipe. Pour at least ten gallons of water over each anode to saturate the anode backfill and surrounding soil. Anodes must not be backfilled prior to inspection and approval by the Contracting Officer or the Contracting Officer's Representative, Technical Expert and Project Manager. Backfill anodes with native soil

3.2.3.1 Lead Wire Installation

Cover the lead wire trench bottom with a 3-inch layer of sand or stone-free earth. Center wire on the backfill layer. Do not stretch or kink the conductor. Place backfill over wire in layers not exceeding six inches deep. Compact each layer thoroughly. Do not place tree roots, wood scrap, vegetable matter and refuse in backfill.

3.2.4 Coupons

Remove the coupons from the packaging and verify cable colors. Once pipe is set on select fill, lay coupon offset 3 inches from pipe as shown. Extend cables to test station location.

3.2.5 Reference Cell

a. Soak reference cell in fresh water for at least 4 hours prior to installation. After this period of time, calibrate the packaged cells to a freshly charged copper/copper-sulfate reference cell. The cells must be within 25 millivolts. Replace any defective cells. Keep reference cell QC test results for inspection by CO or COR.

b. Place the calibrated reference cell horizontally, 3 inches offset from the coupons. Cover the coupons and cell with select sand fill.

c. Extend reference cell test leads to the test station location.

3.2.6 Pipe Test Lead

a. Connections of test leads to fuel pipes shall be made before the pipes are placed in service. The connections shall be made with exothermic welds designed for stainless steel pipe.

b. Clean the factory coating off the pipe in two (2) 2-inch squares, 6 inches apart. Clean the exposed pipe to bright metal. Provide an anchor profile on the polished metal.

c. Strip the test lead insulation so it fits correctly in the graphite mold, set the mold on the cable within the cleaned area of the pipe. Place the weld tin and the weld charge in the mold, close the lid and add the starting powder.

d. Ignite the weld metal holding the mold securely. Wait 10 seconds and remove the mold. Strike the weld with a 2-pound hammer making sure it is secure.

e. Clean the weld with a stainless steel wire brush, and apply the two (2) part liquid epoxy coating.

f. Wrap the test leads around the pipe and extend the pipe test leads to the test station location.

g. Gather the anode, fuel pipe, reference cell and coupon test leads at each test station, support the cables and protect them from damage when the fuel pipes are backfilled.

3.2.7 Test Station

a. Once the pipe trench has been backfilled, coil the test leads within the test station housings. Set the test stations directly over the fuel pipe, with the bottom of the tube extending into the soil, set the top of the housing at the correct elevation.

b. Apply tape over the top of each test station housing, prior to paving or pouring concrete pads. Use care when the concrete is poured to verify the test station housings are set at the correct soil or pavement elevation.

c. Once the concrete cures, locate each test station, remove the protective tape, remove the lid and verify the test leads are present and accessible, and that no concrete entered the housing.

3.2.8 Dielectric Gaskets

a. The mechanical plans show where each of the dielectric gaskets are to be installed. Match the flange gasket, OVP, and protective band to the flange size and type.

b. Install the dielectric gaskets using two (2) alignment pins. Do not pinch the gasket between the flanges.

c. Install the dielectric sleeves, dielectric washers and stainless steel backer washers on each flange bolt. Do not force bolts and sleeves into bolt holes, use pins to align bolt holes.

d. Tighten bolts in a star pattern, to the manufacturer's recommended torque.

e. On one bolt for each dielectric flange, install an OVP using a set of brackets. Be sure the dielectric sleeves extend through the brackets, and tighten the bolt.

f. Wipe inhibitive gel over the surface of the flange, then install the protective band and tighten.

3.2.9 Dielectric Tubing Union

a. Cut tube to correct length, insert into union and tighten.

3.2.10 Wiring Test Stations

a. The cables within the test station housings shall be terminated by the contractor's CP-4, once construction is complete.

3.3 FIELD QUALITY CONTROL

a. The contractor's CP-4 shall provide a written step-by-step cathodic protection installation procedure. The procedures shall be provided in sufficient detail to ensure the mechanical or electrical contractor can carry out the cathodic protection installation with limited onsite guidance. The installation procedure must be submitted to the CO or COR for review and approval.

b. The contractor's CP-4 shall provide a written cathodic protection QC plan with testing requirements and data forms. The QC plan shall address inspection of materials, testing of lead wires after backfill, and testing of lead wires prior to paving.

c. The contractor must submit post-backfill QC test forms to the contractor's CP-4 for review and signed approval. The signed QC forms must be submitted to the CO or COR for review.

d. The contractor's CP-4 must conduct QC inspections and testing prior to paving over any section of jet fuel pipe. The CP-4 must inspect each vault and riser to verify the fuel pipes are electrically isolated. The CP-4 must record potential measurements on each test station test lead wire, and verify all cathodic protection components have been installed and are fully functional. The CP-4 shall also temporarily connect the anode leads to the pipe leads at each test station, and record the "On" potential and anode current, to verify the fuel pipes are electrically isolated. If there are any cathodic protection

system deficiencies, they must be corrected and retested by the contractor at no cost to the government. The test data and analysis must be sent to the CO or COR for review and approval prior to placing pavement over the underground fuel pipes. The CO or COR must approve the reports prior to paving.

e. Reports to include Test Station QC before pavement and electrical isolation before pavement.

3.3.1 Initial Compliance Testing

Final cathodic protection compliance testing shall not take place until construction of the fuel pipes, vaults, pits and pavement over the pipes is complete. All of the fuel pipe connections must be complete prior to testing, and the test station housings must be set in concrete. Provide 14 days' written notice to the CO or COR as to when compliance testing will take place. The field tests shall be conducted by the approved contractor's CP-4.

a. The test criteria to be used for this evaluation is a local "instant off" potential of -950 millivolts or more negative to the fuel pipe, and an anode service life of at least 30 years. No criteria substitution is permitted.

3.3.1.1 Initial Test Procedures

a. All of the compliance inspections and tests shall be completed by the contractor's submitted and approved NACE certified CP Specialist (CP-4). Provide 14 days' written notice of the inspection and testing to the CO or COR.

b. Inspect and test the dielectric gaskets and dielectric unions within the vaults and pits, and at risers, with a 601 isolation checker or equal instrument. Verify that the dielectric gaskets and unions are effectively electrically isolated, and there are no grounded contacts to the fuel pipes within the vaults and pits. Verify that each OVP and protective band has been installed correctly. The contractor must repair any defective gaskets and dielectric union, and clear contacts to the fuel pipes, at no cost to the government, before proceeding with testing.

c. Inspect each cathodic protection test station, verify that the housings are complete and in good condition, verify that the correct test leads are present and of sufficient length to extend 18 inches above grade, confirm that there are no obstructions within each housing and that there is soil access at the bottom of the tube. The contractor must repair any deficiencies at no cost to the government.

d. Record "open circuit"/"baseline" potential measurements on each test lead at each test station. Use a freshly charged copper/copper-sulfate portable reference cell placed in contact with the soil at the bottom of each housing. Terminate and label each test lead as it is tested, but do not connect the pipe lead and the magnetic switch to the calibrated shunt. Record a submeter GPS coordinate to each test station.

e. At the isolation vaults and risers record "baseline" potential measurements to each isolated pipe and valve, to a portable cell

placed in the soil.

f. Once all of the test stations have been inspected, and the test leads have been tested in all of the housings, connect the pipe leads and magnetic switches to the calibrated shunts. Once all of the pipe leads and magnetic switches have been connected, return to each test station and record the "current applied" potential measurement and the anode current.

3.3.1.2 Final Test Procedures

a. Final compliance testing shall be completed 30 to 45 days after initial testing. Provide 14 days' advance notice of the actual test dates.

b. Sixty (60) days prior to final compliance testing, submit the O&M manual for review and approval. Also provide an O&M training course outline.

c. An 8-hour cathodic protection monitoring training class shall be provided for base personnel during final testing. This training must be scheduled in advance, and must incorporate the O&M instructions. The training course outline shall include instructions on corrosion basics, coatings, cathodic protection basics, instrumentation and test methods, data collection and record keeping, troubleshooting and repairs.

d. At each test station, record the "current applied" potential measurement on the fuel pipe and coupons using the stationary cell and a portable cell. Disconnect the pipe lead from the shunt for 2 seconds, and record the displayed potential as a "local instant off". Reconnect the pipe test lead. Record the "instant off" potential of the energized coupon, to the stationary reference cell. Record the anode current in DC milliamperes.

e. At each vault and riser, record the "current applied" potential measurement to each isolated pipe and electrically grounded valve or riser, with the cell in the soil. Verify that the pipes are electrically isolated.

f. Inspect each OVP and protective band, verify they are in place and installed correctly, and that the brackets are electrically continuous with the pipe flanges.

g. Obtain clear photographs of each test station terminal board and dielectric gasket with the OVP and band, to demonstrate they were installed correctly.

h. Prior to leaving the project site, the contractor's CP-4 shall review the field data with the CO or COR, confirming that the pipes are effectively isolated, that they meet the stated criteria, and that the projected anode service life is compliant.

If test points do not meet the stated criteria, the contractor shall make corrections and retest at no cost to the government.

3.3.1.3 Final Compliance Test Report

a. The contractor's CP-4 shall provide a final compliance test report

to the CO or COR. The test report must include;

(1) Tabulated compliance test data
(2) Analysis of the data
(3) Calculated anode service life
(4) As-built Drawings
(5) Compliance statement by CP-4
(6) Warranty statement
(7) QC test forms and reports
(8) Photographs of terminal boards and dielectric gaskets

b. The government will review the report and will issue comments as appropriate. The contractor must address each review comment, which could include additional testing or corrections by the contractor.

c. Once the contractor's cathodic protection compliance report is accepted by the government, a government representative will inspect and test the cathodic protection system. Any deficiencies identified by the government during this inspection will be corrected by the contractor at no cost to the government. Corrective actions may include retesting and reporting.

-- End of Section --

SECTION 26 56 00

EXTERIOR LIGHTING
08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS	(2013; Errata 2013) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C1089	(2013) Standard Specification for Spun Cast Prestressed Concrete Poles

EUROPEAN UNION (EU)

Directive 2011/65/EU	(2011) Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

ILLUMINATING ENGINEERING SOCIETY (IES)

ANSI/IES LM-79	(2019) Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
ANSI/IES LM-80	(2020) Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
ANSI/IES LS-1	(2020) Lighting Science: Nomenclature and Definitions for Illuminating Engineering

ANSI/IES RP-8	(2018; Addenda 1 2020; Errata 1-2 2021) Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting
ANSI/IES TM-15	(2020) Technical Memorandum: Luminaire Classification System for Outdoor Luminaires
ANSI/IES TM-21	(2021) Technical Memorandum: Projecting Long-TermLuminous, Photon, and Radiant Flux Maintenance of LED Light Sources
IES Lighting Library	IES Lighting Library

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.3	(2020) Roadway and Area Lighting Equipment - Luminaire Attachments
ANSI C136.13	(2020) Roadway and Area Lighting Equipment - Metal Brackets for Wood Poles
ANSI C136.21	(2014) American National Standard for Roadway and Area Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C78.377	(2017) Electric Lamps— Specifications for the Chromaticity of Solid State Lighting Products
NEMA C82.77-10	(2020) Harmonic Emission Limits - Related Power Quality Requirements
NEMA C136.10	(2023) American National Standard for Roadway and Area Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacles--Physical and Electrical Interchangeability and Testing
NEMA C136.31	(2023) Roadway and Area Lighting Equipment - Luminaire Vibration
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NEMA SSL 1	(2016) Electronic Drivers for LED Devices, Arrays, or Systems
NEMA SSL 3	(2011) High-Power White LED Binning for General Illumination

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code

UL SOLUTIONS (UL)

UL 773	(2016; Reprint Jul 2020) UL Standard for Safety Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2016; Reprint Jan 2024) UL Standard for Safety Nonindustrial Photoelectric Switches for Lighting Control
UL 924	(2016; Reprint Dec 2022) UL Standard for Safety Emergency Lighting and Power Equipment
UL 1310	(2018; Reprint Jun 2022) UL Standard for Safety Class 2 Power Units
UL 1598	(2021; Reprint Jan 2024) UL Standard for Safety Luminaires
UL 8750	(2020; Reprint Jul 2024) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires, luminaire accessories, or lighting equipment are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications and on the drawings must be as defined in IEEE 100 and ANSI/IES LS-1.

b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in ANSI/IES LM-80.

c. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is gathered from LM-79 data for the luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing

together.

d. Total Harmonic Distortion (THD) is the Root Mean Square (RMS) of all the harmonic components divided by the total fundamental current.

e. The "Groundline Section" of wood poles is that portion of the pole between one foot above, and 2 feet below the groundline.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G

Pole Drawings; G

Control System One-Line Diagram; G

Sequence of Operation for Exterior Lighting Control System; G

SD-03 Product Data

Luminaires; G

Light Sources; G

LED Drivers; G

Luminaire Warranty; G

Lighting Controls Warranty; G

Pole Warranty; G

Photosensors; G

Time Clock; G

Poles; G

Brackets

Pole Foundations; G

Obstruction Marker Luminaires; G

SD-05 Design Data

Luminaire Design Data; G

SD-06 Test Reports

ANSI/IES LM-79 Test Report; G

ANSI/IES LM-80 Test Report; G

ANSI/IES TM-21 Test Report; G

SD-08 Manufacturer's Instructions

Poles

SD-10 Operation and Maintenance Data

Lighting System, Data Package 5; G

Exterior Lighting Control System, Data Package 5; G

Maintenance Staff Training Plan; G

End-User Training Plan; G

1.5 QUALITY ASSURANCE

Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the IES Lighting Library as applicable, for the lighting system specified.

1.5.1 Drawing Requirements

1.5.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), weight, accessories, and installation and construction details. Photometric data, including CRI, CCT, TM-15-11 BUG rating, LED driver type, aiming diagram, zonal lumen data, and candlepower distribution data per LM-79 must accompany shop drawings.

1.5.1.2 Pole Drawings

Include dimensions, wind load determined in accordance with AASHTO LTS and ASCE 7-16, pole deflection, pole class, and other applicable information. For concrete poles, include: section and details to indicate quantities and position of prestressing steel, spiral steel, inserts, and through holes; initial prestressing steel tension; and concrete strengths at release and at 28 days.

1.5.2 Luminaire Design Data

a. Provide distribution data according to IES classification type as defined in IES Lighting Library and ANSI/IES RP-8.

b. B.U.G. rating for the installed position as defined by ANSI/IES TM-15 and shielding as defined by ANSI/IES RP-8.

c. Provide safety certification and file number for the luminaire family. Include listing, labeling and identification in accordance with NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).

d. Provide long term lumen maintenance projections for each LED luminaire in accordance with ANSI/IES TM-21. Data used for projections must be obtained from testing in accordance with ANSI/IES LM-80.

e. Provide wind loading calculations for luminaires mounted on poles. Weight and effective projected area (EPA) of luminaires and mounting brackets must not exceed maximum rating of pole as installed in particular wind zone area.

1.5.3 ANSI/IES LM-79 Test Report

Submit test report on manufacturer's standard production model of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "14.0 Test Report" in ANSI/IES LM-79.

1.5.4 ANSI/IES LM-80 Test Report

Submit report on manufacturer's standard production LED light source (package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "8.0 Test Report" in ANSI/IES LM-80.

1.5.5 ANSI/IES TM-21 Test Report

Submit test report on manufacturer's standard production LED light source (package, array or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data, as well as required interpolation information as outlined under "7.0 Report" in ANSI/IES TM-21.

1.5.6 Test Laboratories

Test laboratories for the ANSI/IES LM-79 and ANSI/IES LM-80 test reports must be one of the following:

a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.

b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.

c. One of the EPA-Recognized Laboratories listed at for LM-80 testing.

1.5.7 Regulatory Requirements

Equipment, materials, installation, and workmanship must be in accordance with the mandatory provisions of NFPA 70 unless more stringent requirements are specified or indicated. Provide luminaires and assembled components that are approved by and bear the label of UL for the applicable location and conditions unless otherwise specified.

1.5.8 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory

commercial or industrial use for six months prior to bid opening. The six-month period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the six-month period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.8.1 Alternative Qualifications

Products having less than a six-month field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.8.2 Material and Equipment Manufacturing Date

Do not use products manufactured more than six months prior to date of delivery to site, unless specified otherwise.

1.6 DELIVERY, STORAGE, AND HANDLING OF POLES

1.6.1 Concrete Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation.

1.7 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 Luminaire Warranty

Provide and transfer to the government the original LED luminaire manufacturers standard commercial warranty for each different luminaire manufacturer used in the project.

a. Provide a written five year minimum replacement warranty for material, luminaire finish, and workmanship. Provide written warranty document that contains all warranty processing information needed, including customer service point of contact, whether or not a return authorization number is required, return shipping information, and closest return location to the luminaire location.

    (1) Finish warranty must include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

    (2) Material warranty must include:

        (a) All LED drivers and integral control equipment.

        (b) Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) are defective, non-starting, or operating below 70 percent of specified lumen output.

b. Warranty period must begin in accordance with the manufacturer's standard warranty starting date.

c. Provide replacements that are promptly shipped, without charge, to the using Government facility point of contact and that are identical to or an improvement upon the original equipment. All replacements must include testing of new components and installation.

1.7.2 Lighting Controls Warranty

Provide and transfer to the government the original lighting controls manufacturers standard commercial warranty for each different lighting controls manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Warranty service must be performed by a factory-trained engineer or technician.

a. Unless otherwise noted, provide a written five year minimum warranty on the complete system for all systems with factory commissioning. Provide warranty that covers 100 percent of the cost of any replacement parts and services required over the five years which are directly attributable to the product failure. Failures include, but are not limited to, the following:

(1) Software: Failure of input/output to execute switching or dimming commands.

(2) Damage of electronic components due to transient voltage surges.

(3) Failure of control devices, including but not limited to photosensors and motion sensors.

b. Provide a written five year minimum warranty on all input devices against defect in workmanship or materials provided by device manufacturer.

c. Provide a written five year minimum warranty on all control components attached to luminaires against defect in workmanship or materials.

1.7.3 Pole Warranty

Provide and transfer to the government the original pole manufacturers standard commercial warranty for each different pole manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Provide a written three year minimum replacement warranty for material, luminaire finish, and workmanship. Warranty service must be performed by a factory-trained engineer or technician.

1.8 OPERATION AND MAINTENANCE MANUALS

1.8.1 Lighting System

Provide operation and maintenance manuals for the lighting system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the lighting system. Include the following:

a. Manufacturers' operating and maintenance manuals.

b. Luminaire shop drawings for modified and custom luminaires.

c. Luminaire Manufacturers' standard commercial warranty information as specified in paragraph LUMINAIRE WARRANTY.

1.8.2 Exterior Lighting Control System

Provide operation and maintenance manuals for the exterior lighting control system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the exterior lighting control system. Include the following:

a. Control System One-Line Diagram

b. Product data for all devices, including installation and programming instructions.

c. Training materials, such as videos or in-depth manuals, that cover basic operation of the lighting control system and instructions on modifying the control system. Training materials must include calibration, adjustment, troubleshooting, maintenance, repair, and replacement.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

2.2 LUMINAIRES

UL 1598, NEMA C82.77-10. Provide luminaires as indicated in the luminaire schedule and XL plates or details on project plans, complete with light source, wattage, and lumen output indicated. All luminaires of the same type must be provided by the same manufacturer. Luminaires must be specifically designed for use with the LED driver and light source provided.

2.2.1 Luminaires

UL 8750, ANSI/IES LM-79, ANSI/IES LM-80. For all luminaires, provide:

a. Complete system with LED drivers and light sources.

b. Housing constructed of non-corrosive materials. All new aluminum housings must be anodized or powder-coated. All new steel housings must be treated to be corrosion resistant.

c. ANSI/IES TM-21, ANSI/IES LM-80. Minimum L70 lumen maintenance value of 50,000 hours unless otherwise indicated in the luminaire schedule. Luminaire drive current value must be identical to that provided by test data for luminaire in question.

d. Minimum efficacy as specified in the luminaire schedule. Theoretical models of initial lamp lumens per watt are not acceptable. If efficacy values are not listed in the luminaire schedule, provide luminaires that meet the following minimum values:

Luminaire Style	Minimum Luminaire Efficacy
Area and Roadway (pole mounted, arm mounted)	119 LPW

e. Product rated for operation within an ambient temperature range of minus 22 degrees F to 122 degrees F.

f. UL listed for wet locations.

g. IES Lighting Library. Light distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans.

h. Housing finish that is baked-on enamel, anodized, or baked-on powder coat paint. Finish must be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or peeling.

i. LED driver and light source package, array, or module are accessible for service or replacement without removal or destruction of luminaire.

j. ANSI/IES TM-15. Does not exceed the BUG ratings as listed in the luminaire schedule.. If BUG ratings are not listed in the luminaire schedule, provide luminaires that meet the following minimum values for each application and mounting conditions:

Lighting Application	Mounting Conditions	BUG Rating
Area and Roadway	All	B3-U0-G3

k. Fully assembled and electrically tested prior to shipment from factory.

l. Finish color is as indicated in the luminaire schedule or detail on the project plans.

m. Lenses constructed of clear tempered glass or UV-resistant acrylic. Provide polycarbonate vandal-resistant lenses.

n. All factory electrical connections are made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

o. NEMA C136.31. Comply with 3G vibration testing.

p. Luminaire arm bolts constructed from 304 stainless steel or zinc-plated steel.

q. Wiring compartment on pole-mounted, street and area luminaires is accessible without the use of hand tools to manipulate small screws, bolts, or hardware.

r. Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, LED drivers, surge suppressors and other electrical components using only a simple tool, such as a manual or cordless electric screwdriver.

s. ANSI C136.3. For all roadway and area luminaires, provide products with an integral tilt adjustment of plus or minus 5 degrees to allow

the unit to be leveled.

2.2.2 Obstruction Marker Luminaires

Provide obstruction marker luminaires for facilities as required by the FAA and in accordance with Section 26 56 20 AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS.

2.3 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type, lumen rating, and wattage as indicated in luminaire schedule on project plans.

2.3.1 LED Light Sources

Provide LED light sources that meet the following requirements:

a. NEMA ANSLG C78.377. Emit white light and have a nominal Correlated Color Temperature (CCT) of 4000 Kelvin.

b. Minimum Color Rendering Index (CRI) of 80.

c. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

d. Light source color consistency by utilizing a binning tolerance within a 4-step McAdam ellipse.

2.4 LED DRIVERS

NEMA SSL 1, UL 1310. Provide LED Drivers that are electronic, UL Class 1 or Class 2, constant-current type and meet the following requirements:

a. The combined LED driver and LED light source system is greater than or equal to the minimum luminaire efficacy values as listed in the luminaire schedule provided.

b. Operate at a voltage of 120-277 volts at 50/60 hertz, with input voltage fluctuations of plus or minus 10 percent.

c. Power Factor (PF) greater than or equal to 0.90 at full input power and across specified dimming range.

d. Maximum Total Harmonic Distortion (THD) less than or equal to 20 percent at full input power and across specified dimming range.

e. Operates for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.

f. Meets the "Elevated" (10kV/10kA) requirements per IEEE C62.41.2 -2002. Manufacturer must indicate whether failure of the electrical immunity system can possibly result in disconnect of power to luminaire. Provide surge protection that is integral to the LED driver.

g. Contains integral thermal protection that reduces the output power to protect the driver and light source from damage if the case temperature approaches or exceeds the driver's maximum operating temperature.

h. Complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

i. Class A sound rating for all drivers mounted under a covered structure, such as a canopy, or where otherwise appropriate.

j. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

k. UL listed for wet locations typical of exterior installations.

l. Non-dimmable.

m. Rated to operate between ambient temperatures of minus 22 degrees F and 122 degrees F.

2.5 LIGHTING CONTROLS

2.5.1 System

Provide exterior lighting control system that operates the exterior lighting system as described in the exterior lighting control strategies in the project plans. Submit Sequence of Operation for Exterior Lighting Control System describing the operation of the proposed exterior lighting control system and devices. Sequence of Operation must provide the strategies identified in the exterior lighting control strategies.

2.5.1.1 Relay Panel

Enclose panel hardware in a surface-mounted, NEMA 3R, stainless steel painted, steel enclosure with lockable access door and ventilation openings. Internal low-voltage compartment must be separated from line-voltage compartment of enclosure with only low-voltage compartment accessible upon opening of door. Provide additional remote cabinets that communicate back to main control panel as required. Provide relay panel that meets the following criteria:

a. Input voltage of 120-277 at 50/60 Hz, with internal low voltage power supply as required.

b. UL 924. 32 single-pole latching relays rated at 30 amps, 120-277 volts. Provide provision for relays to close upon power failure. Provide relays designed for 10 years of use at full rated load.

c. Relay control module operates at 24 VDC and is rated to control a minimum of 32 relays.

2.5.2 Devices

2.5.2.1 Time Clock

NEMA ICS 6. House time clock in a surface-mounted, lockable NEMA 3R enclosure constructed of painted steel or plastic polymer. Provide electronic type time clock that meets the following criteria:

a. astronomic programming function, providing a total of 56 on/off set points.

b. 24 hour type digital clock display format.

c. Power outage back-up for switch utilizing alkaline batteries which provides coverage for a minimum of seven days.

d. Capable of controlling a minimum of 4 channels or loads.

e. Contacts are rated for 30 amps at 120-277 VAC resistive load in a DPST normally open (NO) configuration.

f. Contains manual bypass or remote override control ability for photosensor input.

2.5.2.2 Photosensors

UL 773, UL 773A. Provide Photosensors that meet the following requirements:

a. Hermetically sealed, cadmium sulfide light sensor type, rated at 1000 watts, 277 volts, 50/60 Hz with single-pole, single-throw contacts.

b. Turns ON at 1 to 3 footcandles and turns OFF at 3 to 15 footcandles.

c. Designed to fail to the ON position.

d. Housing is constructed of UV stabilized polypropylene, rated to operate within a temperature range of minus 40 to 158 degrees F.

e. Time delay that prevents accidental switching from transient light sources.

f. Designed for 20-year service to match life expectancy of long-life LED fixtures and exceed 15,000 operations at full load. Provide photosensors with zero-cross technology to withstand severe in-rush current and extend relay life.

g. Swivel base type housing with 1/2 in threaded base for mounting to a junction box or conduit.

h. NEMA C136.10. Twist-lock receptacle type. Provide with solid brass prongs and voltage markings and color coding on exterior of housing.

i. Provide photosensors with metal oxide varistor (MOV) type surge protection.

2.6 POLES

AASHTO LTS and ASCE 7-16. Provide round tapered poles designed for wind loading of 140 miles per hour while supporting luminaires and all other appurtenances indicated. The effective projected areas (EPA) of luminaires and appurtenances used in calculations must be specific for the actual products provided on each pole. Provide poles that are embedded anchor-base type designed for use with underground supply conductors. Poles must have oval-shaped hand hole having a minimum clear opening of 3 by 5 inches. Secure hand hole covers by stainless steel captive screws. Do not install square poles. Provide poles from a Manufacturer with a standard provision for protecting the finish during shipment and installation. Do not install scratched, stained, chipped, or dented poles.

2.6.1 Concrete Poles

ASTM C1089. Cross-sectional shape must be round.

2.6.1.1 Steel Reinforcing

Provide prestressed concrete pole shafts that are reinforced with steel prestressing members. Provide internal longitudinal loading by either pre-tensioning or post-tensioning longitudinal reinforcing members.

2.6.1.2 Tensioned Reinforcing

Primary reinforcement steel used for a prestressed concrete pole shaft must be tensioned between 60 to 70 percent of its ultimate strength. The amount of reinforcement must be such that when reinforcement is tensioned to 70 percent of its ultimate strength, the total resultant tensile force does not exceed the minimum section compressive strength of the concrete.

2.6.1.3 Coating and Sleeves for Reinforcing Members

Where minimum internal coverage cannot be maintained next to required core opening, such as hand holes and wiring inlet, protect reinforcing with a vapor proof noncorrosive sleeve over the length without the 1/2 inch concrete coverage. Apply a nonmigrating slipper coating to each steel reinforcing member which is to be post-tensioned prior to the application of concrete to ensure uniformity of stress throughout the length of each member.

2.6.1.4 Strength Requirement

As an exception to the requirements of ASTM C1089, provide poles that are naturally cured to achieve a 28-day compressive strength of 7000 psi. Poles must not be subjected to severe temperature changes during the curing period.

2.6.1.5 Shaft Preparation

Provide completed prestressed concrete pole shaft with a hard, smooth, nonporous surface that is resistant to soil acids, road salts, and attacks of water and frost, and must be clean, smooth, and free of surface voids and internal honeycombing. Do not install poles within 15 days of manufacture.

2.6.2 Brackets and Supports

ANSI C136.3, ANSI C136.13, and ANSI C136.21. Provide pole brackets that are not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets must be coordinated to luminaires provided, and brackets for use with one type of luminaire must be identical. Brackets for pole-mounted street lights must correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Provide special mountings or brackets as indicated and of metal which will not promote galvanic reaction with luminaire head.

2.6.3 Pole Foundations

Provide anchor bolts consisting of a steel rod with a minimum yield

strength of 50,000 psi; the top 12 inches of the rod must be galvanized in accordance with ASTM A153/A153M. Concrete must be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. The contractor must provide sealed foundation design based on actual pole being provide for project.

2.7 EQUIPMENT IDENTIFICATION

2.7.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.7.2 Labels

UL 1598. Luminaires must be clearly marked for operation of specific light sources and drivers according to proper light source type. Note the following luminaire characteristics in the format "Use Only _____":

a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

b. Driver and dimming protocol.

Markings related to light source type must be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. LED drivers must have clear markings indicating dimming type and indicate proper terminals for the various outputs.

2.8 FACTORY APPLIED FINISH

NEMA 250. Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum meets requirements of corrosion-resistance testing.

2.9 AIRFIELD LIGHTING CONTROL SYSTEM

Modify existing airfield lighting control system to show new apron and taxiway layout. The existing system was manufactured by Crouse-Hinds.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Luminaires

Install all luminaires in accordance with the luminaire manufacturer's written instructions. Install all luminaires at locations and heights as indicated on the project plans. Level all luminaires in accordance to manufacturer's written instructions. Aim all luminaires in accordance with aiming diagram.

3.1.2 LED Drivers

Provide LED drivers integral to luminaire as constructed by the manufacturer.

3.1.3 Field-Applied Painting

Paint lighting equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.1.4 Concrete Poles

Install according to pole manufacturer's instructions.

3.1.5 Pole Setting

Set pole to depth as indicated. Poles in straight runs must be in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6 inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

3.1.6 Lighting Controls

3.1.6.1 Photosensors

Aim photosensor according to manufacturer's recommendations.

3.1.7 Grounding

Ground noncurrent-carrying parts of equipment including luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Perform initial operational test, consisting of the entire system energized for 72 consecutive hours without any failures of any kind occurring in the system. All circuits must test clear of faults, grounds, and open circuits.

3.2.1.1 Lighting Control Verification Test

Verify lighting control system and devices operate according to approved sequence of operations. Verification tests are to be completed after commissioning.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Training

Provide on-site training to the Owner's personnel in the operation and maintenance of lighting and lighting control system. Provide training that includes calibration, adjustment, troubleshooting, maintenance, repair, and replacement.

3.3.1.1 Maintenance Staff Training

Submit a Maintenance Staff Training Plan at least 30 calendar days prior to training session that describes training procedures for Owner's personnel in the operation and maintenance of lighting and lighting control system. Provide on-site training which demonstrate full system functionality, assigning schedules, calibration adjustments for light levels and sensor sensitivity, integration procedures for connecting to third-party devices, and manual override including information on appropriate use. Provide protocols for troubleshooting, maintenance, repair, and replacement, and literature on available system updates and process for implementing updates.

3.3.1.2 End-User Training

Submit a End-User Training Plan at least 30 calendar days prior to training session that describes training procedures for end-users on the lighting control system. Provide demonstration for each type of user interface. Provide users with the curfew schedule as currently commissioned, including conditional programming based on astronomic time clock functionality. Provide users with the correct contact information for maintenance personnel who will be available to address any lighting control issues.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 56 20

AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS
02/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2023) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code
NFPA 70B	(2023) Recommended Practice for Electrical Equipment Maintenance

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2016; Rev L; Change 2) Obstruction Marking and Lighting
FAA AC 150/5345-7	(2013; Rev F) Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
FAA AC 150/5345-26	(2021; Rev E) FAA Specification for L-823 Plug and Receptacle, Cable Connectors
FAA AC 150/5345-42	(2019; Rev J) Specification for Airport Light Bases, Transformer Housings, Junction Boxes and Accessories
FAA AC 150/5345-43	(2019; Rev J) Specification for Obstruction Lighting Equipment
FAA AC 150/5345-44	(2015; Rev K; Errata 2022) Specification for Runway and Taxiway Signs

FAA AC 150/5345-46	(2016; Rev E; Errata 1 2023) Specification for Runway and Taxiway Light Fixtures
FAA AC 150/5345-47	(2005; Rev B) Specification for Series to Series Isolation Transformers for Airport Lighting Systems
FAA AC 150/5345-53	(2012; Rev D) Airport Lighting Equipment Certification Program
FAA E-2519	(1972; Rev A) Types I and II
FAA FO 6850.19	(1978) Frangible Coupling

UL SOLUTIONS (UL)

UL 797	(2007; Reprint Apr 2023) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL Electrical Construction	(2012) Electrical Construction Equipment Directory

1.2 SYSTEM DESCRIPTION

Provide airfield lighting and visual navigation aids as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Protection plan; G

Training; G

SD-02 Shop Drawings

Lighting and visual navigation aids; G

Composite drawings showing coordination of work of one trade with that of other trades and with structural and architectural elements of the work. Provide sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Indicate where conflicts or clearance problems exist between the various trades.

Posted instructions; G

SD-03 Product Data

When equipment or materials are specified to conform to the standards or publications and requirements of AASHTO, ANSI, ASTM, AEIC, ETL, IEEE, IES, NEMA, NFPA, or UL, or to an FAA, FS, or MS, include proof that the items furnished under this section conform to the specified requirements. The label or listing in

UL Electrical Construction or ETL or the manufacturer's certification or published catalog specification data statement that the items comply with applicable specifications, standards, or publications and with the manufacturer's standards will be acceptable evidence of such compliance. Provide manufacturer prepared certificates when the manufacturer's published data or drawings do not indicate conformance with other requirements of these specifications.

Taxiway edge lights; G

Guidance signs; G

Obstruction lighting; G

Light bases, each type; G

Isolation transformers; G

Constant current regulators, each size; G

Frangible couplings; G

Materials and equipment; G

SD-06 Test Reports

Visual inspection; G

Progress testing for series lighting circuits; G

Counterpoise system test and inspection; G

Operating test; G

Distribution conductors, 600-volt class; G

Electrical acceptance tests; G

Low-voltage continuity tests; G

High-voltage insulation resistance tests; G

Constant current regulators, each size; G

SD-07 Certificates

Qualifications of contractor; G

Certified documentation of qualifications, as specified.

Special tools; G

List of special tools and test equipment required for installation, maintenance and testing of the products supplied by the Contractor. Items to be listed include, but are not limited to, the following:

Crimping tool; G

Cable penciler

List of parts; G

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delays.

SD-08 Manufacturer's Instructions

Posted instructions; G

Submit proposed disgrams, instructions, and other sheets prior to posting.

SD-10 Operation and Maintenance Data

Constant current regulators, Data Package 5; G

Maintenance and repair instructions; G

Instructions necessary to check out, troubleshoot, repair, and replace components of the systems, as specified.

Posted operations and maintenance instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

As-built drawings

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "must" has been substituted for "shall" or "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or words of similar meaning, to mean Contracting Officer.

1.4.1.1 Code Compliance

Comply with the requirements and recommendations of NFPA 70 and IEEE C2 and local codes where required.

1.4.2 Standard Products

a. Use only approved equipment listed in FAA AC 150/5345-53 with addendum for the date of delivery the exception of Air Force threshold lights and Army heliport fixture colors and intensities. Inspect wire and cable for date of manufacture. Materials must be certified and listed as FAA AC 150/5345-53D "Approved Airport Lighting Equipment". Do not use wire and cable manufactured more than one year before delivery to job site.

b. Provide materials and equipment listed by FAA, UL, or ETL, when such equipment is listed or approved. Do not use askarel, tetrachlorethylene and insulating liquids containing polychlorinated biphenyls (PCBs) in equipment.

c. Material and equipment must be a standard product of a manufacturer regularly engaged in the manufacture of the product and essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

d. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be products of the same manufacturer unless stated in this section.

1.4.3 Qualifications of Contractor

a. Provide documentation that the aviation lighting equipment contractor and installation electricians are experienced in installing, testing and maintaining aviation lighting systems of a similar complexity. Similar complexity, in increasing complexity, are the following: elevated edge lights and signs, in-pavement lights, and approach light systems. Include a list of government projects and 3 years of experience in constructing similar projects. Include written certification that systems have performed satisfactorily for not less than 18 months. Provide a list of airfield lighting schools or seminars attended in the last 5 years.

b. Submit certification containing the names and the qualifications of persons recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. Indicate that any person recommended to perform actual splicing and termination has been adequately trained in the proper techniques and has had at least 3 recent years of experience in splicing and terminating the same or similar types of cables approved for installation. Any person recommended by the Contractor may be required to perform a dummy or practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage power or series lighting cables. If that additional requirement is imposed, provide short sections of the approved types of cables with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

1.4.4 Protection Plan

Submit detailed procedures to prevent damage to existing facilities or infrastructures. If damage does occur, the procedures must address repair and replacement of damaged property at the Contractor's expense.

1.4.5 Prevention of Corrosion

1.4.5.1 Metallic Materials

Protect metallic materials against corrosion as specified. Do not use aluminum in contact with earth or concrete. Do not use aluminum conductors.

1.4.5.2 Ferrous Metal Hardware

Ferrous metal hardware must be hot-dip galvanized in accordance with ASTM A123/A123M and ASTM A153/A153M.

1.5 DELIVERY, STORAGE, AND HANDLING

The Contractor must deliver, store and secure all airfield lighting materials an equipment in accordance with the manufacturers' requirements.

1.6 PROJECT/SITE CONDITIONS

Items furnished under this section must be specifically suitable for the following unusual service conditions:

1.6.1 Altitude

Any equipment must be suitable for operation up to an altitude of 10,000 feet.

1.6.2 Other

Material or equipment to be installed underground; in handholes, manholes, or underground vaults; or in light bases, must be suitable for submerged operation.

1.6.3 Existing Airfield Lighting Systems

Existing airfield lighting systems must remain in operating condition and interruptions must be held to a minimum. Where interruptions are necessary, they must be scheduled as approved in writing by the Contracting Officer. Prior to the scheduled time for each interruptions, all necessary materials and a sufficient labor force must be assembled to permit completing the work within the scheduled time interval. Under no circumstances must any of the existing airfield lighting circuits be left inoperative without making provisions for suitable temporary connections in the affected area or areas. All airfield lighting circuits covered under this Contract must be replaced in such a manner that they will be operational at dusk each day. The Contractor must submit to the Contracting Officer a plan for outages and maintaining lighting and lighting control.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide airfield lighting and visual navigation aids as indicated on contract drawings.

2.1.1 Design Requirements

2.2 TAXIWAY LIGHTING SYSTEMS

Include edge lights, and all associated equipment, power supplies and controls, mounting devices, and interconnecting wiring to provide complete systems. If LED fixtures are used, provide fixtures that are compatible with the associated constant current regulators.

2.2.1 Taxiway Edge Lights

FAA AC 150/5345-46, Type L-852E(L) LED, Class 2 for semiflush taxiway edge lights with blue filter.

2.3 AIRFIELD GUIDANCE SIGN SYSTEMS

2.3.1 General

Provide guidance signs compatible with all L-828/L-829 regulators.

2.3.2 Photometric Requirements

Guidance signs must meet FAA minimum luminance requirements.

2.3.3 Taxiway Guidance Signs

FAA AC 150/5345-44, Type L-858Y(L) LED for information. Provide signs of the size and with the information indicated. Sign must operate on a multistep 6.6 amp circuit.

2.4 OBSTRUCTION LIGHTING AND MARKING

2.4.1 Obstruction Lights

Mark obstructions on or near the airfield and/or lighted as indicated. Use obstruction marker lights emitting aviation red steady burning light. Use multiple-socket assembly FAA AC 150/5345-43, Type L-810 light fixtures. For multiple flashing lights on a circuit, flash the lights in unison. Use double-unit type obstruction marker lights as indicated. Energize the obstruction lights multiple circuits as indicated.

Do not use LED-based obstruction lights on military facilities.

2.5 LIGHT BASES

FAA AC 150/5345-42 Type L-868 . Use Stainless Steel bases, Class 1B, Size B as indicated or as required to accommodate the fixture or device installed. Provide base plates, cover plates, and adapter plates to accommodate various sizes of fixtures.

Furnish each base with internal and external one-hole ground lugs for attaching ground or counterpoise cables.

Furnish each base with a 4 foot braided, #6 AWG equivalent ground strap with one-hole lug compression fittings. Utilize straps made for the purpose of grounding the light fixture to the base can interior grounding lug.

2.6 ISOLATION TRANSFORMERS

2.6.1 Encapsulated Isolation Transformers

FAA AC 150/5345-47, Type (G) L-830. Provide each transformer with rating as indicated. Insulation Level Primary voltage rating 5000 volts RMS, Secondary 600 V RMS. Operating Temperature range minus 131 degrees F to plus 149 degrees F. Resistant to UV exposure and ozone. Suitable for areas contaminated with oils, aircraft fuels, soil acids, alkalis, and deicing fluids. Compatible with FAA Style 2 and Style 9 connectors.

2.7 MATERIALS AND HARDWARE

2.7.1 Wire and Cable

Use copper conductors installed in conduit. Do not provide or install wire and cable manufactured more than one year before delivery to the job site.

2.7.1.1 Conductor Sizes

Conductor size conforming to American Wire Gage (AWG) or metric trade size. Use stranded conductors for sizes larger #8 AWG. Unless otherwise indicated #8 AWG and smaller may be solid or stranded.

2.7.1.2 Wire and Cable for Series Lighting Circuits

a. FAA AC 150/5345-7, Type L-824 for crosslinked polyethylene Type C5000 -volt cable. Use unshielded cable for series airfield and heliport lighting.

2.7.1.3 Cable Tags

Install cable tags for each cable or wire at duct entrances entering or leaving manholes, handholes, and at each terminal within the lighting vault, and in all base cans. Use stainless steel, bronze or copper strip cable tags, approximately 1/16 inch thick or hard plastic 1/8 inch thick suitable for immersion in salt water and impervious to petroleum products. Use sufficient material length for imprinting the legend on one line using raised letters. Permanently mark or stamped with letters not less than 1/4 inch in height as indicated. Two-color laminated plastic is acceptable. When providing plastic tags utilize white colored with markings of black color to provide contrast so that identification can be easily read. Use nylon or stainless steel ties must be of a type that will not deteriorate when exposed to water with a high saline content and to petroleum products.

2.7.1.4 Cable Connectors and Splices

FAA AC 150/5345-26, Item L-823 for connections and splices appropriate for FAA Type L-824 cable.

2.7.2 Conduit, Conduit Fittings, and Boxes

2.7.2.1 Outlet Boxes for use with RMC, EMT, of LFMC

See 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7.2.2 Plastic Duct for Concrete Encasement

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7.2.3 Plastic Conduit for Direct Burial

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7.2.4 High Density Polyethylene (HDPE) Electrical Conduit for Directional Bore

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7.2.5 Frangible Couplings and Adapters

FAA FO 6850.19 and FAA E-2519. Provide upper section of frangible coupling with one of the following:

a. Unthreaded for slip-fitter connections.

b. 2-13/32 inch 16N-1A modified thread for nut and compression ring to secure 2 inch EMT.

c. 2 inch 11-1/2-N.P.T. (tapered) with 7/32 inch nominal wall thickness to accept rigid conduit coupling.

d. Frangible Couplings for specialized applications as approved.

e. Electrical Metallic Tubing UL 797, where indicated for use with frangible couplings and adapters.

2.7.3 Electrical Tape

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7.4 Ground Rods

As specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7.5 Bolts and Hardware

2.7.5.1 Locking Type Washers

Use locking washers of the two-piece wedge-lock design to prevent damage to the fixture. Do not use split-ring, serrated or star type lock washers.

2.7.5.2 Anti-Seize Compound

Use anti-seize compounds for elevated light fixtures with stainless steel bolts but not for ceramic-metallic/fluorocarbon polymer coated bolts for in-pavement light fixtures. Use as recommended by the fixture manufacturer to provide the required clamping force except as indicated in Part 3 of this specification.

2.7.5.3 Ceramic-Metallic/Fluorocarbon Polymer Coated Bolts

Ceramic-metallic/fluorocarbon polymer coated bolts must be used for in-pavement light fixtures or may be used where recommended by the fixture manufacturer in lieu of using an anti-seize compound.

2.7.5.4 Stainless Steel Bolts for Elevated Fixtures

Use anti-seize lubricating compound.

2.7.6 Manufacturer's Nameplates

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.7.7 Field Fabricated Nameplates

Provide field fabricated nameplates as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.8 ACCESSORIES

2.8.1 Special Tools

List of special tools and test equipment required for installation, maintenance of testing of the products supplied by the Contractor. Items to be listed include, but are not limited to, the following:

4-Jack Positioning Jig, used to install the light base to ensure correct orientation and leveling of in-pavement fixtures.

Crimping Tool

Cable Penciler

Elevated Light Level

2.9 EXISTING CONTROL SYSTEM

The Contractor must update the display for the existing Airfield Lighting Control System to show new apron and connector taxiways. The existing control system manufacturer is Crouse-Hinds.

PART 3 EXECUTION

3.1 LIGHT FIXTURE INSTALLATION REQUIREMENTS

3.1.1 Existing Airfield Lighting Systems

Existing airfield lighting systems must remain in operating condition and interruptions must be held to a minimum. Where interruptions are necessary, they must be scheduled as approved in writing by the Contracting Officer. Prior to the scheduled time for each interruption, all necessary materials and a sufficient labor force must be assembled to permit completing the work within the scheduled time interval. Under no circumstances must any of the existing airfield lighting circuits be left inoperative without making provisions for suitable temporary connections in the affected area or areas. All airfield lighting circuits covered under this Contract must be replaced in such a manner that they will be operational at dusk each day. The Contractor must submit to the Contracting Officer a plan for outages and maintaining lighting and lighting control.

3.1.2 General Installation Requirements

Conform to IEEE C2, NFPA 70, NFPA 70B, and requirements specified herein. Circuits installed underground must conform to the requirements of Section

33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, except as required herein. Steel conduits installed underground must be installed and protected from corrosion in conformance with the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical metallic tubing (EMT) must not be installed underground or encased in concrete. Except as covered herein, perform excavation, trenching, and backfilling in accordance with the requirements of Section 31 00 00 EARTHWORK and Section 32 11 23.23 BASE COURSE DRAINAGE LAYERS.

3.1.3 Airfield Light Fixture Installation

Use 2-part locking type washers for the installation of all airfield light fixtures. Tighten bolts to washer manufacturers recommended torque based on bolt type used. Use only adjustable torque limiting tools.

Where stainless steel bolts are used for elevated fixture installation use an anti-seize lubricating compound.

Where ceramic-metallic/fluorocarbon polymer coated bolts are used for in-pavement fixture installation do not use anti-seize lubricating compounds.

3.1.4 Light Base Installation

3.1.4.1 Installation in Concrete Bed

Where light base can is partially embedded in concrete with jig or holding devices, leave device in place for minimum 24 hours. Let base can set for an additional 48 hours before remaining concrete is placed to the top of the light base.

3.1.5 In-Pavement Airfield

Remove water, debris, and other foreign substances prior to installing in-pavement light base and light. Use a 4-jack positioning jig, obtained from the L-868 base manufacturer, to install the light base to ensure correct orientation and leveling. The individual setting the jig must fully understand reference marks that are provided by the surveyor. Check azimuth by survey before the concrete anchor is placed and again before paving. Do not place the near light base edge closer than two feet from a planned pavement joint. If conflict occurs, immediately notify the Contracting Officer Representative of the conflict.

3.1.5.1 In-Pavement Light Installation

For in-pavement installations, pavement around the light base must be level with the surrounding pavement; dished or mounded pavement near the light base is not acceptable.

3.1.6 Light Fixture Installation Tolerances

	IN-PAVEMENT	ELEVATED
ELEVATION (relative to finished pavement surface)	+0 inch, -1/16 inch (fixture edge on low side in snow areas or on high side in non-snow areas)	+1/4 inch, -0 inch
AZMUTH (*) (w/respect to line parallel to RW/TW centerline)	+/- 1/2 degree	+/- 1/2 degree
LEVEL	+/- 1/2 degree	+/- 1/2 degree
STATIONING (in line parallel to RW/TW centerline)	+/- 2 inch	+/- 2 inch
OFFSET (perpendicular to RW/TW centerline)	+/- 1/4 inch	+/- 1/4 inch

(*)For omni-directional fixtures the Azimuth does not apply.

3.1.7 Isolation Transformers

Conform to FAA AC 150/5345-26 for transformer lead connections. Plug transformer secondary connectors directly into a mating connector on the transformer secondary leads. During installation, cover mating surfaces of connectors until connected and clean when plugged together. At joint where connectors come together, install heat shrinkable tubing with waterproof sealant or with two half-lapped layers of tape over the entire joint. Joint must prevent entrapment of air which might subsequently loosen the joint.

3.2 CABLES

3.2.1 Cable Installation

In addition to the requirements of Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, use kit type connectors to splice 5 kV single-conductor series lighting cables. During installation, keep mating surfaces of connectors covered until connected and clean when plugged together. At joint where connectors come together, install heat shrinkable tubing with waterproof sealant. Alternately, provide two half lapped layers of tape over the entire joint. Joint must prevent entrapment of air which might subsequently loosen the joint.

3.2.2 Airfield 5kV Series Lighting Cables

3.2.2.1 Connectors

Use kit type connectors to splice 5 kV single-conductor series lighting cables. During installation and prior to covering with earth, cover mating surfaces of connectors until connected and clean when plugged together. At joint where connectors come together, install heat shrinkable tubing with waterproof sealant with two half-lapped layers of tape over the entire joint. Joint must prevent entrapment of air which might subsequently loosen the joint.

3.2.2.2 Crimping Tool

Use only splice kit manufacturer's crimping tool on splice connectors for all primary and secondary airfield cable splices. Crimping tool must have an embossed die with gauge marks for gauge of cable being used.

3.2.2.3 Cable Penciler

Airfield cable insulation must only be removed using cabling penciler made specifically for airfield cable.

3.2.3 Cable Markers

Provide cable markers or tags for each cable at duct entrances entering or leaving manholes or handholes and at each termination within the lighting vault. Provide not less than two tags per cable in in each manhole or handhole, one near each duct entrance hole. Immediately after cable installation, permanently attached tags to cables and wires so that they cannot be accidentally detached.

3.3 COUNTERPOISE

Install counterpoise above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete cone of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise conductors above the conduits must be adequate to provide a cone of protection measured 22 1/2 degrees each side of vertical. Install one continuous length of conductor, except where distance exceeds the length usually supplied. Install the counterpoise approximately 6 inches above single duct lines that are not adjacent to pavement. Where trenches or duct lines intersect, electrically interconnect the counterpoise wires. Connect the counterpoise conductor to a ground rod at every 2,000feet of cable run, at lighting vault(s) (but not to vault equipment), and at feeder connection to light circuit(s). Install the counterpoise conductor in a separate duct under roads, railroads and paved areas, above the highest duct containing electrical or communications circuits.

For in-pavement light fixtures, provide counterpoise ground rods at maximum 2,000 foot spacing.

3.4 SAFETY (EQUIPMENT) GROUNDING SYSTEM

The purpose of the safety ground is to protect personnel from possible contact with an energized light base that may result from a shorted power cable or isolation transformer. Install and connect a #16 AWG conductor

by one of the following methods from base to a ground rod

a. Connect each fixture base to a dedicated ground rod located outside the base on the side opposite the counterpoise.

Connect the safety ground conductor to ground rods by exothermic welding and bolted connections. A safety ground is not required for in-pavement fixture bases where a counterpoise is connected to the exterior ground lug. In all cases connect the light fixture, whether in-pavement or elevated, to the base interior ground lug by means of a braided ground strap specified in paragraph "Light Bases".

3.5 DUCT LINES

Duct lines as required in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION and as indicated. Ducts must be installed in trench for 24 hours before trench is backfilled to allow ducts to reach final ground temperature.

3.6 MARKING AND LIGHTING OF AIRWAY OBSTRUCTIONS

Mark and light all towers, poles, smokestacks, buildings of certain shapes and sizes, and other obstructions in accordance with FAA AC 70/7460-1 and as indicated.

3.6.1 Obstruction Marker Lights

Install obstruction marker lights on radio towers, elevated water tanks, smokestacks, buildings, and similar structures with 1 inch zinc-coated rigid steel conduit stems using standard tees and elbows, except that lowering devices, when required, must be installed in accordance with equipment manufacturer's recommendations.

3.7 APPLICATION

3.7.1 Exothermic Welding

Utilize only personnel who are experienced in and regularly engaged in this type of work to make these connections. Prior to any installations in the field, provide documentation that the welding kits, materials and procedures to be used for welded connections are satisfactory. Comply with the manufacturer's recommendations and the following:

a. Remove all slag from welds.

b. The light fixture base cans should be provided with internal and external one-hole ground lugs that are coated with hot dipped galvanizing, the same as the rest of the base cans. The external ground lug should be bolted to a separate ground lug that is exothermically welded to a #4 AWG stranded bare copper grounding cable. That is connected to a ground rod for Air Force or Army projects or the counterpoise for Navy projects.

c. All direct buried welds must be thoroughly coated 6 mil of 3M "Scotchkote", or approved equivalent, or coated with coal tar bitumastic material to prevent surface exposure to corrosive soil or moisture.

3.7.2 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.7.3 Equipment for Silicone Sealant

Equipment for silicone sealant must be air-powered pump, components, and hoses as recommended by the sealant manufacturer. Hoses and seals must be lined to prevent moisture penetration and withstand pumping pressures. Equipment must be free of contamination from previously used other type sealant.

3.7.4 Concrete

Concrete used in underground structures, such as manholes, handholes, pull boxes and foundations must have minimum 28-day strength of 4000 psi. Similar structures in areas where freeze/thaw conditions are common, must have minimum 28-day strength of 4500 psi. Concrete used for non-structural items, such as equipment pads, must have minimum 28-day strength of 2000 psi.

3.7.5 Grounding

Ground non-current carrying metallic parts associated with electrical equipment as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.8 FIELD QUALITY CONTROL

Notify the Contracting Officer five working days prior to each test. Correct all deficiencies and repeat tests. Field test reports must be written, signed and provided as each circuit or installation item is completed. Include resistance-to-ground and resistance between conductors field tests, and continuity measurements for each circuit. For each series circuit measure the input voltage and output current of the constant current regulator at each intensity. For multiple circuits measure the input and output voltage of the transformer for each intensity setting. Provide report documenting the visual inspection of the lights operation markings appearance installed fixtures or units.

3.8.1 Visual Inspection

Inspection reports must be prepared and provided as each stage of installation is completed. Identify the activity by contract number, location, quantity of material placed, and compliance with requirements.

3.8.2 Operating Test

Upon completion of tests, show by demonstration in service that circuits, control equipment, and lights covered by the contract are in good operating condition. Operate each switch in the control tower lighting panels so that each switch position is engaged at least twice. During this process, observe lights and associated equipment to determine that each switch controls properly corresponding circuit. Provide telephone or radio communication between the operator and the observers. Repeat tests from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Test each

lighting circuit by operating the lamps at maximum brightness for not less than 30 minutes. Visually examine at the beginning and at the end of this test to ensure that the correct number of lights are burning at full brightness. Conduct one day and one night operating test for the Contracting Officer.

Provide performance test reports, upon completion and testing of the installed system, in booklet form showing all field tests performed to adjust each component and all field tests performed to provide compliance with the specified performance criteria. For each test, indicate the final position of controls.

3.8.3 Distribution Conductors, 600-Volt Class

Using an instrument which applies a voltage of approximately 500 volts providing a direct reading in resistance, performing testing to verify that no short circuits or accidental grounds exist.

3.8.4 Counterpoise System Test and Inspection

At accessible locations, visually inspect counterpoise system to ensure continuity of counterpoise system. Test continuity of counterpoise system to the vault grounding system in manhole closest to the vault.

3.8.5 Progress Testing for Series Lighting Circuits

Conduct a megger test on each section of circuit or progressive combinations of sections as they are installed. Test each section or progressive combination of sections with a megohmmeter providing a voltage of approximately 1000 volts, a direct reading in resistance. Document all results. Eliminate faults found by these tests, and re-test before proceeding with the circuit installation.

3.8.6 Electrical Acceptance Tests

Perform acceptance tests for series and multiple airfield and heliport lighting circuits only on complete lighting circuits. Each series and multiple lighting circuit must receive a high voltage insulation test. Check that cable insulation resistance to ground is not less than 50 megohms per FAA-C-1391, Installation and Splicing of Underground Cable.

3.8.7 Low-Voltage Continuity Tests

Test each series circuit for electrical continuity. Eliminate faults indicated by this test and perform retest before proceeding with the high-voltage insulation resistance test.

3.8.8 High-Voltage Insulation Resistance Tests

Subject each series lighting circuit to a high-voltage insulation resistance test by measurement of the insulation leakage current with a suitable high-voltage test instrument which has a steady, filtered direct current output voltage and limited current. High-voltage tester must include an accurate voltmeter and microammeter for reading voltage applied to the circuit and resultant insulation leakage current. Do not exceed voltage test values specified below.

a. Test Procedure: Disconnect both leads from regulator output terminals and support so that air gaps of at least 3 inches or as defined by

FAA AC 150/5345-7 Table 1 exists between bare conductors and ground. Clean and dry cable sheaths for a distance of 1 feet from ends of cables and exposed insulation at ends of cables. Connect ends of both conductors of the circuit together and to high-voltage terminals of test equipment, and test voltage applied as specified in the following tabulation between conductors and ground for a period of 5 minutes.

Test Voltage, DC		
	First Test on New Circuits	Test on Existing Circuits
High Intensity Series Lighting Circuits (5,000 volt leads, 500 and 200 watt transformers)	9000	5000
Medium Intensity Series Lighting Circuits (5,000 volt leads, 30/45 watt transformers)	6000	3000
600-Volt Circuits	900	600

When additions are made to existing circuits, test only new sections in accordance with "First Test on New Circuits" in table above. To ensure reliable operation, test complete circuit at reduced voltages indicated above.

b. Leakage Current: Measure and record insulation leakage current for each circuit after a 1 minute application of the test voltage. If leakage current exceeds values specified below, sectionalize the circuit and retest, and repair or replace defective parts. Leakage current limits include allowances for the normal number of connectors and splices for each circuit as follows:

1. Three microamperes for each 1000 feet of cable.

2. Two microamperes for each isolation transformer.

3. If measured value of insulation leakage current exceeds calculated value, sectionalize the circuit and test as specified for each section. Repair or replace defective components until repeated tests indicate an acceptable value of leakage current for the entire circuit.

c. Resistance Values versus Cable Length

An alternate test procedure for circuit validation is to use a megohmeter. Use 5000V test for new circuits and 3000V test for existing circuits. If the minimum resistance values are not achieved then use the leakage current test indicated above.

Circuit Length in Feet Meters	Minimum Resistance to Ground (Megohms)
10,000	50
10,000-20,000	40
>20,000	30

3.9 PHOTOMETRIC TESTING

3.9.1 Constant Current Regulators

3.9.1.1 Visual Examination

Examine each constant current regulator to ensure that porcelain bushings are not cracked, no shipping damage has occurred, internal and external connections are correct, switches and relays operate freely and are not tied or blocked, fuses, if required, are correct, and oil level of oil-filled regulators is correct. Remove relay panel covers only for this examination; it is not necessary to open the main tank of oil-filled regulators. Accomplish the instructions on the plates attached to the regulators. Replace covers tightly after completing examinations and tests.

3.9.1.2 Electrical Tests

Ensure that supply voltage and input tap correspond. With load disconnected, energize regulator and observe the open circuit protector to ensure that it de-energizes the regulator within 3 seconds. After testing circuits for open connections and grounds and after determining that lamps are good and in place, apply circuit load to the regulator and measure the voltage and current simultaneously on brightness taps. Voltmeter and ammeter must have an accuracy of plus or minus one percent. Record readings and make readings during the day and night in order to obtain the average supply voltage. Output current on each brightness tap must be within plus or minus 2 percent of the nameplate values after making necessary correction in the supply voltage. Late model regulators have automatic supply voltage correction in lieu of input taps, and output current does not change as supply voltage varies. When output current on tap 5 deviates from nameplate value by more than 2 percent, and regulator is not overloaded, check internal adjustment as described on regulator instruction plate. Since adjustment may be rather delicate, allow a deviation of up to plus or minus 5 percent on taps 1 through 4 before attempting to readjust the regulator.

3.10 CLOSEOUT ACTIVITIES

3.10.1 Demonstration

After completion of installations and the above tests, circuits, control equipment, and lights covered by the contract must be demonstrated to be in acceptable operating condition. Each switch in the control tower lighting panels must be operated so that each switch position is engaged at least twice. During this process, lights and associated equipment must be observed to determine that each switch properly controls the corresponding circuit. Telephone or radio communication must be provided

between the operator and the observer. Tests must be repeated from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Each lighting circuit must be tested by operating the lamps at maximum brightness for not less than 30 minutes. At the beginning and at the end of this test the correct number of lights must be observed to be burning at full brightness. One day and one night operating test must be conducted for the Contracting Officer.

3.10.2 Training

Submit requirements of training four weeks before training is scheduled to begin. Submit information describing training to be provided, training aids to be used, samples of training materials, and schedules; instructions necessary to checkout, troubleshoot, repair, and replace components of the systems, including integrated electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting after acceptance of the system.

a. Provide training on the proper operation and maintenance procedures for the system. Submit a list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

b. Submit six copies of operation for the equipment furnished. One complete set must be furnished prior to performance testing and the remainder must be furnished upon acceptance. Operating manuals must detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals must include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features.

c. Submit six copies of maintenance manuals listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals must include conduit and equipment layout and simplified wiring and control diagrams of the system as installed.

3.10.3 As-Built Drawings

Submit as-built drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible, as instructed. The as-built drawings must show installations with respect to fixed installations not associated with the systems specified herein. Cable and wire must be accurately identified as to direct-burial or in conduit and must locate the connection and routing to and away from bases, housings, and boxes.

3.10.4 Posted Instructions

Submit a typed copy of the proposed posted instructions showing wiring, control diagrams, complete layout and operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system.

3.11 MAINTENANCE

3.11.1 List of Parts

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delays.

3.11.2 Maintenance and Repair Instructions

Instructions necessary to check out, troubleshoot, repair, and replace components of the systems, as specified.

3.11.3 Posted Operations and Maintenance Instructions

Submit proposed diagrams, instructions, and other sheets prior to posting.

3.12 SCHEDULES

Refer to Section 01 35 13 SPECIAL PROJECT PROCEDURES for construction outage plan requirements.

-- End of Section --

SECTION 31 00 00

EARTHWORK
08/23

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 85	(2025) Standard Method of Test for Specific Gravity and Absorption of Course Aggregate
AASHTO T 210	(2025) Standard Method of Test for Aggregate Durability Index

ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M	(2024a) Standard Specification for Concrete Aggregates
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C144	(2018) Standard Specification for Aggregate for Masonry Mortar
ASTM D1140	(2017) Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1883	(2021) Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
ASTM D2321	(2020) Standard Practice for Underground

	Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2453	(2015; R 2020; E 2020) Standard Test Method for Shrinkage and Tenacity of Oil- and Resin-Base Caulking Compounds
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2974	(2020; E 2020) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D3740	(2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D3786/D3786M	(2018; R 2023) Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method
ASTM D4253	(2016; E 2019) Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4254	(2016) Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4533	(2011; R 2023) Trapezoid Tearing Strength of Geotextiles
ASTM D4632/D4632M	(2015a; R2023) Grab Breaking Load and Elongation of Geotextiles
ASTM D4829	(2021) Standard Test Method for Expansion Index of Soils
ASTM D4833/D4833M	(2007; R 2020) Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
ASTM D6431	(2018) Standard Guide for Using the Direct Current Resistivity Method for Subsurface Site Characterization
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM G57	(2020) Standard Test Method for Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.2 DEFINITIONS

1.2.1 Structural Fill

Soil material placed to support buildings, walls, pads, and other similar facilities.

1.2.2 Embankment Fill

Soil material placed to construct embankment.

1.2.3 Porous Fill

Free-draining material placed for subsurface drainage, as a capillary break, or another specific purpose.

1.2.4 Topsoil

Surface layer of primarily organic soil capable of supporting vegetation growth.

1.2.5 Utility Bedding Material

Fill placed to directly support pipes, conduits, cables, and appurtenant structures. Bedding may also be used to provide a cushion between utilities and bedrock, obstacles, obstructions and other unyielding materials.

1.2.6 Flowable Fill

Fill placed in a plastic or liquid form that flows to near its final placement location with limited assistance and subsequently cures or solidifies to provide a stable or impermeable barrier.

1.2.7 Satisfactory Materials

Satisfactory materials for fill and backfill, and/or any in-situ soils to remain in place comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, SW, SP, SM, SW-SM, and SP-SM. In situ soils defined as CH, CL, MH, ML, CL-ML must be removed in their entirely; however they can be reconditioned and reused in landscape and non-loaded areas only and not

under structures and pavements. Maximum particle size to be no greater than 3 inches in any dimension.

1.2.8 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; roots and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials. Perform testing, for classifying high organic content materials in accordance with ASTM D2974. High organic content material are considered unsatisfactory, except for use as topsoil.

1.2.9 Cohesionless Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Materials classified as GM, SM, GP-GM, GW-GM, SP-SM and SW-SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C117, ASTM C136/C136M and ASTM D1140.

1.2.10 Cohesive Materials

Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, SM, GP-GM, GW-GM, SP-SM and SW-SM will be identified as cohesive only when the fines are plastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C117, ASTM C136/C136M and ASTM D1140.

1.2.11 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal. Boulder size and smaller hard materials are present on the site.

1.2.12 Unstable Material

Unstable materials are too weak to adequately support the utility pipe, conduit, equipment, or appurtenant structure. Satisfactory material may become unstable due to ineffective drainage, dewatering, becoming frozen, excessive loading.

1.2.13 Expansive Soils

Expansive soils are defined as soils that have an expansion index greater than 20 when tested in accordance with ASTM D4829.

1.2.14 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried

masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling that is performed merely to increase production. Shallow bedrock is expected to be encountered across most of the site, anticipate most excavation will be in rock.

1.2.15 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural or manufactured sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

1.2.16 Degree of Compaction (Proctor)

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180-21 paragraph 1.5, Note 1.

1.2.17 Degree of Compaction (Relative Density)

Degree of compaction required for soils with less than 5 percent passing the No. 200 sieve, is expressed as a relative percentage of the maximum index density/dry unit weight and minimum index density/dry unit weight, obtained by the test procedures in accordance with ASTM D4253 and ASTM D4254, respectively, abbreviated as a percent of laboratory relative density.

1.2.18 Borrow

Soil brought to the project site from an external location for the purposes of project construction.

1.2.19 Subgrade

Earth materials directly below foundations and directly below granular base materials in building slab and pavement areas including shoulders.

1.2.20 Sand Filter Fill

Soil material placed above geotextile-encapsulated crushed stone for karst feature repairs as shown on the drawings.

1.3 SUBSURFACE DATA

Subsurface soil boring logs are shown in project plans. These data represent available subsurface information; however, variations may exist between boring locations.

1.4 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Subsurface conditions and ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent subsurface and ground water elevation at the time of construction.

d. Material character is indicated by the boring logs.

e. Hard materials and rock will be encountered as indicated in boring logs.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Excavation and Trenching Plan; G

Borrow Plan; G

Dewatering Work Plan; G

Disposition of Surplus Materials; G

Preconstruction Meeting; G

SD-06 Test Reports

Material Test Report; G

Borrow Site Testing; G

Pipe Inspection Report; G

Geotechnical Evaluation Report; G

Subsurface Extents of Karst Features Report; G

Karst Feature Repair Methodology and Hydrogeologic Assessment Report; G

1.6 QUALITY CONTROL

1.6.1 Geotechnical Engineer

Provide a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer must visit the site within two weeks of earthwork operations beginning and a minimum of every two months thereafter or whenever earthwork operations begin in a new area or when

subsurface conditions change. The Geotechnical Engineer or their representative is responsible for preparing and updating the Excavation and Trenching Plan and Dewatering Work Plan as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly Geotechnical Evaluation report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contractor is responsible for arranging meetings with the Geotechnical Engineer and Contracting Officer throughout the contract duration.

1.6.2 Geotechnical Field Representative

Provide a Geotechnical Field Representative to inspect, monitor, sample, and performing field testing. The Geotechnical Representative qualifications need to have or be a current National Institute for Certification in Engineering Technologies (NICET) Level II minimum certification in Construction Materials Testing Soils and certified by ACI per Section 03 30 00 CAST-IN-PLACE CONCRETE, paragraph FIELD TESTING TECHNICIAN AND TESTING AGENCY; be one of the following; Geologist-in-Training; an Engineer-in-Training; a Registered Geologist; or a Professional Engineer.

The Geotechnical Field Representative must have a minimum of 5 years of experience in site development, mass grading and foundation construction with similar subsurface materials for this Contract. If the Geotechnical Engineer is not able to be on-site to perform their role, the Geotechnical Field Representative can perform the on-site duties of the Geotechnical Engineer provided they are in direct contact with the Geotechnical Engineer while performing these functions. The role of the Geotechnical Field Representative in no way eliminates the requirement of the Geotechnical Engineer to perform site visits as specified in paragraph GEOTECHNICAL ENGINEER. The Geotechnical Field Representative must be present for all earthwork activities when the Geotechnical Engineer is not on site.

1.6.3 Lab Validation

Perform testing by a Corps validated commercial testing laboratory or Contractor established testing laboratory meeting the requirements of Section 01 45 00 (or similar number) entitled QUALITY CONTROL and approved by the Contracting Officer. Submit testing laboratory validation for the testing to be performed. Do not permit work requiring testing until testing facilities have been inspected, Corps validated and approved by the Contracting Officer.

1.6.4 Preconstruction Meeting

Conduct a preconstruction meeting at the jobsite at least five business days prior to the start of earthwork operations on the project. The preconstruction meeting is to be arranged by the Contractor and is to follow the written agenda submitted prior to the meeting. The purpose of this meeting is to review the requirements of this specification and the associated plans. The following individuals must be in attendance at this meeting: Contractor's Project Manager and Project Superintendent, earthwork subcontractor's Project Manager and Site Foreman, Contractor's Geotechnical Engineer and Testing Agency, Government Geotechnical Engineer and Civil Engineer, and Government Construction Manager and Engineering Technician.

The minutes of this meeting are to be recorded by the Contractor and published via email within 48 hours to all attendees. The minutes must be re-published within 48 hours via email pending any subsequent comments from the attendees.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

2.1.1 Structural Fill

Materials classified as GW, GP, GM, GW-GM, or GP-GM in accordance with ASTM D2487. Select material type appropriate for the intended purpose. Only GW or GP may be used beneath airfield pavements.

2.1.2 Embankment Fill

Materials classified as GW, GP, GM, GC, GW-GM, GW-GC, GP-GM, GP-GC, GC-GM, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, ML, MH, CL, or CH in accordance with ASTM D2487. Select material type appropriate for the intended purpose. Embankment fill beneath airfield pavements and proposed structures must not include cohesive material such as ML, MH, CL or CH. Only GW or GP may be used beneath airfield pavements. Other fill material utilized outside airfield pavement embankment must have a plasticity index not more than 12 percent and a liquid limit not greater than 35 percent, and containing no more than 25 percent passing a number 200 sieve, but with adequate sand content for dense compaction. Only cohesionless fill may be incorporated into embankments beneath structures.

2.1.3 Porous Fill

Materials containing less than 5 percent passing the No. 200 sieve. Provide the gradation as appropriate for the intended purpose.

2.1.4 Topsoil

Material suitable for topsoil obtained from excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth.

2.1.5 Utility Bedding Material

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with ASTM D2321. Install bedding for plastic piping to spring line of pipe. Utility bedding material may include the following:

Pipe bedding material for exterior coated steel pipe must be clean, sand conforming to ASTM C144 (masonry aggregate) or ASTM C33/C33M (fine concrete aggregate) with not more than 5 percent by weight passing the No. 200 sieve. Resistivity tests for sand backfill must verify the sand has an average wet resistivity greater than 10,000 ohm-cm as determined by ASTM G57.

Sieve	ASTM C33 Percent Passing	ASTM C144 Percent Passing
3/8 inch	100	---
No. 4	95 to 100	100
No. 8	80 to 100	95 to 100
No. 16	50 to 85	70 to 100
No. 30	25 to 60	40 to 75
No. 50	10 to 30	10 to 35
No. 100	2 to 10	2 to 15
No. 200	---	0 to 5

2.1.5.1 Class I

Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

2.1.5.2 Class II

Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

2.1.5.3 Gravel and Crushed Stone

Clean, coarsely graded natural gravel, crushed stone or a combination thereof or having a classification of GW, GP in accordance with ASTM D2487 for bedding. Do not exceed maximum particle size of 3 inches.

2.1.6 Durable Stone

Hard, durable, angular rock that is resistant to weathering and water action and free of organic or other unsuitable materials. Do not use shale, rock with shale seams, or other fissile or fissured rock that may break into smaller pieces in the process of handling and placing. Durable stone must conform to the following:

a. Apparent Specific Gravity, AASHTO T 85: 2.5 min.

b. Absorption, AASHTO T 85: 4.2percent max.

c. Coarse Durability Index, AASHTO T 210: 50 min.

2.1.7 2.1.7 Sand Filter Fill

Sand having particle sizes that range from fine sand to coarse sand, with less than 2 percent fines, and having a classification of SP or SW in accordance with ASTM D2487.

2.2 BURIED WARNING AND IDENTIFICATION MARKERS

Provide polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Yellow	Gas, Oil; Dangerous Materials
Orange	Telephone and Other Communications
Blue	Water Systems
Green	Sewer Systems
White	Steam Systems
Gray	Compressed Air

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.2.3 Detection Wire for Non-Metallic Piping

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.3 MATERIAL FOR RIP-RAP

Provide bedding material filter fabric and rock conforming to these requirements for construction indicated.

2.3.1 Bedding Material

Provide bedding material consisting of sand, gravel, or crushed rock, well graded, or poorly graded with a maximum particle size of 2 inches. Compose material of tough, durable particles. Allow fines passing the No. 200 standard sieve with a plasticity index less than 6.

2.3.2 Rock

Provide rock fragments which ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized such that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Provide rock with a minimum specific gravity of 2.50. Do not permit the inclusion of more than trace 1 percent quantities of dirt, sand, clay and rock fines.

2.4 BORROW

Provide borrow materials from sources located within and/or outside of Government property meeting the requirements of paragraph STRUCTURAL FILL, EMBANKMENT, FILL TOPSOIL. Borrow materials must be free of organic content, according to ASTM D2974.

PART 3 EXECUTION

3.1 PROTECTION

Perform all work specified in accordance with applicable requirements of the Corps of Engineers publication EM 385-1-1 Safety and Health Requirements Manual. Provide a Geotechnical Engineer to monitor construction activities and to prepare necessary work plans and reports; see paragraph QUALITY CONTROL.

Use equipment of type and size appropriate for the site conditions (soil character and moisture content). Maintenance of exposed subgrades and fills is the responsibility of the Contractor. The Contractor is required to prevent damage by ineffective drainage, dewatering, and heavy loads and equipment by implementing precautionary measures. Repair or replace any defects or damage.

3.1.1 Underground Utilities

Location of the existing utilities indicated is approximate. Physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor is responsible for protecting utilities from damage during construction.

3.1.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.1.2.1 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Construct storm drainage features

(ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to keep soils from becoming unstable, prevent erosion, or undermining of foundations. Remove unstable material from working platforms for equipment operation and soil support for subsequent construction features and provide new material as specified herein. It is the responsibility of the Contractor to assess the site conditions to employ necessary measures to permit construction to proceed.

3.1.2.2 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches are not allowed within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Perform control measures by the time the excavation reaches the water level in order to maintain the integrity of the in-situ material. While the excavation is open, maintain the water level continuously, at least 3 feet below the working level. Submit a Dewatering Work Plan outlining procedures for accomplishing dewatering work.

3.1.3 Shoring and Sheeting

Submit an Excavation and Trenching Plan to stabilize features, prevent undermining or unintended horizontal and vertical movement of adjacent structures, and prevent slippage or movement in banks or slopes adjacent to the excavation. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Drawings to include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations are to include data and references used.

3.1.4 Protection of Graded Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.2 BORROW

Select borrow material to meet the requirements and conditions of the fill or embankment for which it is to be used. Obtain borrow material selected by the Contractor from approved private sources. Submit a Borrow Plan that includes materials to be excavated, stockpile locations, proposed slopes, drainage, and closure. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners.

3.2.1 Government Furnished Borrow Area(s)

3.2.1.1 Drainage of Borrow Excavations

Provide adequate drainage of borrow area. Ensure that borrow operations result in minimum detrimental effects on natural environmental conditions.

3.2.2 Contractor Furnished Borrow Area(s)

Obtain approved borrow materials from approved offsite sources. If a borrow source is selected that is not a commercial entity from which soil material is directly purchased, submit a Borrow Plan that includes the borrow source location, geotechnical test results showing the fill material meets the Contract requirements, environmental test results in accordance with paragraph ENVIRONMENTAL REQUIREMENTS FOR OFF-SITE SOIL, and any Federal, State, and local permits required for excavation and reclamation of the borrow area.

3.2.3 Environmental Requirements for Off-Site Soil

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill may not contain concentrations above appropriate State and EPA criteria, and for hazardous waste characteristics. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020/8260B. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform hazardous waste characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. Provide borrow site testing for hazardous waste characteristics (TPH, BTEX and TCLP) from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring borrow material to project site until Borrow Plan containing environmental test results has been received and approved by the Contracting Officer. Supplier certified or representative testing by the contractor must be supplemented by production sampling prior to delivery to the site for every 150,000 cubic yards delivered.

3.3 SURFACE PREPARATION

3.3.1 Clearing and Grubbing

Clear and grub as specified in Section 31 11 00 CLEARING AND GRUBBING.

Remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations. Remove stumps entirely. Grub out matted roots and roots over 3 inches in diameter to at least 18 inches below existing surface.

3.3.2 Stripping

Strip site where indicated on the plans. Strip existing surface materials to a depth of 4 inches below the existing ground surface in areas

designated as Clear and Grub on the plans. Strip existing surficial soils to a depth of 4 inches in all other areas. Strip in all areas within the planned limits of disturbance. All stripped materials not suitable for reuse as topsoil will be wasted in specified disposal area. Screen all stripped soils to remove roots and organic materials prior disposal.

3.3.3 Electrical Resistivity Tomography (ERT)

The Contractor must engage a geophysicist or geotechnical engineering firm meeting the requirements of ASTM D3740 that is familiar with ERT testing methods in accordance with ASTM D6431. The firm must provide a project geophysicist, QC geophysicist, and geophysical survey team leader for the project. The QC geophysicist and geophysical team leader must be present during all ERT work. The QC geophysicist must review the ERT tests results produced by the geophysical team leader. The project geophysicist must be present at the beginning of the ERT work to coordinate the areas where ERT work will be done with the Contracting Officer, and to provide general supervision of the ERT work at the start of the project. The project geophysicist must be present on-site as needed and as requested by the Contracting Officer, and must otherwise be available for remote work related to the ERT testing and review of the ERT testing. ERT testing must be performed where shown on the drawings, and in additional areas approved by the Contracting Officer. After site stripping is completed, the exposed area must be evaluated using ASTM D6431 with probe spacing sufficient to evaluate the potential karst features from the ground surface up to 60 feet below the existing subgrade. Perform ERT testing using a 100-ft grid-based pattern. To evaluate the area, individual parallel arrays must have a horizontal spacing no greater than 100 feet, with arrays positioned perpendicular to these and at the same spacing. ERT testing must extend 100-feet beyond the perimeter of the testing areas identified on the drawings, and in additional areas approved by the Contracting Officer. ERT testing in additional areas that are approved by the Contracting Officer must be done for sinkhole throat widths of greater than 6 feet.

GPS coordinates must be provided by the ERT testing firm for all ERT test arrays, with coordinates being provided for the ends of each straight line segment along each individual ERT test array. The locations of each ERT test must be shown on a map of the site plan. The Contractor's hydrogeologist/geotechnical engineer must provide GPS coordinates for the approximate center point of the throat of all encountered sinkholes requiring repair. The Contractor's hydrogeologist/geotechnical engineer must provide GPS coordinates of the perimeter of the sinkhole throat for sinkholes with throat widths greater than 6-feet in width. The QC geophysicist must review the raw data to check for anomalies and errors due to poor electrode contact or environmental noise. For each array, two-dimensional plots of the resistivity with depth along the array must be provided with suspect karst features noted. A report of these ERT test results entitled "Subsurface Extents of Karst Features Report" must must be prepared and submitted to the Contractor's hydrogeologist/geotechnical engineer, and must include the locations, depths, and extents of the karst features and supporting data. A draft report of the ERT data must be provided within 2 days of each day of completed field testing summarizing the results for a single day of testing. A final report of ERT testing must be provided within 7 days of the completion of all testing. For karst features with throat widths greater than 6 feet, the Contractor's hydrogeologist/geotechnical engineer will prepare a Karst Feature Repair Methodology and Hydrogeologic Assessment Report based on the Karst Features Report, and will submit these reports to the Contracting Officer,

DOR, and GEPA for review. The Karst Feature Repair Methodology and Hydrogeologic Assessment Report must include the Zone type as shown on the Karst Features project drawings at the location of the sinkhole, in addition to the locations, depths, extents of the karst features, photographs ans measurements of the encountered sinkhole, means and methods for the repair's construction, and must include a hydrogeologic assessment(s) and report in accordance with GEPA Regulation 22, Div 2, Ch 10, Section 10107, para F. Upon review of the Karst Feature Repair Methodology and Hydrogeologic Assessment Report, a repair method will be issued to the Contractor by the Contracting Officer indicating the backfill requirements. Contractor must not backfill suspect areas without permission of the Contracting Officer.

3.3.4 Proof Rolling

Perform proof rolling on exposed subgrade that is unfrozen and free of surface water (wet conditions resulting from rainfall). Perform proof rolling under the full time observation of the Geotechnical Field Representative. Notify the Contracting Officer a minimum of three days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer.

After stripping, excavating, and rough grading to the planned elevation, proof roll the existing subgrade of all building, pavement and embankment locations with six passes of a loaded tandem axle dump truck. Operate the truck in a systematic manner to ensure the number of passes over all areas, and at speeds between 2.5 to 3.5 miles per hour. Subgrade materials that exhibit excessive deflection and/or rutting during proof rolling need to be scarified, aerated, and re-compacted to specified density at plus or minus 3 percent of optimum moisture content prior to being considered for remedial action by the Contracting Officer. When proof rolling under buildings, the building subgrade is considered to extend 5 feet beyond the building lines, and make one-half of the passes with the roller in a direction perpendicular to the other passes. A 15 ton pneumatic-tired or smooth drum roller may be used instead of a loaded tandem axle dump truck for proof rolling.

3.3.5 Stockpiling Operations

Place and grade stockpiles of satisfactory as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. Do not create stockpiles that could obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.4 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Excavate soil disturbed or weakened by Contractor's operations, and soils softened or made unstable for subsequent construction due to exposure to weather. Use material removed from excavations meeting the specified requirements in the construction of fills, embankments, subgrades, shoulders, bedding (as

backfill), and for similar purposes to minimize surplus material and to minimize additional material to brought on site. Do not excavate below indicated depths except to remove unstable material as determined by the Geotechnical Field Representative and confirmed by the Contracting Officer. Remove and replace excavations below the grades shown with appropriate materials as specified.

3.4.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown. Do not excavate below grades shown. Backfill excessive excavation as directed by the Contracting Officer, with satisfactory, compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed. Do not allow material to be deposited within 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.4.2 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended by the manufacturer. Provide vertical trench walls where no manufacturer installation instructions are available. Do not exceed the trench width of 24 inches below the top pipe plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for pipe sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.4.2.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 3 inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.4.2.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 4 inch below the required grade and replaced with suitable materials as provided in paragraph FILLING AND COMPACTION.

3.4.2.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with suitable material as provided in paragraph FILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.4.2.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members and of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown.

3.4.2.5 Gas Distribution

Excavate trenches to a depth that will provide a minimum 18 inches of cover in rock excavation and a minimum 24 inches of cover in other excavation.

3.4.2.6 Water Lines

Excavate trenches to a depth that provides a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.4.3 Underground Utilities

Perform work adjacent to utilities as indicated. Excavation made with power-driven equipment is not permitted within 2 feet of known utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.4.4 Structural Excavation

Following general excavation and rough grading activities, excavate the entire building footprint area and at least 5 feet beyond, to the deeper of 4 feet below existing grade or 3 feet below bottom of footings. Scarify the exposed surface to a depth of 4 to 6 inches, moisture-condition, and compact to at least 100 percent of laboratory maximum density. For new pavement areas including exterior concrete pads, over-excavate granular soils including GW and GP to a minimum of 12 inches below bottom of new pavement/pad base course, scarify, moisture-condition, and compact to at least 100 percent. For all other soils, excavate a minimum of 36 inches below bottom of new pavement/pad base course, and replace with structural fill, moisture-condition, and compact to at least 100 percent of the laboratory maximum density. Cohesive soils must not be placed beneath structures or pavements.

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata.

Footing subgrades must be inspected by the Geotechnical Field Representative prior to placing reinforcement and concrete. Following inspection by the Geotechnical Field Representative, the Contracting

Officer must be notified prior to proceeding with Concrete placement.

When intact hard rock is encountered, terminate excavation at the bottom of footing elevation shown on the plans. If the subgrade can be scarified, scarify as described above. Level the excavated rock subgrade with a minimum 1 inch thick lean concrete or sand-cement grout with a minimum 28 day unconfined compressive strength of 1,500 psi. Determine if a mixed soil-rock subgrade condition exists. Pothole a maximum spacing of 50 feet and where a mixed soil and rock subgrade is observed. Excavate soil or weak, broken rock to a depth of 3 feet below subgrade. Replace these areas with structural fill.

3.4.5 Rock Excavation and Blasting

Excavate rock encountered in the cut section to a depth of 6 inches below finished grade and replace with satisfactory material. Blasting will not be permitted.

3.5 SUBGRADE PREPARATION

3.5.1 General Requirements

Shape subgrade to line, grade, and cross section as indicated. Remove unsatisfactory and unstable material in surfaces to receive fill or in excavated areas, as determined by proof rolling, and replaced with satisfactory materials. Do not place material on surfaces that are muddy, or otherwise containing unstable material. Scarify the surface to a depth of 4 inches prior to placing fill. Step or bench sloped surfaces steeper than 1 vertical to 4 horizontal prior to scarifying. Place 4 inches of loose fill and blend with scarified material. When subgrade is part fill and part excavation or natural ground, scarify to a depth of 8 inches. Perform probing and grouting beneath structures as shown on the plans prior to the placement of structural fill. Perform probing and grouting according to Section 31 33 10 FOUNDATION DRILLING AND GROUTING IN ROCK.

3.5.2 Subgrade for Structures, Spread Footings, and Concrete Slabs

Do not excavate below depth shown for structures, spread footings, and concrete slabs. If over excavation occurs, compact disturbed material to at least 100 percent of ASTM D1557. After final rolling, the surface of the subgrade for buildings and pavements must not show deviations greater than 0.05 foot when tested with a 12-foot straightedge applied both parallel and at right angles to the centerline of the area.

3.5.3 Subgrade for Pavements

Compact top 12 inches of subgrade for pavements to at least 100 percent of ASTM D1557. After final rolling, the surface of the subgrade for buildings and pavements must not show deviations greater than 0.05 foot when tested with a 12-foot straightedge applied both parallel and at right angles to the centerline of the area.

3.5.4 Subgrade for Shoulders

Compact the upper 16 inches of subgrade for shoulders to at least 100 percent of ASTM D1557 for the depth below the surface of shoulder shown.

3.5.5 Subgrade for Airfield Pavements

Compact top 12 inches of subgrade, to at least 100 percent of ASTM D1557. After final rolling, the surface of the subgrade for buildings and pavements must not show deviations greater than 0.05 foot when tested with a12-foot straightedge applied both parallel and at right angles to the centerline of the area.

3.6 FILLING AND COMPACTION

Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs for SUBGRADE PREPARATION. Do not place material on surfaces that are muddy. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to plus or minus 3 percent of optimum moisture. Fill and backfill to contours, elevations, and dimensions indicated. Compact and test each lift before placing overlaying lift.

3.6.1 Trench Backfill

Backfill trenches to the grade shown. Do not backfill the trench until all specified tests are performed.

3.6.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with satisfactory material or initial backfill material.

3.6.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with satisfactory material placed in layers not exceeding 6 inches loose thickness.

3.6.1.3 Bedding and Initial Backfill

Provide bedding of the type and thickness shown. Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except where shown or when specified otherwise in the individual piping section, provide bedding for buried piping in accordance with PART 2 paragraph UTILITY BEDDING MATERIAL. Compact backfill to top of pipe to 95 percent of ASTM D1557 maximum density. Provide plastic piping with bedding to spring line of pipe.

3.6.1.4 Final Backfill

Do not begin backfill until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Bring backfill to indicated finish grade. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and one foot above other utility lines need to be free from stones larger than one inch in any dimension. Heavy equipment for spreading and compacting backfill are not to be operated closer to

foundation or retaining walls than a distance equal to the height of backfill above the top of footing; compact remaining area in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Place backfill carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Do not place backfill against foundation walls prior to 7 days after completion of the walls. As far as practicable, bring backfill up evenly on each side of the wall and sloped to drain away from the wall. Cohesive soils must not be placed beneath structures or pavements.

Fill the remainder of the trench, except for special materials for buildings, airfields and pavements with satisfactory material. Place backfill material and compact as follows:

3.6.1.4.1 Buildings, Airfields and Pavements

Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction. Compact as specified for Structural Fill. Subgrade materials placed within 3 feet of the final subgrade elevation below pavements must be tested to confirm that a minimum CBR value of 20 has been achieved in accordance with ASTM D1883.

3.6.1.4.2 Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 8 inches loose thickness, and compact it to 90 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.6.1.5 Electrical Distribution System

Provide a minimum cover of 24 inches from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.6.1.6 Displacement of Features

After other required tests have been performed and the trench backfill compacted to the finished grade surface, inspect the pipe to determine whether unexpected or damaging displacement has occurred. Conduct walk-through inspection of pipe sizes larger than 48 inches. Inspect pipes smaller than 48 inches using remote methods using closed circuit television, sonar, or hybrid that can provide a 360-degree inspection of the pipe. Prepare and submit a pipe inspection report consisting of digital video or photos. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.6.1.7 Buried Tape And Detection Wire

3.6.1.7.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.6.1.7.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over its entire length. Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.6.2 Structural Fill Placement

Place fill and backfill beneath and adjacent to structures in successive horizontal layers of loose material not more than 8 inches in depth, or in loose layers not more than 4 inches in depth when using hand-operated compaction equipment. Do not place over wet materials. Compact to at least 100 percent of laboratory maximum density for cohesionless materials, except as otherwise specified. Perform compaction in such a manner as to prevent wedging action or eccentric loading upon or other damage to the structure. Moisture condition fill and backfill material to within range of plus 2 or minus 2 percent of optimum moisture content at the time of compaction.

3.6.3 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.6.4 Compaction

3.6.4.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5 foot line of the paved area or structure to at least 85 percent of ASTM D1557.

3.6.4.2 Adjacent Areas

Compact areas within 5 feet of structures to at least 95 percent of ASTM D1557.

3.6.5 Backfill for Karst Repairs

Perform karst mitigation where shown on Karst Features Plan and perform as shown on Karst Features Detail. Zone 2 repairs requiring geotextile placement must meet the following requirements for a Class A Filter Geotextile:

Geotextile Strength Requirements for Drains		
Strength Type	Test Method	Class A
Grab Tensile	ASTM D4632/D4632M	180
Seam	ASTM D4632/D4632M	160
Puncture	ASTM D4833/D4833M	80
Burst	ASTM D3786/D3786M	290
Trapezoid Tear	ASTM D4533	50

3.7 EMBANKMENTS

3.7.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 8 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 100 percent laboratory maximum density for cohesionless materials beneath structures and 95 percent laboratory maximum density for cohesionless materials not beneath structures. Cohesive materials are not permitted under structures or pavements and must only be placed in turf/green and miscellaneous fill areas. The cohesive materials in these areas must be compacted to a minimum of 90 percent of the laboratory Proctor. Backfill and fill material are to be within the range of minus 3 to plus 3 percent of optimum moisture.

Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.8 RIP-RAP CONSTRUCTION

Construct rip-rap on bedding material in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.8.1 Bedding Placement

Spread bedding material uniformly to a thickness of at least 3 inches on prepared subgrade as indicated.

3.8.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in

conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.9 FINISHING/FINISH OPERATIONS

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, frozen or otherwise unstable subgrade.

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except as indicated for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.9.1 Capillary Water Barrier

Place a capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.9.2 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.9.3 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

3.9.4 Topsoil and Seed

Provide as specified in Section 32 92 19 SEEDING.

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 4 inch and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials

that would interfere with planting and maintenance operations. Remove from the site any surplus of topsoil from excavations and gradings. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.10 DISPOSITION OF SURPLUS MATERIAL

Remove from Government property all surplus or other soil material not required or not suitable for filling or backfilling, along with brush, refuse, stumps, roots, and timber. Properly disposed of in accordance with all applicable laws and regulations. Prepare plan for Disposition of Surplus Materials to include permissions document to dispose of nonsalable products.

3.11 TESTING

Perform testing as indicated in Table 1. Submit Material Test Reports within 24 hours of tests being completed. The material test reports must include a plan showing test identification, elevation, location, coordinates, and a table of the results and action taken for non-conforming items. When test results indicate that compaction is not as specified, the material must be removed, replaced, and recompacted to meet specification requirements. Tests on recompacted areas must be performed to determine conformance with specification requirements.

MATERIAL TESTED	PROCTOR TYPE	MIN PERCENT DRY DENSITY	MOUISTURE CONTENT RANGE	FREQUENCY OF TESTING*
Structural Fill (Granular)	Modified (ASTM D1557)	100 percent	-2 to + 2 percent >95 percent saturated	1 per 1,000 cy of fill placed per ASTM D6938
Random Fill (non-load bearing)	Modified (ASTM D1557)	90 percent	-3 to + 3 percent	1 per 3,000 cy of fill placed per ASTM D6938
Utility Trench Backfill/Wall Backfill	Modified (ASTM D1557)	90 percent	-2 to + 2 percent	1 per 200 cy of fill placed per ASTM D6938

*Minimum of 1 test per lift
A minimum of one density test is required per footing or slab.
Test per ASTM D2453 and ASTM D4254 for relative density for soils with less than 5 percent passing the No. 200 Sieve at the same frequency as shown above per ASTM D6938.

Material	Test Type	Frequency of Test
Embankments beneath structures, fills, backfills, borrow, and subgrade	Modified Proctor (ASTM D1557)	1 per 5,000 CY or material change
	CBR - Field or Laboratory (ASTM D1883)	1 per 5,000 CY or material change
	Gradation (ASTM C136/C136M)	1 per 1,000 CY or material change
	Atterberg Limits (ASTM D4318)	1 per 1,000 CY or material change
	Organic Content (ASTM D2974)	1 representative test per 200 lineal feet of embankment
Native Soil Subgrades other than beneath structures or pavement	Modified Proctor (ASTM D1557)	1 per 10,000 CY or material change
	Gradation (ASTM C136/C136M)	1 per 3,000 CY or material change
	Atterberg Limits (ASTM D4318)	1 per 3,000 CY or material change
	Organic Content (ASTM D2974)	1 representative test per 200 lineal feet of embankment
Utility Trench Backfill	Modified Proctor (ASTM D1557)	1 per 1,000 CY or material change
	Gradation (ASTM C136/C136M)	1 per 500 CY or material change
	Atterberg Limits (ASTM D4318)	1 per 500 CY or material change
	Organic Content (ASTM D2974)	1 representative test per 200 lineal feet of embankment

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 11 00

CLEARING AND GRUBBING
11/18

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.1.2 Trees, Shrubs, and Existing Facilities

Protect trees and vegetation to be left standing from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.1.3 Utility Lines

Protect existing utility lines that are not indicated to be removed or abandoned from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repair of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 30 00 ADMINISTRATIVE REQUIREMENTS and Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for additional utility protection.

3.2 CLEARING

Clearing consists of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing also includes the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas

to be cleared, except such trees and vegetation as may be indicated or directed to be left standing.

3.2.1 Tree Removal

Tree and stump removal must occur within the limits of disturbance and shall be removed from areas outside those areas designated for clearing and grubbing. This work includes the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Dispose of trees as specified in paragraph DISPOSAL OF MATERIALS.

3.2.2 Grubbing

Grubbing consists of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Fill depressions made by grubbing with suitable material as defined in Section 31 00 00 EARTHWORK and compact to make the surface conform with the original adjacent surface of the ground.

3.3 DISPOSAL OF MATERIALS

Dispose of excess materials in accordance with the approved solid waste management permit and include those materials in the solid waste management report.

All wood or wood like materials remaining from clearing, prunning or grubbing such as limbs, tree tops, roots, stumps, logs, rotten wood, and other similiar materials shall become the property of the Contractor and disposed of off site.

-- End of Section --

SECTION 31 32 19.16

GEOTEXTILE SOIL STABILIZATION
02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4354	(2012; R 2020) Sampling of Geosynthetics for Testing
ASTM D4355/D4355M	(2014) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491/D4491M	(2017) Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4533/D4533M	(2015) Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4632/D4632M	(2015a; R2023) Grab Breaking Load and Elongation of Geotextiles
ASTM D4759	(2011; R 2018) Standard Practice for Determining the Specification Conformance of Geosynthetics
ASTM D4873/D4873M	(2017) Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D6241	(2014) Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Thread
Manufacturing Quality Control Sampling and Testing

SD-04 Samples

Quality Assurance Samples and Tests

SD-07 Certificates

Geotextile

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle geotextile in accordance with ASTM D4873/D4873M.

1.3.1 Delivery

Notify the Contracting Officer a minimum of 24 hours prior to delivery and unloading of geotextile rolls packaged in an opaque, waterproof, protective plastic wrapping. Do not remove the plastic wrapping until deployment. If quality assurance samples are collected, immediately rewrap rolls with the plastic wrapping. Repair or replace as directed, geotextile or plastic wrapping damaged during storage or handling. Label each roll with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.3.2 Storage

Protect rolls of geotextile from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, either elevate rolls off the ground or place them on a sacrificial sheet of plastic in an area where water will not accumulate.

1.3.3 Handling

Handle and unload geotextile rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Do not drag rolls along the ground, lift by one end, or drop to the ground.

PART 2 PRODUCTS

2.1 RAW MATERIALS

A minimum of 7 days prior to scheduled use, submit manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. For needle punched geotextiles, certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. Provide the certificate of compliance attested to by a person having legal authority to bind the geotextile manufacturer.

2.1.1 Geotextile

Provide geotextile that is a woven pervious sheet of polymeric material consisting of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Add stabilizers and/or inhibitors to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that

have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material must not be used. Form geotextile into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	LBS IN	30	ASTM D4632/D4632M
SEAM STRENGTH	LBS		ASTM D4632/D4632M
PUNCTURE	LBS	930	ASTM D6241
TRAPEZOID TEAR	LBS	555	ASTM D4533/D4533M
PERMITTIVITY	cm/sec	5x10^-9	ASTM D4491/D4491M
ULTRAVIOLET DEGRADATION	PERCENT	50 AT 500 HRS	ASTM D4355/D4355M

2.1.2 Thread

A minimum of 7 days prior to scheduled use, submit proposed thread type for sewn seams along with data sheets showing the physical properties of the thread. Construct sewn seams with high-strength polyester, nylon, or other approved thread type. Provide thread with ultraviolet light stability equivalent to the geotextile and color that contrasts with the geotextile.

2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. A minimum of 7 days prior to scheduled use, submit manufacturer's quality control manual. Provide documentation describing the quality control program upon request. Perform manufacturing quality control sampling and testing in accordance with the manufacturer's approved quality control manual. As a minimum, randomly sample geotextiles for testing in accordance with ASTM D4354, Procedure A. Acceptance of geotextile must be in accordance with ASTM D4759. Tests not meeting the specified requirements will result in the rejection of applicable rolls.

PART 3 EXECUTION

3.1 QUALITY ASSURANCE SAMPLES AND TESTS

3.1.1 Quality Assurance Samples

Provide assistance to the Contracting Officer in the collection of quality assurance samples for quality assurance testing; assign 7 days in the schedule to allow for testing. Collect samples upon delivery to the site . Identify samples with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. Note the date and a unique sample number on the sample. Discard the outer layer of the geotextile roll prior to sampling a roll. Collect samples by cutting the full-width of the geotextile sheet a minimum of 3 feet long in the machine direction. Immediately reseal rolls which are sampled in their protective covering.

3.1.2 Quality Assurance Tests

Provide quality assurance samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Do not perform test method ASTM D4355/D4355M on the collected samples. Base geotextile product acceptance on ASTM D4759. Tests not meeting the specified requirements will result in the rejection of applicable rolls.

3.2 INSTALLATION

3.2.1 Subgrade Preparation

The surface underlying the geotextile must be smooth and free of ruts or protrusions which could damage the geotextile. Provide subgrade materials and compaction requirements in accordance with Section 31 00 00 EARTHWORK.

3.2.2 Placement

Notify the Contracting Officer a minimum of 24 hours prior to installation of geotextile. Repair or replace geotextile rolls which are damaged or contain imperfections as directed. Lay the geotextile flat and smooth so that it is in direct contact with the subgrade. The geotextile must also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, lay the geotextile with the machine direction of the fabric parallel to the slope direction.

3.3 SEAMS

3.3.1 Overlap Seams

Continuously overlap geotextile panels a minimum of 12 inches at all longitudinal and transverse joints. Where seams must be oriented across the slope, lap the upper panel over the lower panel. If approved, sewn seams may be used instead of overlapped seams.

3.4 PROTECTION

Protect the geotextile during installation from clogging, tears, and other damage. Repair or replace damaged geotextile as directed. Use adequate ballast (e.g. sand bags) to prevent uplift by wind. Do not leave the geotextile uncovered for more than 14 days after installation.

3.5 REPAIRS

Repair torn or damaged geotextile. Remove clogged areas of geotextile. Perform repairs by placing a patch of the same type of geotextile over the damaged area. Extend the patch a minimum of 12 inches beyond the edge of the damaged area. Continuously fasten patches using approved methods. Align the machine direction of the patch with the machine direction of the geotextile being repaired. Remove and replace geotextile rolls which cannot be repaired. Perform repairs at no additional cost to the Government

3.6 COVERING

Do not cover geotextile prior to inspection and approval by the Contracting Officer. Place cover soil in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. On side slopes, place soil backfill from the bottom of the slope upward. Do not drop cover soil onto the geotextile from a height greater than 3 feet. Do not operate equipment directly on top of the geotextile without approval of the Contracting Officer. Use equipment with ground pressures less than 7 psi to place the first lift over the geotextile. Maintain a minimum of 12 inches of soil between full-scale construction equipment and the geotextile. Cover soil material type, compaction, and testing requirements are described in Section 31 00 00 EARTHWORK. Do not use equipment for placing cover soil that stops abruptly, makes sharp turns, spins their wheels, or travels at speeds exceeding 5 mph.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 33 10

FOUNDATION DRILLING AND GROUTING IN ROCK
05/25

PART 1 GENERAL

1.1 SUMMARY

a. This section covers drilling exploratory holes; drilling drain holes; drilling, washing and pressure testing grout holes; making grout connections; furnishing, handling, transporting, storing, mixing and injecting the grouting materials; backfilling holes; patching the finished grout holes; care and disposal of drill cuttings, waste water and waste grout; clean up of grout galleries and shafts, the areas upon completion of the work and all other such operations as are incidental to the drilling and grouting. The work contemplated consists of constructing a grouted mass for support of structures and fill, the approximate locations, limits, and details which are indicated. Perform Government preconstruction sampling and testing as specified below:

b. Perform sampling and testing of sand, cementitious materials, and admixtures in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

c. Perform sampling and testing of grout materials in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM C31/C31M	(2025a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C91/C91M	(2018) Standard Specification for Masonry Cement
ASTM C150/C150M	(2024) Standard Specification for Portland Cement
ASTM C939/C939M	(2022) Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

ASTM C1019	(2024a) Standard Test Method for Sampling and Testing Grout

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Grout Installation Procedure

SD-02 Shop Drawings

Grouting Location Plan

SD-03 Product Data

Drilling Equipment

Grouting Equipment

Grout Plant; G

1.4 DELIVERY, STORAGE, AND HANDLING

Furnish transportation and storage of materials in accordance with section 03 30 00 CAST-IN-PLACE CONCRETE. Store a sufficient quantity of cement at or near the site of the work to insure that grouting operations will not be delayed by shortage of cement. In the event the cement is found to contain lumps or foreign matter of a nature and in amounts which, in the opinion of the Contracting Officer, may be deleterious to the grouting operations, screening through a standard 100 mesh screen may be required. No payment will be made for such screening.

1.5 PROJECT/SITE CONDITIONS

The program shown and described is based on currently available information. Conditions encountered during construction may require additions or deletions. Do not modify or curtail the grouting program as a construction expediency. It is a required part of design and is not secondary to any time or scheduling restrictions. Determine grouting mixes, pressures, injection rate and the sequence in which the holes are drilled and grouted in the field and as directed.

PART 2 PRODUCTS

2.1 GROUTING MATERIAL

Provide grout composed of water and cement. The grout mixes will be designed by the Contracting Officer and will be varied to meet the characteristics of each hole as determined by conditions encountered. Furnish various materials conforming to the specifications listed in paragraphs below.

2.1.1 Water

Furnish the water used in the grout. Provide fresh, clean water that is free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.Water suitable for use in the work will be furnished by the Government. It is the responsibility of the Contractor to provide any necessary connections and extensions to the Government supply line shown.

2.1.2 Cement

Provide cement used in grout conforming to the requirements of ASTM C91/C91M and ASTM C150/C150M. The use of bulk cement will be permitted provided the Contractor employs methods of handling, transporting, and storage that are satisfactory to the Contracting Officer, otherwise only cement furnished in cloth or paper bags will be accepted to use in the work. Store cement in accordance with paragraph DELIVERY, STORAGE, AND HANDLING.

2.2 METAL PIPE AND FITTINGS

Furnish, cut, thread, and fabricate pipe and fittings required for constructing grout, drainage and exploratory holes.

2.2.1 Pipe

Pipe will be black steel of the diameter and in the location indicated. Furnish pipe conforming to ASTM A53/A53M.

2.2.2 Fittings

Provide black, malleable iron fittings in accordance with ASME B16.3.

PART 3 EXECUTION

3.1 PROBE HOLE PLANNING

3.1.1 Probe Hole Locations

Prior to drilling the probe holes for grout installation, the contractor shall prepare a GROUTING LOCATION PLAN noting the proposed drilling and grouting locations in reference to the proposed structures and pavement areas. This plan shall be approved by the Contracting Officer prior to execution of drilling activities. If the field conditions warrant performing additional probe holes, the contractor shall revise their GROUTING LOCATION PLAN and submit it to the Contracting Officer for approval. Though hand markups will be permitted during construction activities, a final as-installed drawing will need to be provided to the Government noting the Hole ID number, grout quantity installed and depth of drilling.

3.1.1.1 Density Probe Hole Locations

The actual number of probe holes will need to be dictated by the actual field conditions. However, probe holes must be performed at a minimum 1 hole per footing. Additional holes must be installed per 100 square feet of foundation footings. One probe hole must be installed per each 15-foot spacing along continuous wall footings. For concrete slab and rigid concrete mat foundations addtional probe holes must be installed per each 100 square feet of foundation. All probe holes must be advanced to a

minimum of 30 feet deep below the footing bottom.

3.1.2 Grout Installation Procedure

The contractor shall provide the Contracting Officer with a probing and grouting procedure stating the individual steps they plan to follow to drill and grout the probe holes. The plan shall include methods they propose to use to confirm that a hole is cleaned out prior to grouting and how they will confirm that the hole is adequately grouted without negatively impacting the global aquifer. This can include limiting the amount or flow rate of grout injected and the installation and sequencing of additional probe holes.

3.2 EQUIPMENT

Submit details and data on the drilling and grouting equipment.

3.2.1 General

Use drilling and grouting equipment of a type, capacity and mechanical condition suitable for performing the work, as determined by the Contracting Officer. Provide power and equipment and the layout thereof meeting all applicable requirements of local, State, and Federal regulations and codes, both safety and otherwise.

3.2.2 Drilling Equipment

Use standard drilling equipment of the rotary or percussion type to perform the drilling as specified in paragraphs GROUT HOLE DRILLING, DRAIN HOLE DRILLING, COMPLETION OF GROUTING AND DRAIN HOLE DRILLING, and EXPLORATORY HOLE DRILLING. Use air for removing cuttings from the hole during drilling operations. Equip air driven drills used in galleries with suitable mufflers. Supplies include all bits, drill rods, tools, casing, piping, pumps, water, and power to accomplish the required drilling. All drilling rigs and pumps will be equipped with pressure gages.

3.2.3 Grouting Equipment

Furnish grout plant capable of supplying, mixing, stirring and pumping the grout and additives, to the satisfaction of the Contracting Officer. Submit a detailed plan showing equipment and grout plant layout proposed for mixing and placing grout. Maintain it at all times and replace any grout hole that is lost or damaged due to mechanical failure of equipment or inadequacy of grout supply by another hole, drilled by the Contractor, at its expense. Provide the amount of grouting equipment as necessary to perform the work specified herein.

3.3 GROUT, DRAINAGE AND EXPLORATORY HOLES

Drill all holes for grouting, drainage or exploration at the locations, in the direction, angle, and to the depths as directed by the Contracting Officer. Increase the number of grout holes progressively as deemed necessary by the Contracting Officer until the amount of grout used indicates that the foundation is tight. Protect each hole drilled from becoming clogged or obstructed by means of a cap or other suitable device on the collar and clean out any hole that becomes clogged or obstructed due to fault of the Contractor before completion of operations in a manner satisfactory to the Contracting Officer or provide another hole at the

expense of the Contractor.

3.3.1 Grout Hole Drilling

a. Drill grout holes with standard rotary or percussion drilling equipment. No core recovery will be required and the type bit used will be optional with the Contractor.

b. Perform drilling in accordance with the applicable grouting method hereinafter described.

3.4 PROCEDURES FOR DRILLING AND GROUTING

3.4.1 General

Accomplish drilling and grouting in single or multiple lines as shown. Drill and grout by zones using the stage grouting method as described herein.

3.4.2 Grouting

Perform all grouting operations in the presence of the Contracting Officer, and in accordance with the following general procedures.

3.4.2.1 Grout Injection

a. If an open hole condition exists, as determined by loss of drill water or inability to build up pressure during washing operations, then start grouting with a thicker mix and with a grout pump operating as nearly as practicable at constant speed at all times.

b. Do not consider the grouting of any hole complete until that hole refuses to take any grout.

c. Should grout leaks develop, caulk such leaks when and as directed, the cost thereof being included in the contract price for unit price pay item "Placing Grout", in accordance with Section 01 20 00 PRICE AND PAYMENT PROCEDURES.

d. If, due to size and continuity of fracture, it is found impossible to maintain a head of grout at the minimum workable water/cement ratio reduce the speed of the pumping or stop pumping temporarily and perform intermittent grouting, allowing sufficient time between grout injections for the grout to stiffen. Following such reduction in pumping speed, if the desired result is not obtained, discontinue grouting in the hole when directed. In such event, clean the hole, allow the grout to set, and perform additional drilling and grouting in this hole or in the adjacent areas as directed, until the desired resistance is built up.

e. After the grouting of any stop of a hole is finished, maintain the pressure by means of a stop-cock or other suitable device until the grout has set to the extent that it will be retained in the hole.

f. Grout that cannot be placed, for any reason, within two hours after mixing must be wasted. If such grout is mixed at the direction of the Contracting Officer or with his knowledge and consent, such wasted grout, except as specified in Section 01 20 00 PRICE AND PAYMENT PROCEDURES, must be paid for at the contract unit prices for the

materials contained therein.

3.4.2.2 Backfilling of Holes

Backfill holes with grout proportioned as directed by the Contracting Officer and generally having a water/cement ratio less than 1.0. Accomplish backfilling by injection of grout through a tremie pipe or hose inserted to full depth of hole. When grout vents at the surface, gradually withdraw the tremie, maintaining grout in pipe or hose until completely removed. Do not backfill holes containing freshly injected grout until the injected grout has set. No separate payment will be made for backfilling holes; however, grout will be paid for at the contract unit price for the Portland cement therein. Holes must be grouted within 48 hours of drilling. Hole left open must be redrilled at the direction of the Contracting Officer. Foundation probe holes must have a minimum diameter of 4.5 inches. The contractor shall provide a means to discharge the grout through the center of the hole such that the side walls of the hole do not cave-in. Holes that have cave in shall be redrilled to the initial depth. Top-down grouting may be performed in dry holes with no standing water or groundwater table provided following additional steps are taken:

a. Sound each probe hole immediately before grouting to confirm their probe depth.

(1) Sound probe holes with suitable equipment such as a short piece of rebar appropriately attached to an open reel long tape measure.

(2) Include sounding method in Probing and Grouting Work Plan submittal.

(3) Sounding of the probe hole must be observed and documented and included in the probing and grouting logs by the CQC Geotechnical Engineer or Geotechnical Field Representative. Shouild the CQC Geotechnical Specialist or Geotechnical Field Representative not observe and document the sounding of the probe hole directly prior to grouting, a supplemental proble hole must be drilled to the required depth and grouting within close proximity to the Government and under the observation and documenation of the CQC Geotechnical Engineer or Geotechnical Field Representative.

(4) The probe hole sounded depth must be the same as the drilled depth of the probe hole.

3.4.2.3 Equipment Arrangement and Operation

Arrange the grouting equipment to provide a continuous circulation of grout throughout the system and to permit accurate pressure control by operation of a valve on the grout return line, regardless of how small the grout take may be. Prevent the equipment and lines from becoming fouled by the constant circulation of grout and by the periodic flushing out of the system with water. Flush with the grout intake valve closed, the water supply valve open, and the pump running at full speed.

3.4.2.4 Protection to Work and Cleanup

During grouting operations take such precautions as may be necessary to prevent drill cuttings, equipment exhaust oil, wash water, and grout, from defacing or damaging the existing utilities or previously constructed

structural elements. Daily maintenance may be required along grout lines, in order to offer better inspection of interconnected holes and breakouts. The Contractor will be required to furnish such pumps as may be necessary to care for waste water and grout from his operations. Upon completion of these operations, clean up all waste resulting from his operations that is unsightly or would interfere with the efficient operation of the project as anticipated by the original design.

3.4.3 Records

The Contractor shall maintain individual records including the following as a minimum: contract number, probe number/identification, date of probing/drilling, date(s) of grouting, drilling and probing equipment and methods used, probe hole diameter, top elevation of probe at time of drilling, total depth probed/drilled, bottom elevation of probe, depths and thicknesses of any cavities or voids encountered, grout volume and level after each grouting cycle if performed, and grout slump at the time of grouting. The Contractor shall maintain an overall installation plan noting the probe locations with the probe number listed.

The Contractor's Geotechnical Field Representative must keep and maintain records of all probing and grouting operations and provide these records to the Contracting Officer, including a log of the grout holes, results of washing and pressure testing operations, time of each change of grouting operation, pressure, rate of pumping, amount of cement for each change in water/cement ratio, and other data as deemed by them to be necessary.

3.4.4 Communications

When, for its own convenience, the Contractor has the individual elements of the plant so located that communication by normal voice between these elements is not satisfactory, the Contracting Officer may require him to install a satisfactory mechanical means of communications, such as a telephone or other suitable device.

3.4.5 Quality Control

Contractor collect grout samples on a daily basis or every 100 cyds, whichever is more frequent. Samples must be tested for flow per ASTM C939/C939M and compressive strength per ASTM C1019 and ASTM C31/C31M. Compressive samples shall include a set of 7, 3 by 6 inch cylinders to be tested at an interval of 7 days (2 samples) and 28 days (3 samples) with 2 samples to be held to 56 days if strength requirements are not achieved at 28 days. Grout shall achieve a minimum compressive strength of 600 psi at 28 days.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 01 19.61

SEALING OF JOINTS IN RIGID PAVEMENT
11/19, CHG 1: 11/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C603	(2014; R 2019) Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
ASTM C639	(2024)Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
ASTM C661	(2015; R 2022) Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
ASTM C679	(2015; R 2022) Standard Test Method for Tack-Free Time of Elastomeric Sealants
ASTM C719	(2014; R 2019) Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
ASTM C792	(2023) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C793	(2023) Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
ASTM C920	(2018; R 2024) Standard Specification for Elastomeric Joint Sealants
ASTM C1016	(2014; R 2022) Standard Test Method for Determination of Water Absorption of Sealant Backing (Joint Filler) Material
ASTM C1193	(2016) Standard Guide for Use of Joint Sealants
ASTM D412	(2016; R 2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D789	(2015) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)

ASTM D903	(1998; R 2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
ASTM D5249	(2010; R 2016) Standard Specification for Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D5893/D5893M	(2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Submit catalog cuts, specifications, Safety Data Sheets and other information documenting conformance to Contract requirements.

Manufacturer's Recommendations

SD-04 Samples

Sealants

Provide for testing a 5-gal sample of each sealant with associated primer to the Contracting Officer a minimum of 60 days prior to its use on the job. Provide factory-sealed containers with a factory applied label showing the following information:

Name of sealant

Identification of component, or primer

Specification number and type

Manufacturer's name

Manufacturer's lot and batch number

Date of Manufacture (month and year)

Shelf life retest date (month and year)

List of hazardous components

Quantity of material in container (volume)

Storage instructions

Instructions for use

Blocking Media/Backup Materials

Backer Rod

Bond Breaking Tapes

SD-06 Test Reports

Sealants

SD-07 Certificates

Equipment List

SD-08 Manufacturer's Instructions

Sealants

Provide instructions that include, but not limited to: storage requirements, ambient temperature and humidity ranges, and moisture condition of joints for successful installation; requirements for preparation of joints; safe heating temperature; mixing instructions; installation equipment and procedures; application and disposal requirements; compatibility of sealant with filler material; curing requirements; and restrictions to be adhered to in order to reduce hazards to personnel or to the environment. Submit instructions at least 30 days prior to use.

1.3 QUALITY ASSURANCE

1.3.1 Test Requirements

Test the sealant and backup or separating material for conformance with the referenced material specification. The materials will be tested by the Government. Do not use material at the project prior to receipt of written notice that the materials meet the laboratory requirements. The cost of the first test of samples will be borne by the Government. If the samples fail to meet specification requirements, replace the materials represented by the sample and test the new materials at the Contractor's expense. Conformance with the requirements of the laboratory tests specified does not constitute final acceptance of the materials. Base final acceptance on the performance of the in-place materials. Submit samples of the materials (sealant, primer if required, and backup material), in sufficient quantity for testing and approval 60 days prior to the beginning of work. Do not use material until it has been approved.

1.3.2 Trial Joint Sealant Installation

Prior to cleaning and sealing the joints for the entire project, prepare a test section at least 200 ft long using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of the types of joints in the project. Following the completion of the test section and before any other joint is sealed, inspect the test section to determine that the materials and installation meet the requirements specified. Inspect joint seal test section. Provide written notice of deficiencies and required corrections or

adjustments in the joint seal installation procedures. Correct deficiencies and obtain approval of test section prior to installing joint seals. If it is determined that the materials or installation do not meet the requirements, remove the materials, and reclean and reseal the joints at no cost to the Government. Permit the test section meeting the requirements to be incorporated into the permanent work and paid for at the Contract unit price per linear foot for sealing items scheduled. Prepare and seal other joints in the manner approved for sealing the test section. Notify the Contracting Officer upon completion of the test section.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for visible damage, and unload and store with a minimum of handling. Deliver joint materials in original sealed containers and protect from freezing or overheating. Provide jobsite storage facilities capable of maintaining temperature ranges within manufacturers recommendations.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not proceed with work when weather conditions detrimentally affect the quality of cleaning joints or applying sealants. Proceed with joint preparation and sealing only when weather conditions are in accordance with manufacturer's instructions. Install joint sealant to dry surfaces and protect sealant and bond breakers from moisture.

1.6 TRAFFIC CONTROL

Do not permit vehicular or heavy equipment traffic on the pavement in the area of the joints being sealed during the protection and curing period of the sealant. Permit traffic on the pavement at the end of the curing period.

PART 2 PRODUCTS

2.1 SEALANTS

Use materials for sealing in accordance with ASTM D5893/D5893M based on the type of area as follows:

Area	Sealing Material
Around in-pavement structures and other identified areas	ASTM D5893/D5893M

Use self leveling, non-acid curing silicone sealant meeting the following requirements in accordance with ASTM C920 or ASTM C1193:

TEST	TEST METHOD	REQUIREMENTS
Weight Loss	ASTM C792 Modified (see Note 1 below)	10 percent max.
Flow	ASTM C639 (Type I)	Smooth and level

TEST	TEST METHOD	REQUIREMENTS
Extrusion Rate	ASTM C603	30 sec. max.
Tack Free Time	ASTM C679	5 hours max.
Hardness (Shore 00) (see Note 2 below)	ASTM C661	30 - 80
Tensile Stress at 150 Percent Elongation (see Note 2 below)	ASTM D412 (Die C)	30 psi max.
Percent Elongation (see Note 2 below)	ASTM D412 (Die C)	700 min.
Accelerated Weathering	ASTM C793	Pass 5000 hours
Bond and Movement Capability	ASTM C719	Pass 10 cycles at plus 50 percent movement (no adhesion or cohesion failure)
Peel	ASTM D903	Minimum 20 psi of width with at least 75 percent cohesive failure

NOTES:
1. Percent weight loss of wet (uncured) sample after placing in forced-draft oven maintained at 158 degrees plus 1 degree F for two hours.

2. Specimen cured 21 days at 73 degrees plus 1 degree F and 50 percent plus 5 percent humidity.

ACCELERATED WEATHERING FACTORY TEST REPORT. For the Accelerated Weathering test, in lieu of testing of actual sealant to be used on the project, it is permitted to submit a report of a factory test, performed within two years of Contract award.

2.2 PRIMERS

Use primers in accordance with the recommendation of the manufacturer.

2.3 BOND BREAKERS

2.3.1 Blocking Media/Backup Materials

Provide backup (joint filler) material that is a compressible, nonshrinking, nonstaining, nonabsorbing, nonreactive material with the sealant. Use backup material compliant with ASTM D5249. Use material with a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use material with a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C1016. Use backup (joint filler) material that is 25 plus or minus 5 percent larger in diameter than the nominal width of the crack. Use blocking media consistent with the sealant manufacturer's installation instructions.

2.3.2 Bond Breaking Tapes

Provide a bond breaking tape or separating material that is a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. Use material with a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use bond breaker tape approximately 1/8 in wider than the nominal width of the joint and that does not bond to the sealant. Use bond breaking tape consistent with the sealant manufacturer's installation instructions.

PART 3 EXECUTION

3.1 EXECUTING EQUIPMENT

Submit equipment list and description of the equipment to be used and a statement from the supplier of the sealant that the proposed equipment is acceptable for installing the specified sealant. Use equipment for heating, mixing, and installing seals in accordance with the instructions provided by the sealant manufacturer. Provide equipment, tools, and accessories necessary to clean existing joints and install liquid joint sealants. Maintain machines, tools, and other equipment in proper working condition. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 60 days prior to use on the project.

3.1.1 Joint Cleaning Equipment

3.1.1.1 Tractor-Mounted Routing and Plowing Tool

Use routing tools for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that do not damage the sides of the joints. Use tools designed to be adjusted to remove the old material to varying depths and widths as required. Use equipment capable of maintaining accurate cutting depth and width control. Use a joint plow equipped with a spring or hydraulic mechanism to release pressure on the tool prior to spalling the concrete. Do not permit the use of V-shaped tools or rotary impact routing devices. Permit the use of hand-operated spindle routing devices to clean and enlarge random cracks.

3.1.1.2 Concrete Saw

Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified, for refacing joints, cleaning sawed joints where sandblasting does not provide a clean joint, widening, or deepening existing joints as specified without damaging the sides, bottom, or top edge of joints. Permit single or gang type blades with one or more blades mounted in tandem for fast cutting. Select saw adequately powered and sized to cut specified opening with not more than two passes of the saw through the joint.

3.1.1.3 Waterblasting Equipment

Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. Provide water tank and auxiliary resupply equipment of sufficient capacity to permit continuous operations. Use a nozzle with an adjustable guide that holds the nozzle aligned with the joint approximately 1 in above the pavement surface.

Adjust the height, angle of inclination and the size of the nozzle to obtain satisfactory results. Use a pressure gauge mounted at the pump that shows the pressure in psi at which the equipment is operating.

3.1.1.4 Air Compressor

Use a portable air compressor capable of operating the sandblasting equipment and capable of blowing out sand, water, dust adhering to sidewalls of concrete, and other objectionable materials from the joints. Use a compressor that provides air at a pressure not less than 90 psi and a minimum rate of 150 cubic ft of air per minute at the nozzles and free of oil.

3.1.1.5 Vacuum Sweeper

Use a self-propelled, vacuum pickup sweeper capable of completely removing loose sand, water, joint material, and debris from pavement surface.

3.1.1.6 Hand Tools

Permit the use of hand tools, such as brooms and chisels, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

3.1.2 Sealing Equipment

Use joint sealing equipment of a type required by the sealant manufacturer's installation instructions. Use equipment capable of installing sealant to the depths, widths and tolerances indicated. Do not proceed with joint sealing when malfunctions are noted until the malfunctions are corrected.

3.1.2.1 Cold-Applied, Single-Component Sealing Equipment

Use equipment for installing ASTM D5893/D5893M single component joint sealants that consists of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. Use a nozzle with dimensions that allows the tip of the nozzle to extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier's instructions, and unaltered in any way without obtaining prior approval. Use lined hoses and seals to prevent moisture penetration and withstand pumping pressures. Use equipment free of contamination from previously used or other type sealant. Permit use of small hand-held air-powered equipment (i.e., caulking guns) for small applications.

3.2 SAFETY

Do not place sealant within 25 ft of LOX equipment, LOX storage, or LOX piping. Clean joints in this area and leave them unsealed.

In accordance with the provisions of the Contract respecting "Accident Prevention," take appropriate measures to control worker exposure to toxic substances during the work. Provide personnel protective equipment as required. Make Material Safety Data Sheets (Department of Labor Form OSHA-20 or comparable form) available on the site.

3.3 PREPARATION OF JOINTS

3.3.1 Bond Breaker

At the time the joints receive the final cleaning and are dry, install bond breaker material as indicated with a steel wheel or other approved device.

3.3.1.1 Blocking Media (Backer Rod) (Except for Expansion Joints)

When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a blocking media/back-up material to prevent the entrance of the sealant below the specified depth. Take care to ensure that the blocking media/backup material is placed at the specified depth and is not stretched or twisted during installation.

3.3.1.2 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond breaker separating tape to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Bond the tape to the bottom of the joint opening to prevent it from floating up into the new sealant.

3.3.2 Rate of Progress of Joint Preparation

Limit the stages of joint preparation, including sandblasting, air pressure cleaning and placing of the back-up material to only that lineal footage that can be sealed during the same day.

3.3.3 Disposal of Debris

Sweep pavement surface to remove excess joint material, dirt, water, sand, and other debris by vacuum sweepers or hand brooms. Remove the debris immediately to a point off station.

3.4 PREPARATION OF SEALANT

3.4.1 Single-Component, Cold-Applied Sealants

Inspect the ASTM D5893/D5893M sealant and containers prior to use. Reject materials that contain water, hard caking of any separated constituents, nonreversible jell, or materials that are otherwise unsatisfactory. Do not reject sealants that exhibit settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools.

3.5 INSTALLATION OF SEALANT

3.5.1 Time of Application

After approval of the test section, seal joints immediately following final cleaning and placing of bond breakers. Commence sealing joints when walls are dust free and dry, and when weather conditions meet sealant manufacturer's instructions. If the above conditions cannot be met, or when rain interrupts sealing operations, reclean and permit the joints to dry prior to installing the sealant.

3.5.2 Sealing Joints

Do not install joint sealant until joints to be sealed have been inspected and approved. Install bond breaker just prior to pouring sealant. Fill the joints with sealant from bottom up until joints are uniformly filled solid from bottom to top using the specified equipment for the type of sealant required. Fill joints as recommended by manufacturer below top of pavement, and without formation of voids or entrapped air. Do not permit gravity methods or pouring pots to be used to install the sealant material. Except as otherwise permitted, tool the sealant immediately after application to provide firm contact with the joint walls and to form the indicated sealant profile below the pavement surface. Remove excess sealant that has been inadvertently spilled on the pavement surface. Do not permit traffic over newly sealed pavement until authorized. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's recommendations. Check sealed joints frequently to ensure that newly installed sealant is cured to a tack-free condition within the specified time. Protect new sealant from rain during curing period.

3.6 INSPECTION/FIELD QUALITY CONTROL

3.6.1 Joint Cleaning

Inspect joints during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Approve cleaned joints prior to installation of the separating or back-up material and joint sealant.

3.6.2 Sampling Sealant

Obtain a one gal sample of each type of sealant on the project from material used for each 10,000 linear ft or less of joints sealed. Store samples according to sealant manufacturer's instructions. Retain samples until final acceptance of the work.

3.6.3 Sealant Application Equipment

Inspect the application equipment to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Suspend operations if there is evidences of bubbling, improper installation, or failure to cure or set until causes of the deficiencies are determined and corrected.

3.6.4 Joint Sealant

Inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Remove sealants exhibiting these deficiencies prior to the final acceptance of the project from the joint, wasted, and replace at no additional cost to the Government. Obtain approval for each joint seal installation.

3.7 ACCEPTANCE

Reject sealer that fails to cure properly, or fails to bond to joint walls, or reverts to the uncured state, or fails in cohesion, or shows excessive air voids, blisters, surface defects, swelling, or other deficiencies, or is not properly recessed within indicated tolerances.

Remove rejected sealer and reclean and reseal joints. Perform removal and reseal work promptly by and at the expense of the Contractor.

3.8 CLEAN-UP

Upon completion of the project, remove unused materials from the site and leave the pavement in a clean condition.

-- End of Section --

SECTION 32 05 33

LANDSCAPE ESTABLISHMENT
08/17

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.1.2 Stand of Turf

95 percent ground cover of the established species.

1.1.3 Planter Beds

A planter bed is defined as an area containing one or a combination of the following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, excluding turf. Trees may also be found in planter beds.

1.2 RELATED REQUIREMENTS

Section 32 84 24 TEMPORATY IRRIGATION SPRINKLER SYSTEM applies to this section for installation of temporary irrigation equipment requirements, with additions and modifications herein.

Section 32 92 19 SEEDING applies to this section for installation of seed requirements, with additions and modifications herein.

Section 32 93 00 EXTERIOR PLANTS applies to this section for installation of ground cover with additions and modifications herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Integrated Pest Management Plan; G

SD-03 Product Data

Fertilizer; G

Mulches Topdressing

Organic Mulch Materials

SD-07 Certificates

Maintenance Inspection Report

Plant Quantities; G

SD-10 Operation and Maintenance Data

Maintenance

1.4 DELIVERY, STORAGE AND HANDLING

1.4.1 Delivery

Deliver fertilizer, gypsum, iron to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to Territory of Guam and federal laws. Instead of containers, fertilizer, gypsum may be furnished in bulk with a certificate indicating the above information.

1.4.2 Storage

1.4.2.1 Fertilizer, Lime, Iron, Storage

Store material in designated areas. Store lime and fertilizer in cool, dry locations away from contaminants.

1.4.2.2 Antidesiccant's Storage

Do not store with fertilizers or other landscape maintenance materials.

1.4.3 Handling

Do not drop or dump materials from vehicles.

1.5 MAINTENANCE

Submit Operation and Maintenance (O&M) Manuals for planting materials. Include instructions indicating procedures during one typical year including variations of maintenance for climatic conditions throughout the year. Provide instructions and procedures for watering; promotion of growth, including fertilizing, pruning, and mowing; and integrated pest management. O&M Manuals must include pictures of planting materials cross referenced to botanical and common names, with a description of the normal appearance in each season.

Develop a water monitoring program for surface and ground water on the project site consistent with the water management program utilized during construction operations.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

Fertilizer for groundcover, wildflowers, and grasses is not permitted. Provide fertilizer for trees, plants, and shrubs as recommended by plant supplier, except synthetic chemical fertilizers are not permitted.

Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.1.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

16 percent available nitrogen
16 percent available phosphorus
16 percent available potassium

2.2 WATER

Source of water must be approved by the Designer of Record, and be of suitable quality for irrigation. Use collected storm water or graywater when available.

2.3 MULCHES TOPDRESSING

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.3.1 Organic Mulch Materials

Provide shredded hardwood.

2.4 PESTICIDES

Submit an Integrated Pest Management Plan, including weed and pest management strategies or proposed alternatives to herbicides and pesticides. Use biological pest controls as approved in Plan.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include mowing, edging, overseeding, aeration, fertilizing, watering, weeding, pruning, stake and guy adjusting for all newly installed landscape areas, unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

Police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Collected debris must be promptly removed and disposed of at an approved disposal site.

3.2 IRRIGATION ESTABLISHMENT PERIOD

The irrigation establishment period will commence on the date that inspection by the Design Builder shows that the temporary irrigation equipment furnished under this contract have been satisfactorily installed and is functional and must continue for a period of 365 days.

3.2.1 Maintenance During the Temporary Irrigation Establishment Period

Begin maintenance immediately after irrigation equipment has been installed and is functional. Inspect irrigation equipment at least once a week during the installation and establishment period and perform needed maintenance promptly. Automatic controllers not equipped with rain shut-off sensors must be turned off during periods of rain that exceed twelve hours of continuous rainfall in one day or during rain storms of one day or more. Once the rain has subsided timers must be reactivated. Irrigation controllers must be inspected and reprogrammed after power outages. Contractor must be responsible for winterization and startup. Sprinkler heads must direct water away from buildings and hard surfaced areas.

3.2.2 Water Restrictions

Abide by Territory of Guam, local or other water conservation regulations in force during the establishment period. Automatic controller must be adjusted to comply with the water conservation regulations schedule.

3.2.3 Fire Hydrants

To use a fire hydrant for temporary irrigation, obtain prior clearance from the Contracting Officer and provide the tools and connections approved for use on fire hydrants. If a fire hydrant is used, Provide a reduced pressure backflow preventer for each connection between hose and fire hydrant. Backflow preventer used must be tested once per month by a certified backflow preventer tester.

3.2.4 Final Acceptance

Upon completion of the establishment period and final acceptance of groundcover and exterior plants, temporary irrigation equipment must be removed.

3.3 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the Contracting Officer shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period must continue for a period of 365 days.

3.3.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed. Inspect areas once a week during the installation and establishment period and perform needed maintenance promptly.

3.3.2 Promotion of Growth

Maintain groundcover in a manner that promotes proper health, growth, natural color. Turf must have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, topdress and perform other operations necessary to promote growth, as approved by Contracting Officer and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.3.3 Mowing

3.3.3.1 Turf

Mow turf at a uniform finished height. Mow turfed areas to a minimum average height of 2 inches when average height of grass becomes 4 inches for spring/summer maintenance and to a minimum average height of 2 inches when the average height of grass reaches 4 inches for fall and winter maintenance. The height of turf is measured from the soil. Perform mowing of turf in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area must be picked up and disposed. Adjacent paved areas must be swept/vacuumed clean.

3.3.4 Turf Edging and Trimming

Perimeter of sidewalks, driveways, curbs, and other paved surfaces must be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Perform edging on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas such as an edge between turfgrass and a planter bed. Exercise care to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees, fences, poles, walls, and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming must be performed on the same day the turf's mowed. Care must be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas to be utilized to avoid injury to tree trunks. Protective tree collar to remain in place after maintenance period has ended.

3.3.5 Post-Fertilizer Application

Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies must be determined by the laboratory soil analysis results the requirements of the particular turf species. Apply fertilizer by approved methods in accordance with the manufacturer's recommendations.

3.3.6 Turf Watering

Perform irrigation in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, Territory of Guam, and local water agencies and authorities directives. The Contractor must be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. Abide by Territory of Guam, local or other water conservation regulations or restrictions in force during the establishment period.

3.3.7 Turf Aeration

Upon completion of weed eradication operations and Contracting Officer's approval to proceed, aerate turf areas by approved device. Core, by

pulling soil plugs, to a minimum depth of 2 inches. Leave all soil plugs that are produced in the turf area.

3.3.8 Replanting

Replant in accordance with Section 32 92 19 SEEDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

3.3.9 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf. Final acceptance of grass areas will be based upon a stand of 95 percent groundcover of established species.

3.3.10 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer.

3.4 EXTERIOR PLANT ESTABLISHMENT PERIOD

The exterior plant establishment period will commence on the date that inspection by the Contracting Officer shows that the new plants furnished under this contract have been satisfactorily installed and must continue for a period of 365 days.

3.4.1 Frequency of Maintenance

Begin maintenance immediately after plants have been installed. Inspect exterior plants at least once a week during the installation and establishment period and perform needed maintenance promptly.

3.4.2 Slope Erosion Control Maintenance

Provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped areas. Maintenance tasks include immediate repairs to weak spots in sloped areas, and maintaining clean, clear culverts, and graded berms, to intercept and direct water flow to prevent development of large gullies and slope erosion and during periods of extended rainfall, irrigation systems must be secured. Eroded areas must be filled with amended topsoil and replanted with the same plant species. Erosion control netting or blankets damaged due to slope erosion must be reinstalled.

3.4.3 Removal of Dying or Dead Plants

Remove dead and dying plants and provide new plants immediately upon commencement of the specified planting season, and replace mulch and eroded earth mound water basins. Provide an additional 90 day establishment period for replacement plants beyond the original warranty period. A ground cover must be considered dying or dead when a minimum of 20 percent of the plant has died. The Contractor must determine the cause for dying plant material and provide recommendations for replacement.

3.4.4 Tracking of Unhealthy Plants

Note plants not in healthy growing condition, as determined by the Contracting Officer, and as soon as seasonal conditions permit, remove and replace with plants of the same species and sizes as originally specified. Install replacement plantings in accordance with Section 32 93 00 EXTERIOR PLANTS.

3.4.5 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final turf acceptance will be based upon a satisfactory stand of turf.

3.4.5.1 Weeding

Earth mound water basins are free of weeds.

3.4.5.2 Remedial Work

Remedial measures directed by the Contracting Officer to ensure plant material survival and promote healthy growth have been completed.

3.4.6 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer.

3.5 FIELD QUALITY CONTROL

3.5.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations must be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Submit results of site observation visits to the Contracting Officer within 7 calendar days of each site observation visit.

3.5.2 Plant Quantities

Provide Contracting Officer with the number of plant quantities. In addition, provide total exterior area of hardscape and landscaping such as turf and total number of shrubs.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 11 20

BASE COURSE FOR RIGID PAVING
05/22

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Waybills and Delivery Tickets

Submit copies of waybills and delivery tickets during progress of the work. Before the final payment is allowed, file certified waybills and certified delivery tickets for all aggregates actually used.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C29/C29M	(2023) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials

ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4718/D4718M	(2015) Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	(2017) Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
ASTM E11	(2024) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.3 DEGREE OF COMPACTION

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the laboratory maximum dry density in accordance with ASTM D1557 Method C and corrected with ASTM D4718/D4718M.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G

Waybills and Delivery Tickets

SD-06 Test Reports

Initial Tests; G

In-Place Tests; G

Test Section Report; G

1.5 QUALITY ASSURANCE

Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00 QUALITY CONTROL. Do not start work requiring

testing until the testing laboratory has been inspected and approved. All contractor quality control testing laboratories performing acceptance testing require USACE validation by the Material Testing Center (MTC) for both parent laboratory and on-site laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Contact the MTC manager listed at https://mtc.erdc.dren.mil/requestvalidation.aspx# for costs and scheduling. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. Furnish copies of test results within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M.

1.5.2 Tests

1.5.2.1 Gradation

Perform gradation in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11. Perform particle-size analysis of the soils in conformance with ASTM D7928.

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M, or ASTM D6938. For the method presented in ASTM D1556/D1556M, use the base plate, as shown in the drawing. For the method presented in ASTM D6938, check the calibration curves and adjust them, if necessary, using only the sand cone method as described in Annex A2, of the ASTM publication. Use ASTM D6938 to determine the moisture content of the soil. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in Annex A2, in ASTM D6938, on each different type of material to be tested at the beginning of a job and at intervals as directed. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

1.5.2.5 Wear Test

Perform wear tests on subbase course and rigid pavement base course material in conformance with ASTM C131/C131M.

1.5.2.6 Weight of Slag

Determine weight per cubic foot of slag in accordance with ASTM C29/C29M.

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

1.7 ACCEPTANCE

1.7.1 Tolerances

Acceptance of separation layer is based on compliance with the tolerances presented in Table 1. Remove and replace any course identified by the failing tests.

TABLE 1

Measurement	Tolerance
Grade	Plus 0, Minus 1/2 inch
Smoothness	Plus/Minus 1/2 inch
Total Thickness	Plus/Minus 1/2 inch
Average Job Thickness	Plus/Minus 1/4 inch
Compaction	
Subbase	Mimimum 100 percent
Rigid Pavement Base Course	Mimimum 100 percent

1.7.2 Test Section

Construct a test section consisting of 1000 square yards of separation layer to demonstrate the materials, equipment, and construction processes meet the requirements of this specification. Acceptance of the test section is based on compliance with the tolerances listed in Table 1. Rework, re-compact, or remove and replace test sections that do not meet specification requirements. Do not commence full operations until the test section report has been approved. Use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments are approved in advance.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Separation Layer

Provide aggregates consisting of crushed stone or gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Provide aggregates which are durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Limit the percentage of loss to a maximum of 50

percent after 500 revolutions when tested in accordance with ASTM C131/C131M. Provide aggregates with at least 75 percent by weight retained on each sieve having one freshly fractured face with the area at least equal to 75 percent of the smallest midsectional area of the piece. Provide aggregate that is reasonably uniform in density and quality. Provide aggregates having a maximum size of 2 inches, a minimum of 70 percent passing the 3/4 inch sieve, and within the limits specified as follows:

Maximum Aggregate Size	Lesser of 2 inches or mor 1/4 of layer thickness
Maximum CBR	50
Maximum Percent Passing No. 10	50
Maximum Percent Passing No. 200	8
Maximum Liquid Limit	25
Maximum Plasticity Index	5
d_{15} of Seperation Layer to d_{85} of Subgrade	Less than or equal to 5

Limit the portion of any blended component and of the completed course passing the No. 40 sieve to be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5. Provide any additional stability required to maintain a working platform for construction equipment. If a test section can demonstrate that a material has adequate stability to support construction equipment, the fractured face requirement can be deleted, subject to approval by the Government.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Initial Tests

Perform one of each of the following Initial Tests on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation. Complete this testing for each source if materials from more than one source are proposed.

a. Gradation.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.2.2 Approval of Material

Tentative approval of material will be based on initial test results.

2.3 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work are subject to approval by the Government before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 OPERATION OF AGGREGATE SOURCES

Condition aggregate sources on private lands in accordance with local laws and authorities.

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated to prevent segregation. Stockpile materials obtained from different sources separately.

3.4 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the separation layer. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, stabilize the surface prior to placement of the overlying course. Stabilize by mixing the overlying course material into the underlying course and compacting by approved methods. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the overlying course is placed.

3.5 GRADE CONTROL

Provide a finished and completed subbase and rigid pavement base courses conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.6 MIXING AND PLACING MATERIALS

Mix and place the materials to obtain uniformity of the material at the

water content specified. Make such adjustments in mixing or placing procedures or in equipment as directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to provide a satisfactory course.

3.7 LAYER THICKNESS

Compact the completed course to the thickness indicated. Limit individual compacted lifts to a maximum thickness of 6 inches and a minimum thickness of 3 inches. Compact the course(s) to a total thickness that is within the tolerances of paragraph ACCEPTANCE. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. However, the requirements for the overlying course thickness and plan grade are still applicable. The average job thickness will be the average of all thickness measurements taken for the job and within the tolerances of paragraph ACCEPTANCE.

3.8 COMPACTION

Compact each lift of the material, as specified, with approved compaction equipment. For cohesive soils, maintain water content during the compaction procedure to within plus or minus 2 percent of optimum water content determined from laboratory tests as specified in this Section and for cohesionless soils, maintain a water content to facilitate compaction without bulking. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction of the separation layer until each lift is compacted through the full depth to meet the compaction requirements of Table 1. Make such adjustments in compacting or finishing procedures to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a compliant separation layer r course. Remove any materials that are found to be non-compliant and replace with compliant material or rework, as directed, to meet the requirements of this specification.

3.9 PROOF ROLLING

In addition to the compaction specified, proof roll subbase course in areas designated on the drawings by application of 6 coverages of a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds and inflated to a minimum of 125 psi. A coverage is defined as the application of one tire print over the designated area. In the areas designated, apply proof rolling to the top lift of the completed subbase course. Maintain water content of the top lift of the subbase course as specified in paragraph COMPACTION from start of compaction to completion of proof rolling. Remove any subbase course materials that produce permanent deformation exceeding 1/2 inch and replace with satisfactory materials. Then recompact and proof roll to meet specifications.

3.10 EDGES OF SEPARATION LAYER

Place approved material along the outer edges of the separation layer in sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more lifts, simultaneously roll and compact at least a 2 foot width of this shoulder material with the rolling and compacting of each lift of the separation layer, as directed.

3.11 FINISHING

Finish the surface of the top lift of rigid pavement base course after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin lifts of material to the top lift to meet grade. If the elevation of the top lift exceeds the tolerances of paragraph ACCEPTANCE, scarify the top lift to a depth of at least 3 inches and blend new material in and compact to bring to grade. Make adjustments to rolling and finishing procedures to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable rigid pavement base course. If the surface becomes rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the non-compliant portion and rework and recompact it or replace as directed.

3.12 SMOOTHNESS TEST

Construct the top lift so that the surface shows no deviations exceeding the tolerances of paragraph ACCEPTANCE when tested with a 12 foot straightedge. Test the entire area in both a longitudinal and a transverse direction on parallel lines. Perform the transverse lines 15 feet or less apart, as directed. Perform the longitudinal lines at the centerline of each placement lane and at the 1/8th point in from each side of the lane. Hold the straightedge in contact with the surface and move ahead one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the surface and measuring the maximum gap between the straightedge and the surface. Determine measurements along the entire length of the straight edge. Correct deviations exceeding the tolerances of Table 1 by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.13 FIELD QUALITY CONTROL

3.13.1 In-Place Tests

Perform one of each of the following In-Place Tests on samples taken from the placed and compacted separation layer course. Determine sample locations using random sampling in accordance with ASTM D3665. Take samples and test at the rates indicated.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 2,000 square feet, or portion thereof, of completed area.

b. Perform gradation including 0.02 mm size material on every lift of material placed and at a frequency of one gradation for every 1,000 square yards, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the gradation.

d. Measure the thickness of each course at intervals providing at least one measurement for each 2,000 square feet or part thereof. Measure the thickness using test holes, at least 3 inches in diameter through the course.

3.13.2 Approval of Material

No paving shall occur without final approval of materials in prior lifts or strata and no paving over materials out of specifications will be permitted.

Final approval of the materials will be based on tests for density, thickness measurements, gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

3.14 TRAFFIC

Completed portions of the separation layer can be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Do not allow heavy equipment on the completed separation layer except when necessary for construction. When it is necessary for heavy equipment to travel on the completed separation layer, protect the area against marring or damage to the completed work. Repair damage to meet these specifications.

3.15 MAINTENANCE

Maintain the completed course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area that is damaged as necessary to comply with this specification.

3.16 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed outside the limits of Government-controlled land. No additional payments will be made for materials that have to be replaced.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 11 23

GRADED CRUSHED AGGREGATE BASE COURSES
05/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2022) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C1252	(2017) Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1883	(2021) Standard Test Method for California Bearing Ratio (CBR) of

	Laboratory-Compacted Soils
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4718/D4718M	(2015) Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	(2017) Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
ASTM E11	(2024) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Graded-Crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the laboratory maximum dry density in accordance

with ASTM D1557 Method C and corrected with ASTM D4718/D4718M.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G

SD-06 Test Reports

Initial Tests; G

In-Place Tests; G

Test Section Report; G

1.4 QUALITY ASSURANCE

Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00 QUALITY CONTROL. Do not start work requiring testing until the testing laboratory has been inspected and approved. All contractor quality control testing laboratories performing acceptance testing require USACE validation by the Material Testing Center (MTC) for both parent laboratory and on-site laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Contact the MTC manager listed at https://mtc.erdc.dren.mil/requestvalidation.aspx# for costs and scheduling. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. Furnish copies of test results within 24 hours of completion of the tests.

1.4.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M.

1.4.2 Tests

1.4.2.1 Gradation Analysis

Perform gradation analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11.

1.4.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.4.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.4.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M, or ASTM D6938.

For the method presented in ASTM D1556/D1556M use the base plate as shown in the drawing. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in Annex A2 of ASTM D6938. Use ASTM D6938 to determine the moisture content of the soil. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in Annex A2 of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

1.4.2.5 Wear Test

Perform wear tests on GCA course material in conformance with ASTM C131/C131M.

1.4.2.6 Flat and Elongated Pieces

Determine flat and elongated pieces on GCA course material in conformance with ASTM D4791, Method A.

1.4.2.7 Soundness

Perform soundness tests on GCA in accordance with ASTM C88.

1.4.2.8 Fractured Faces

Perform fractured faces test on GCA coarse aggregate in comformance with ASTM D5821. Determine uncompacted void content of the GCA fine aggregate in accordance with ASTM C1252, Method A.

1.5 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

1.6 ACCEPTANCE

1.6.1 Tolerances

Acceptance of GCA is based on compliance with the tolerances presented in Table 1. Remove any materials found to be non-compliant and replace with compliant material or rework, as directed, to meet the requirements of this specification

TABLE 1

Measurement	Tolerance
Grade	Plus 1/4 inch, Minus 1/2 inch

TABLE 1	
Smoothness	Plus/Minus 3/8 inch
Individual Test Total Thickness	Plus/Minus 1/2 inch
Average Job Thickness	Plus/Minus 1/4 inch
Compaction	Minimum 100 percent

1.6.2 Test Section

Construct a test section consisting of 1000 square yards to demonstrate the materials, equipment, and construction processes meet the requirements of this specification. Acceptance of the test section is based on compliance with the tolerances listed in Table 1. Rework, re-compact, or remove and replace test sections that do not meet specification requirements. Do not commence full operations until a test section report has been approved. Use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments are approved in advance.

PART 2 PRODUCTS

2.1 AGGREGATES

Provide GCA consisting of clean, sound, durable particles of crushed stone, crushed gravel, crushed recycled concrete, angular sand, or other approved material. Provide GCA that is free of silt and clay as defined by ASTM D2487, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve is known as coarse aggregate; that portion passing the No. 4 sieve is known as fine aggregate. When the coarse and fine aggregate is supplied from more than one source, provide aggregate from each source that meets the specified requirements.

2.1.1 Coarse Aggregate

Provide coarse aggregates with angular particles of uniform density. Separately stockpile coarse aggregate supplied from more than one source.

a. Crushed Gravel: Provide crushed gravel that has been manufactured by crushing gravels and that meets all the requirements specified below.

b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.

c. Crushed Recycled Concrete: Provide crushed recycled concrete (RCA) consisting of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. Provide RCA of a consistent gradation and properties obtained from on-base stockpiles or concrete pavement demolished under this contract. Provide recycled concrete that is free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and that has been crushed and processed to meet the required gradations for coarse aggregate. Reject recycled concrete aggregate exceeding this value. Provide crushed recycled concrete that meets all other applicable requirements

specified below.

2.1.1.1 Graded-Crushed Aggregate Base Course

Limit the percentage of loss of GCA coarse aggregate to a maximum of 45 percent when tested in accordance with ASTM C131/C131M. Provide GCA coarse aggregate that does not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate, or 12 percent weighted average, at five cycles, when tested in sodium sulfate in accordance with ASTM C88. . Provide aggregate that contains a maximum of 20 percent flat and elongated particles for the fraction retained on the 1/2 inch sieve nor 20 percent for the fraction passing the 1/2 inch sieve when tested in accordance with ASTM D4791, Method A. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, provide crushed aggregate containing a minimum of 90 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures is required to be a minimum of 30 degrees in order to count as two fractured faces. Manufacture crushed gravel from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 2.

2.1.2 Fine Aggregate

Provide fine aggregates consisting of angular particles of uniform density.

2.1.2.1 Graded-Crushed Aggregate Base Course

Provide GCA fine aggregate consisting of angular particles produced by crushing stone, slag, recycled concrete, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate. Provide fine aggregate that contains a minimum of 45 percent by weight of uncompacted voids when tested in accordance with ASTM C1252, Method A.

2.1.3 Gradation Requirements

Apply the specified gradation requirements to the completed base course. Provide aggregates that are continuously well graded within the limits specified in TABLE 2. Use sieves that conform to ASTM E11.

TABLE 2. GRADATION OF AGGREGATES

Percentage By Weight Passsing Square-Mesh Sieve	
Sieve Designation	No. 1
2 inch	100
1-1/2 inch	90-100
3/4 inch	50-80

TABLE 2. GRADATION OF AGGREGATES	
No. 4	30-60
No. 40	15-30
No. 200	5-13

NOTE 1: Limit particles having diameters less than 0.02 mm to a maximum of 3 percent by weight of the total sample tested as determined in accordance with ASTM D7928.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, test the materials in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. Correct the percentages passing the various sieves as directed if the specific gravities vary by more than 10 percent.

2.2 LIQUID LIMIT AND PLASTICITY INDEX

Apply liquid limit and plasticity index requirements to the completed course and to any component that is blended to meet the required gradation. Limit the portion of any component or of the completed course passing the No. 40 sieve to be either nonplastic or have a maximum liquid limit of 25 and a maximum plasticity index of 6.

2.3 CALIFORNIA BEARING RATIO

GCA must have a bearing ration of at least 100 as determined by ASTM D1883 ASTM D1883

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

2.4.1 Initial Tests

Perform one of each of the following initial tests on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed. Submit certified copies of test results for approval a mimimum of 30 days before material is required for the work.

a. Gradation Analysis including 0.02 mm material.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

e. Flat and Elongated Pieces.

f. California Bearing Ratio.

2.4.2 Approval of Material

Tentative approval of material will be based on initial test results.

2.5 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work are subject to approval by the Government before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the GCA is constructed in more than one lift, clean the previously constructed lift of loose and foreign matter by sweeping with power sweepers or power brooms. Use hand brooms in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 OPERATION OF AGGREGATE SOURCES

Condition aggregate sources on private lands in accordance with local laws or authorities.

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated to prevent segregation. Stockpile materials obtained from different sources separately.

3.4 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the base course(s). Do not construct base course(s) on underlying course or subgrade that is frozen. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, stabilize the surface prior to placement of the base course(s). Stabilize by mixing GCA into the underlying course and compacting by approved methods. Proof roll in accordance with paragraph PROOF ROLLING. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a compliant condition until the base course is placed.

3.5 GRADE CONTROL

Provide a finished and completed base course conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.6 MIXING AND PLACING MATERIALS

3.6.1 Mixing

Mix the coarse and fine aggregates in a stationary plant. Make adjustments in mixing procedures or in equipment to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to produce a satisfactory base course meeting all requirements of this specification.

3.6.2 Placing

Place the mixed material on the prepared subgrade or subbase in lifts of uniform thickness with an approved spreader. Place the lifts so that when compacted they are true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one lift, clean the previously constructed lift of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms. Make adjustments in placing procedures or equipment to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to produce an acceptable base course.

3.7 LAYER THICKNESS

Compact the completed base course to the thickness indicated. Limit individual compacted lifts to a maximum thickness of 6 inches and a minimum thickness of 3 inches. Compact the base course(s) to a total thickness that is within the tolerances of paragraph ACCEPTANCE of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. However, the requirements for wearing course thickness and plan grade are still applicable. The average job thickness will be the average of all thickness measurements taken for the job and within the tolerances of paragraph ACCEPTANCE of the thickness indicated.

3.8 COMPACTION

Compact each lift of the base course, as specified, with approved compaction equipment. For cohesive soils, maintain water content during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified and for cohesionless soils, maintain the water content to facilitate compaction without bulking. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction until each lift is compacted through the full depth to meet the compaction requirements of Table 1. Make such adjustments in compacting or finishing

procedures to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to produce a compliant base course. Remove any materials found to be non-compliant and replace with compliant material or rework, as directed, to meet the requirements of this specification.

3.9 PROOF ROLLING

In addition to the compaction specified, proof roll areas designated on the drawings by application of 3 coverages of a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds and inflated to a minimum of 125 psi. A coverage is defined as the application of one tire print over the designated area. In the areas designated, apply proof rolling to the top of the underlying material on which the base course is laid and to the top of the completed base course. Maintain water content of the underlying material and each lift of the base course as specified in Paragraph COMPACTION from start of compaction to completion of proof rolling of that lift. Remove any base course materials or any underlying materials that produce permanent deformation exceeding 3/8 inch by proof rolling and replace with satisfactory materials. Then recompact and proof roll to meet these specifications.

3.10 EDGES OF BASE COURSE

Place the base course(s) so that the completed section is a minimum of 2 feet wider, on all sides, than the next lift that will be placed above it. Place approved material along the outer edges of the base course in sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more lifts, simultaneously roll and compact at least a 2 foot width of this shoulder material with the rolling and compacting of each lift of the base course.

3.11 FINISHING

Finish the surface of the top lift of base course after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin lifts of material to the top lift of base course to meet grade. If the elevation of the top lift of base course exceeds the tolerances of paragraph ACCEPTANCE, scarify the top lift to a depth of at least 3 inches and blend new material in and compact and proof roll to bring to grade. Make adjustments to rolling and finishing procedures to minimize segregation and degradation, obtain grades, maintain moisture content, and produce an acceptable base course. If the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the non-compliant portion and rework and recompact it or replace as directed.

3.12 SMOOTHNESS TEST

Construct the top lift so that the surface shows no deviations exceeding the tolerances of paragraph ACCEPTANCE when tested with a 12 foot straightedge. Test the entire area in both a longitudinal and a transverse direction on parallel lines. Perform the transverse lines at a maximum spacing of 15 feet or less apart, as directed. Perform the longitudinal lines at the centerline of each placement lane, regardless of whether multiple lanes are allowed to be paved at the same time, and at the 1/8th point in from each side of the lane. Hold the straightedge in contact with the surface and moved ahead one-half the length of the

straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and measuring the maximum gap between the straightedge and the pavement surface. Determine measurements along the entire length of the straight edge. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.13 FIELD QUALITY CONTROL

3.13.1 In-Place Tests

Perform each of the following in-place tests on samples taken from the placed and compacted GCA. Determine sample locations using random sampling in accordance with ASTM D3665. Take samples and test at the rates indicated.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area. Gradations containing more than 30 percent retained on the ¾ inch sieve can produce inconsistent compacted density values when tested in accordance with paragraph DEGREE OF COMPACTION.

b. Perform gradation analysis including 0.02 mm size material on every lift of material placed and at a frequency of one sieve analysis for every 500 square yards, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of the base course at intervals providing at least one measurement for each 500 square yards of base course or part thereof. Measure the thickness using test holes, at least 3 inch in diameter through the base course.

3.13.2 Approval of Material

Final approval of the materials will be based on tests for density, thickness measurements, gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

3.14 TRAFFIC

Do not allow traffic on the completed base course.

3.15 MAINTENANCE

Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any base course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area of base course that is damaged as necessary to comply with this specification.

3.16 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed outside the limits of Government-controlled land. No additional payments will be made for materials that have to be replaced.

-- End of Section --

SECTION 32 11 23.23

BASE COURSE DRAINAGE LAYERS
08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C29/C29M	(2023) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM E11	(2024) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plants, Equipment, and Tools; G

SD-06 Test Reports

Initial Tests; G

Test Section Construction Report; G

1.3 QUALITY ASSURANCE

Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00 QUALITY CONTROL. Do not start work requiring testing until the testing laboratory has been inspected and approved. All contractor quality control testing laboratories performing acceptance testing require USACE validation by the Material Testing Center (MTC) for both parent laboratory and on-site laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Contact the MTC manager listed at https://mtc.erdc.dren.mil/requestvalidation.aspx# for costs and scheduling. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. Furnish copies of test results within 24 hours of completion of the tests.

1.3.1 Sampling

Take aggregate samples in accordance with ASTM D75/D75M.

1.3.2 Tests

1.3.2.1 Gradation Analyses

Perform gradation analyses in accordance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11.

1.3.2.2 Compaction Tests

Perform field compaction tests in accordance with ASTM D6938 by Backscatter Method (Procedure B). Use ASTM D6938 to determine the moisture content of the aggregate drainage layer material. Check the calibration curves furnished with the moisture gauges along with compaction calibration checks as described in ASTM D6938. Make the calibration checks of both the compaction and moisture gauges using the prepared containers of material method, as described in Annex A2 of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. Submit copies of field test results within 24 hours after the tests are performed.

1.3.2.3 Soundness Test

Perform soundness tests in accordance with ASTM C88.

1.3.2.4 Wear Test

Perform wear tests in conformance with ASTM C131/C131M.

1.3.2.5 Flat or Elongated Particles Tests

Perform flat and/or elongated particles tests in accordance with ASTM D4791 Method A.

1.3.2.6 Fractured Faces Tests

When aggregates are supplied from crushed gravel, test in accordance with ASTM D5821 to verify the aggregate meets the requirements for fractured faces in paragraph AGGREGATES.

1.3.3 Testing Frequency

1.3.3.1 Initial Tests

Perform one of each of the following tests on the proposed material, prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, complete the following tests for each source.

a. Gradation Analysis.

b. Flat and/or elongated particles.

c. Fractured Faces.

d. Wear.

e. Soundness.

1.3.4 Approval of Materials

Submit material sources and material test results prior to field use.

1.3.4.1 Aggregate

Select the aggregate source at least 60 days prior to field use in the test section. Tentative approval of the source will be based on certified test results to verify that materials proposed for use meet the contract requirements. Final approval of both the source and the material will be based on test section performance and tests for gradation, soundness, wear, flat and/or elongated particles tests and fractured faces tests. For aggregate drainage layer materials, perform these tests on samples taken from the completed and compacted drainage layer course within the test section.

1.4 ENVIRONMENTAL REQUIREMENTS

Place drainage layer material when the atmospheric temperature is above 35 degrees F. Correct areas of completed drainage layer or underlying

courses that are damaged by rainfall, or other weather conditions or by contamination from sediments, dust, dirt, or foreign material to meet specified requirements.

1.5 ACCEPTANCE

1.5.1 Tolerances

Acceptance of the drainage layer is based on compliance with the tolerances presented in Table 1. Remove and replace any course represented by the failing tests or submit plan for approval.

TABLE 1

Measurement	Tolerance
Grade	Plus/Minus 1/2 inch
Smoothness	Plus/Minus 3/8 inch
Layer Thickness	Plus/Minus 1/2 inch
Average Job Thickness	Plus/Minus 1/4 inch
Compaction	Based on Test Section Evaluation

1.5.2 Test Section

1.5.2.1 Data

Construct a test section to evaluate the constructability of the drainage layer including required mixing, placement, and compaction procedures as well as the ability to carry traffic. Test section data will be used to validate the required number of compaction passes given in paragraph Compaction Requirements and the field compaction requirements for full scale production.

1.5.2.2 Schedule/Evaluation

Construct the test section a minimum of 30 days prior to the start of full scale production to provide sufficient time for an evaluation of the proposed materials, equipment and testing.

1.5.2.3 Location and Size

Construct a test section near the job site, but not as part of the production pavement area. Provide an underlying grade or pavement structure upon which the test section is to be constructed the same as the remainder of the course. Do not construct the drainage layer in the test section until the underlying courses and subgrade preparation, required for the pavement section, have been completed, inspected and approved. Place the test section a minimum of 100 feet long and two full paving lanes wide side by side, with a longitudinal cold joint between the lanes.

1.5.2.4 Initial Testing

Provide approved certified test results prior to the start of the test

section to verify that the materials proposed for use in the test section meet the contract requirements.

1.5.2.5 Mixing, Placement, and Compaction

Accomplish mixing, placement, and compaction using equipment meeting the requirements of paragraph EQUIPMENT. Operate compaction equipment at speeds no greater than 1.5 mph.

1.5.2.6 Procedure

1.5.2.6.1 General

Use the same equipment, materials, and construction techniques on the test section as proposed for use in all subsequent work. Compact the RDM with the number of passes specified below. A pass is defined as the movement of a roller over the drainage layer area for one direction only. Divide the test section into three equal areas for the required compaction and gradation sampling. Conduct compaction tests in each area of the test section in accordance with ASTM D6938, Procedure B (Backscatter Method) until the maximum variation in compaction is less than 2 pounds per cubic foot. Once a rolling pattern has been determined based on the variation in compaction, take a minimum of two gradations in each area of the test section. Evaluate the gradation results in accordance with paragraph: Evaluation. In addition, perform a minimum of two nuclear tests per area and determine the average of the six tests for establishing the compaction range for production. If compaction is not within the required maximum variation in compaction limits after the specified number of passes, perform additional passes and gradation testing, as directed

1.5.2.6.2 RDM Aggregate Drainage Layer Tests

Construct the test section with aggregate in a wet state so as to establish a correlation between number of roller passes and compaction achievable during field production. Compact the RDM using a minimum of 4 passes in the vibrating mode and one final pass in the static mode.

1.5.2.7 Evaluation

Within 10 days of completion of the test section, submit a Test Section Construction Report complete with all required test data and correlations. Evaluate the data as follows:

a. Plot the compaction and percent passing the No. 4 and No.16 sieve sizes against cumulative passes. If the percent passing the given sieve sizes is increasing, the aggregate is being broken down by the compaction effort. Maximize compaction while minimizing aggregate degradation. Establish the required compaction at plus or minus 4 pounds per cubic foot from the average compaction value determined during the test section.

b. Base the required number of passes on test section observations of degradation in lieu of sieve analyses. Establish the required compaction at plus or minus 4 pounds per cubic foot from the average compaction value determined during the test section.

c. Evaluate the ability to carry construction traffic for the proposed paving width using the fleet of vehicles proposed for use on the work by applying 10 passes of the highest ground pressure vehicle in the

construction traffic mix. If rutting or displacement of the drainage layer occurs, adjust the equipment for drainage layer construction.

PART 2 PRODUCTS

2.1 AGGREGATES

Provide aggregates consisting of clean, sound, hard, durable, angular particles of crushed stone, crushed slag, or crushed gravel which meet the specification requirements. Slag must be an air-cooled, blast-furnace product having a dry weight of not less than 65 pcf determined by ASTM C29/C29M. Provide aggregates free of silt and clay as defined by ASTM D2487, vegetable matter, and other objectionable materials or coatings.

2.1.1 Aggregate Quality

Provide aggregate with a maximum soundness loss of 18 percent weighted averaged at 5 cycles when tested in magnesium sulfate or 12 percent weighted average at five cycles when tested in sodium sulfate in accordance with ASTM C88 and a maximum percentage of loss on abrasion of 40 after 500 revolutions as determined by ASTM C131/C131M. Determine the percentage of flat and/or elongated particles by ASTM D4791 Method A with the following modifications: 1) Separate the aggregates into two size fractions, particles greater than 1/2 inch sieve and particles passing the 1/2 inch sieve and retained on the No. 4 sieve. 2) Limit thepercentage of flat and/or elongated particles in either fraction to a maximum of 20. 3) A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. 4) When the aggregate is supplied from more than one source, aggregate from each source is required to meet the specified requirements. Manufacture crushed gravel from gravel particles 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE 2. In the portion retained on each sieve specified, provide crushed gravel containing at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. When two fractures are contiguous, the angle between planes of the fractures is required to be at least 30 degrees in order to count as two fractured faces. Test for fractured faces in accordance with ASTM D5821.

2.1.2 Gradation Requirements

Provide drainage layer aggregates that are well graded within the limits specified in TABLE 2.

TABLE 2

GRADATION OF DRAINAGE LAYER MATERIAL

Percentage by Weight Passing Square-mesh Sieve

Sieve Designation	Rapid Draining Material (RDM)
1-1/2 inch	100
1 inch	70-100

TABLE 2	
3/4 inch	55-100
1/2 inch	40-80
3/8 inch	30-65
No. 4	10-50
No. 8	0-25
No. 16	0-5

NOTE 1: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves require appropriate correction when aggregates of varying specific gravities are used.

NOTE 2: For RDM, maintain the coefficient of uniformity (CU) greater than 3.5 (CU = D60/D10). Adjust the RDM gradation within the ranges listed in Table 2 to provide a stable construction surface for the proposed equipment and method of transporting materials. Stabilize the RDM drainage layer with Portland cement or asphalt at no additional cost, if approved during the test section.

NOTE 4: The Optional Table 2 gradation can be met in some areas with 77% #57 stone and 23% concrete sand blend.

2.2 EQUIPMENT, TOOLS, AND MACHINES

2.2.1 Equipment

All plants, equipment, and tools used in the performance of the work are subject to approval before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times.

2.2.2 Placement Equipment

Use an asphalt paving machine to place drainage layer material. Alternate methods can be used if it can be demonstrated in the test section that these methods obtain the specified results.

2.2.3 Compaction Equipment

Use a dual smooth 10 short ton (min.) vibratory drum roller, which provides a maximum compactive effort without crushing the drainage layer aggregate, to compact drainage layer material.

PART 3 EXECUTION

3.1 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas to prevent segregation. Stockpile materials obtained from different sources separately.

3.2 PREPARATION OF UNDERLYING COURSE

Clean the underlying course of all foreign materials prior to constructing the drainage layer. Construct the underlying course in accordance with

Section 32 11 20 SEPARATION LAYER. Correct ruts or soft yielding spots in the underlying courses having inadequate compaction and deviations of the surface from the requirements set forth herein by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line, and grade, and recompacting to specified density. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the drainage layer is placed.

3.3 TRANSPORTING MATERIAL

3.3.1 Aggregate Drainage Layer Material

Transport aggregate drainage layer material to the site in a manner which prevents segregation and contamination of materials.

3.4 PLACING

3.4.1 General

Place drainage layer material on the underlying course in lifts of uniform thickness using equipment meeting the requirements of paragraph EQUIPMENT. When a compacted layer 6 inches or less in thickness is required, place the material in a single lift. When a compacted layer in excess of 6 inches is required, place the material in lifts of equal thickness. Limit compacted lift thickness to a maximum of 6 inches and a minimum of 3 inches in compacted thickness. Place and compact lifts true to the grades or levels required with the least possible surface disturbance. Where the drainage layer is placed in more than one lift, clean the previously constructed lift of loose and foreign material. Make adjustments in placing procedures or equipment as needed to obtain true grades and minimize segregation and degradation of the drainage layer material.

3.4.2 Hand Spreading

Hand spread drainage layer material in areas where machine spreading is impractical. Spread the material uniformly in a loose layer to prevent segregation. Construct the layer so that the compacted material conforms to the required grade and thickness after compaction.

3.5 COMPACTION REQUIREMENTS

3.5.1 General

Base field compaction requirements on the results of the test section, using the materials, methods, and equipment demonstrated in the test section

3.5.2 Number of Passes

Accomplish compaction using rollers meeting the requirements of paragraph EQUIPMENT and operating at a rolling speed of no greater than 1.5 miles per hour. Follow the rolling pattern established during the test section. Compact each lift of drainage material with the number of passes determined from successful completion of the test section in accordance with paragraph ACCEPTANCE.

3.5.3 Compaction

In addition, maintain a minimum field dry density as specified by the Contracting Officer. If the required field dry density is not obtained, adjust the number of roller passes in accordance with paragraph DEFICIENCIES. Compact aggregate in a moisture state as determined in the test section. Avoid crushing of aggregate particles by excessive rolling. Complete field compaction within 60 minutes. In all places not accessible to the rollers, compact the drainage layer material with mechanical hand operated tampers.

3.6 FINISHING

Finish the top surface of the drainage layer after final compaction, as determined from the test section. Make adjustments in rolling and finishing procedures to obtain grades and minimize segregation and degradation of the drainage layer material.

3.7 EDGES OF DRAINAGE LAYER

Place shoulder material along the edges of the drainage layer course in a quantity that will compact to the thickness of the layer being constructed. Roll and compact at least a 3 feet width of the shoulder simultaneously with the rolling and compacting of each lift of the drainage layer.

3.8 SMOOTHNESS TEST

Construct the top lift so that the surface show no deviations in excess of 3/8 inch when tested with either a 10 or 12 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Correct deviations exceeding 3/8 inch in accordance with paragraph DEFICIENCIES.

3.9 THICKNESS CONTROL

Compact the drainage layer to a thickness that is within 1/2 inch of the thickness indicated. Measure thickness at intervals providing at least one measurement for each 500 square yards of drainage layer. Make measurements in test holes at least 3 inches in diameter unless the Contractor can demonstrate, for COR approval, that a steel rod pushed through the drainage layer clearly stops at the material interface. Where the measured thickness is more than 1/2 inch deficient, correct such areas in accordance with paragraph DEFICIENCIES. Where the measured thickness is 1/2 inch more than indicated, it will be considered as conforming to the requirements plus 1/2 inch, provided the surface of the drainage layer is within 1/2 inch of established grade. The average job thickness will be the average of all job measurements as specified above but within 1/4 inch of the thickness shown on the drawings.

3.10 DEFICIENCIES

3.10.1 Grade and Thickness

Correct deficiencies in grade and thickness so that both grade and thickness tolerances are met. Do not add thin layers of material to the top surface of the drainage layer to meet grade or increase thickness. Trim the top of the drainage layer to grade and finish in accordance with paragraph FINISHING if the surface elevation is more than 1/2 inch above

the plan grade. If the elevation of the top surface of the drainage layer is 1/2 inch or more below the required grade, scarify the surface of the drainage layer to a depth of at least 3 inches, add new material , and blend and recompact the layer to bring it to grade. Where the measured thickness of the drainage layer is more than 1/2 inch deficient, correct such areas by excavating to the required depth and replace with new material to obtain a compacted lift thickness of at least 3 inches. Control the depth of required excavation to keep the final surface elevation within grade requirements and to preserve layer thicknesses of materials below the drainage layer.

3.10.2 Density

Density will be considered deficient if the field dry density test results are below the dry density specified by the Contracting Officer. Roll the layer with 2 additional passes of the specified roller if the densities are deficient. If the dry density is still deficient, work will be stopped until the cause of the low dry densities can be determined and reported to the Contracting Officer.

3.10.3 Smoothness

Correct deficiencies in smoothness as if they are deficiencies in grade or thickness. Maintain all tolerances for grade and thickness while correcting smoothness deficiencies.

-- End of Section --

SECTION 32 12 13

BITUMINOUS TACK AND PRIME COATS
05/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D8	(2022a) Standard Terminology Relatimg to Materials for Roads and Pavements
ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D977	(2020) Standard Specification for Emulsified Asphalt
ASTM D1250	(2019; E 2020) Standard Guide for Use of the Joint API and ASTM Adjunct for Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils: API MPMS Chapter 11.1
ASTM D2397/D2397M	(2020) Standard Specification for Cationic Emulsified Asphalt
ASTM D2995	(2023) Determining Application Rate of Bituminous Distributors

1.2 DEFINITIONS

See ASTM D8 for more definitions relating to this specification.

1.2.1 Prime Coat

Application of a low-viscosity asphalt material to an absorptive surface, such as an unbound granular layer, designed to penetrate, bond, temporarily weatherproof, and stabilize this existing surface and to promote adhesion between it and construction course that follows.

1.2.2 Tack Coat

Tack Coat is also referred to as bond coat. Tack coat is an application of bituminous material to an existing relatively nonabsorptive surface, such as existing densely graded asphalt mixture (milled or new), to provide a thorough bond between old and new surfacing.

1.2.3 Emulsion

Emulsion is also known as emulsified asphalt or asphalt emulsion. Mostly

made of paving grade asphalt binder and water containing a small amount of emulsifying agent. Emulsifying agent may also be referred to as a surfactant. The purpose of the surfactant is to prevent the coalescence of the asphalt droplets and to keep them suspended independently in the water. Surfactants used in the emulsions can be produced with positive or negative charges resulting in anionic or cationic emulsions.

1.2.4 Diluted Emulsion

An emulsion that has been diluted by adding an additional amount of water equal to or less than the total volume of emulsion.

1.2.5 Residual Asphalt

The amount of asphalt binder remaining after all water has evaporated from an asphalt emulsion.

1.2.6 Shot Rate

Shot rate, also referred to as bar rate, is the application rate set by the computerized control system in the bituminous distributor for the cutback asphalt, asphalt binder, or the asphalt emulsion. This value is typically represented by units of g/yd^2.

1.2.7 Emulsion Break

Emulsion break, also referred to as break or breaking, is the initiation of asphalt binder droplets coalescing and water separating within the emulsion, at which point color begins to change from brown to black.

1.2.8 Emulsion Set

Emulsion set, also referred to as cure or curing, is the completion of emulsion breaking when water has evaporated, leaving behind a thin film of asphalt binder residue.

1.2.9 Certificate of Analysis (COA)

The COA is the manufacturer’s Certificate of Compliance (COC) including all applicable test results required by the specifications.

1.2.10 Certificate of Compliance (COC)

The manufacturer’s certification stating that materials or assemblies furnished fully comply with the requirements of the contract. Provide signed COC by the manufacturer’s authorized representative. The COC may also be referred to as the Bill of Lading.

1.2.11 Screenings

Screenings are a uniformly sized, fine, sandy material with some silt particles. The term screening is used to designate the finer fraction of crushed stone that accumulates after primary and secondary crushing and separation on a No. 4 sieve. Screenings commonly range in particle size from 1/8 in down to finer than No. 200 sieve. The size distribution, particle shape, and other physical properties can be somewhat different from one quarry location to another, depending on the geological source of the rock quarried, the crushing equipment used, and the method used for coarse aggregate separation. Screenings generally contain freshly

fractured faces, have a fairly uniform gradation, and do not usually contain large quantities of plastic fines.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Prime Coat Certificate Of Analysis (COA); G

Tack Coat Certificate Of Analysis (COA); G

SD-06 Test Reports

Sampling and Testing

Application Rate Calibration; G

Daily Application Rate Verification

SD-07 Certificates

Certificates Of Compliance (COC)

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect the materials delivered to the site for contamination and damage. Unload and store the materials with minimal handling.

1.5 ENVIRONMENTAL REQUIREMENTS

Apply bituminous coat only when the surface to receive the bituminous coat is dry. A limited amount of moisture (approximately 0.03 gallon/square yard) can be sprayed on the surface of unbound material when prime coat is used to improve coverage and penetration of asphalt material. Apply bituminous coat only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application, unless otherwise directed.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Bituminous Distributor

Provide a self propelled pressure distributor with pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the surface being sprayed. Provide a bituminous distributor capable of circulating and agitating the bituminous material during the heating process. The distributor truck is required to have a ground speed control device (radar or contact-wheel: DMI) interconnected with the asphalt pump such that the desired application rate will be supplied at any speed. Include with the distributor equipment a tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature

of tank contents, and a hand hose or wand attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. A uniform double or triple overlap is required to be produced by the equipped spray bar. Equip the distributor and spray bar with an instantaneous shutoff. No dripping of material from the spray bar is allowed after shutoff.

Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled total liquid rates from 0.03 to 1.0 gallon per square yard, with a pressure range of 25 to 75 psi and with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths.

2.2 PRIME COAT MATERIAL

Provide the prime coat Certificate of Analysis (COA), including specific gravity, for the product specified below. COA's should be provided at preconstruction, prior to Application Rate Calibration, and any other COA's during production:

2.2.1 Emulsified Asphalt

Provide emulsified asphalt conforming to ASTM D977, Type SS-1h ASTM D2397/D2397M, Type CSS-1 CSS-1h. Asphalt emulsion can be diluted up to 1 part water to 1 part emulsion for prime coat use. Where prime coats are to be diluted, certify the dilution was done in accordance with the specific dilution requirements for each product and for each load of material used.

2.3 TACK COAT MATERIAL

Provide the tack coat Certificate of Analysis (COA), including specific gravity, for the product specified below. No dilution is allowed for tack coat applications.

2.3.1 Emulsified Asphalt

Provide emulsified asphalt conforming to ASTM D977, Type SS-1 SS1h ASTM D2397/D2397M, Type CSS-1 CSS-1h.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT STORAGE AND BITUMINOUS DISTRIBUTOR

Most anionic and cationic emulsions are not compatible. Thoroughly clean the asphalt emulsion storage and bituminous distributor if previous asphalt emulsion used is non-compatible with the specified emulsion. As an example, if CSS-1h (cationic) was utilized in the distributor previously, and the specified emulsion is a SS-1h (anionic), this would require the storage to be thoroughly cleaned prior to receiving the material and the bituminous distributor storage tanker to be thoroughly cleaned prior to depositing into the bituminous distributor storage tanker.

Ensure bituminous material is at the recommended application temperature and it has been thoroughly cycled through the distributor bar. Test the bituminous distributor under pressure by means of a test shot area (outside the project limits) to ensure there are no leaks or dripping for the nozzles after shut-off.

3.2 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, remove all loose material, dirt, clay, or other objectionable material from the surface to be treated by means of a power broom or blower supplemented with hand brooms. Apply treatment only when the surface is dry and clean.

3.3 TRIAL APPLICATIONS AND CALIBRATIONS

3.3.1 Trial Applications

Trial applications below are for the initial settings of the bituminous distributor computer controlled application rate settings prior to performing the APPLICATION RATE CALIBRATION.

3.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous materials in the amount of 0.15 gallon per square yard (shot rate). For emulsions, make other trial applications using various amounts of material or adjusting other setting as may be deemed necessary to meet the residual application rate and uniform coverage.

3.3.3 Tack Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous tack coat materials in the amount of 0.06 gallons per square yard. Make other trial applications using various amounts of material or adjusting other setting as may be deemed necessary to meet the residual application rate and uniform coverage.

3.3.4 Application Rate Calibration

Provide all equipment, materials, and labor necessary to calibrate the application rate produced from the bituminous distributor per the following guidance. Each distributor truck proposed for use on the project will have the application rate calibrated for each material type proposed for use. Perform the application rate calibration after the distributor arrives on the project, after the test shot, and at least 24 hours prior to use for application of prime coat and tack coat. Calibrate the application rate in accordance with ASTM D2995. If utilizing a cutback or asphalt binder, utilize ASTM D2995 Option A. If utilizing an emulsified asphalt, utilize ASTM D2995 Option B. Provide pads made from berber carpet (or other approved durable absorbent pad) with rubber or waterproof backing measuring 12 inches by 12 inches. For transverse testing, stack pads end-to-end that spans the maximum width of the spray bar. For longitudinal testing, stack three sets of six pads end-to-end longitudinally with 100 foot separation between sets.

Measure the transverse and longitudinal application rates with all nozzles inserted in the distributor bar. Submit the results for the application rate calibration in the longitudinal direction and the transverse direction to the Government identifying, at a minimum, the following items:

a. Project name, Contract number, testing date.

b. Emulsified, cutback, or asphalt binder material.

c. Distributor make, model and serial number.

d. Distributor setup at time of calibration including target application rate (shot rate as shown on the computer control system), spray bar height, and distributor truck speed or motor RPM.

e. Dry weight of each pad prior to application.

f. Wet weight of each pad immediately after application.

g. For emulsions, oven dry each pad until constant mass. Record oven dry mass of each pad in 20 minute increments. Mass at the end of a 60 minute oven dry period is considered constant mass.

h. For emulsions, residual asphalt rate for each pad and average residual asphalt rate. For cutbacks, shot rate for each pad and average shot rate.

For the Application Rate Calibration to be acceptable, provide the average residual asphalt rate for emulsions or the average shot rate for cutbacks and asphalt binder in compliance with Table 3a or Table 3b and no individual pad rate is to vary more than 20 percent from the average. Perform the Estimating Application Rate of Bituminous Distributors in the presence of the project QC staff and the Government. Reference ATTACHMENT 1. If the application rate calibration fails to meet the requirements of this section, make adjustments to the distributor setup, shot rate or other settings as appropriate, and re-perform the application rate calibration until the results are within an acceptable range. Do not modify the distributor setup, or shot rate after application rate calibration is accepted without approval by the Government. Use ASTM D2995 to determine the estimation of application rate of bituminous distributors every 14 days of production, or as determined necessary by the Government.

3.3.5 Daily Application Rate Verification

Following acceptable results as outlined in paragraph APPLICATION RATE CALIBRATION, perform daily application rate verification each day when the distributor is in use and provide results daily during execution. The production application rates will utilize the volume method of determination as follows:

a. Determine the total distance to be sprayed.

b. Calculate the area sprayed.

c. Calculate the gallons of material applied by subtracting the beginning volume by the ending volume. Utilizing the dipstick which has been provided with the distributor truck or the onboard meter.

d. Correct for temperature back to 60 degrees F by applying correction factor as provided in ASTM D1250.

e. Calculate and report the temperature corrected shot rate by dividing the corrected gallons per item d. by the total area sprayed.

3.4 APPLICATION RATE CORRECTION

If the daily application rate verification varies by more than 0.015

gallon per square yard from the shot rate established during application rate calibration that met the rates in Table 3a or Table 3b, immediately re-perform the application rate calibration in accordance with paragraph APPLICATION RATE CALIBRATION and ensure results are in compliance with the rates specified in Table 3a or Table 3b prior to applying additional prime coat or tack coat.

3.5 APPLICATION TEMPERATURE

3.5.1 Viscosity Relationship

Apply bituminous material at a temperature that will provide a viscosity between 10.0 and 60.0 seconds, Saybolt Furol or between 20 and 120 centistokes. Furnish the temperature viscosity relation to the Contracting Officer.

3.5.2 Temperature Ranges

The viscosity requirements determine the application temperature to be used. Table 2 presents a normal range of application temperatures.

Table 2	
Tack Coat or Prime Coat Application Temperatures	
Asphalt Emulsion	
Cationic Emulsified Asphalt	130-170 degrees F
(1) Max temperature may be increased to 375 degrees F if recommended by the manufacturer to facilitate uniform application free of equipment clogging issues when hard base asphalt is used.	

3.6 APPLICATION

3.6.1 General

Following preparation and subsequent inspection of the surface, apply the prime coat or tack coat with the distributor at the specified rate with uniform distribution over the surface to be treated. Properly treat all areas and spots, not capable of being sprayed with the distributor, with the hand spray. Until the succeeding layer of pavement is placed, maintain the surface by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, spread clean dry sand to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment are permitted within 25 feet of heating, distributing, and transferring operations of cutback materials. Prevent all traffic, except for paving equipment used in constructing the surfacing, from using the underlying material, whether primed or not, until the surfacing is completed.

3.6.2 Prime Coat

Apply the prime coat at locations shown on the Drawings only when the underlying material meets the specified material density requirements, and the moisture content is within 2 percent of optimum moisture. Application should be achieved within the limits of the temperature described in paragraph ENVIRONMENTAL REQUIREMENTS and quantities to achieve the rate of

residual asphalt shown in Table 3a. At the time of priming, ensure that the base is firm, unyielding and in such condition that no undue distortion will occur. Ensure the prime coat adheres to the underlying material. Apply the prime coat material using a bituminous distributor. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, spread building paper on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper and to ensure that all sprayers will operate at full force on the surface to be treated. Immediately after application, remove and discard the building paper. If blotter aggregate is used, lightly sweep the area with a power broom, or other approved means, to remove any excess blotter aggregate.

Table 3a

Prime Coat Application Rates

Surface Type	Product Type	Rate (gal/yd^2)
Unbound Layers	Emulsion(1)	0.05 - 0.12 (residual rate)

(1) Emulsion prime coats may be diluted up-to a 1 to 1 dilution rate.

3.6.3 Tack Coat

Immediately following the preparation of the surface for treatment, apply the tack coat by means of the distributor, within the limits of the temperature described in paragraph ENVIRONMENTAL REQUIREMENTS and in quantities to achieve the rate of residual application rates shown in Table 3b. Ensure the surface is clean and dry. Apply tack coat at the locations shown on the Drawings sufficiently in advance of placing the asphalt mixture to permit breaking and initial stages of curing. Do not apply tack coat so far in advance that it might lose its adhesiveness as a result of being covered with dust or other foreign material. When using a spray paver with appropriate tack coat products, tack coat breaking requirements do not apply. Dilution of tack coat is prohibited. A tack coat should be applied to every bound surface (asphalt or concrete pavement) that is being overlaid with asphalt mixture and at transverse and longitudinal joints. Apply the bituminous material so that uniform distribution is obtained over the entire surface to be treated. Treat lightly coated areas and spots missed by the distributor by spraying with a hand wand or using other approved method. To obtain uniform application of the tack coat, at the junction of previous and subsequent applications, spread building paper on the surface for a sufficient distance back from the ends of each application to start and stop the tack coat on the paper and to ensure that all sprayers will operate at full force on the surface to be treated. Immediately after application, remove and discard the building paper. If blotter aggregate is used, lightly sweep with a power broom, or other approved means, to remove any excess blotter aggregate. Maintain and protect the treated surface from damage until the succeeding course of pavement is placed.

Table 3b

Tack Coat Application Rates[1,3,4]

Surface Type	Residual Rate (gal/yd^2)	Approximate Bar Rate Undiluted[2] (gal/yd^2)
New Asphalt (between layers)	0.02 - 0.05	0.03 - 0.07
Existing Asphalt	0.04 - 0.07	0.06 - 0.11
Portland Cement Concrete	0.03 - 0.05	0.05 - 0.08

(1) Dilution of tack coat is not allowed

(2) Assumes emulsion is 33 percent water and 67 percent asphalt

(3) Emulsified asphalt is prohibited to be applied at application rates over 0.12 gal/yd^2

(4) Residual rate is the same as bar rate when using hot-applied asphalt binders. Use residual rate tolerances as shown above for target when using hot-applied asphalt binders.

3.7 FIELD QUALITY CONTROL

Certificates of compliance (COC) for asphalt materials delivered will be obtained and checked to ensure that specification requirements are met. Quantities of applied material will be determined. Prime coat materials when emulsions are used can be diluted on site with potable water up to 1 part water to 1 part emulsion, as long as the residual rate is still being met. Do not dilute tack coat materials. If requested by the Government, obtain samples of the bituminous material under the supervision of the Government per paragraph SAMPLING and send for analysis.

3.7.1 Sampling and Testing

Furnish certified copies of the manufacturer's test reports indicating temperature-viscosity relationship for asphalt materials and compliance with applicable specified requirements, not less than 5 days before the material is required in the work.

3.7.2 Sampling

Unless otherwise specified, sample bituminous material in accordance with ASTM D140/D140M.

3.8 PRIME COAT SET PERIOD

Allow the prime coat to set without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread enough blotter aggregate to effectively blot up excess bituminous material.

3.9 TACK COAT BREAKING PERIOD

Following application of an emulsified asphalt tack coat and prior to application of the succeeding layer of asphalt mixture, allow emulsified asphalt tack coats to break. No break period is required for cutback or hot-applied asphalt binder tack coat products.

3.10 TRAFFIC CONTROLS

Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

3.11 ATTACHMENT

ATTACHMENT 1: Estimating Application Rate of Bituminous Distributors

-- End of Section --

.

SECTION 32 12 15.13

ASPHALT PAVING FOR AIRFIELDS
11/20, CHG 1: 05/22

PART 1 GENERAL

1.1 FULL PAYMENT

1.1.1 Method of Measurement

Utilize the quantity of hot-mix warm-mix asphalt pavement, per ton placed and accepted, for the purposes of assessing the pay factors stipulated below.

1.1.2 Basis of Payment

The measured quantity of hot-mix warm-mix asphalt pavement will be paid for and included in the lump sum contract price. If less than 100 percent payment is due based on the pay factors stipulated in paragraph PERCENT PAYMENT and ACCEPTANCE, a unit price of $937.00 per ton will be used for purposes of calculating the payment reduction.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 156	(2013; R 2017) Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
AASHTO T 329	(2015) Standard Test Method for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method

ASPHALT INSTITUTE (AI)

AI MS-2	(2015) Asphalt Mix Design Methods

ASTM INTERNATIONAL (ASTM)

ASTM C29/C29M	(2023) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2022) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017; R 2023) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C1252	(2017) Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D242/D242M	(2009; R 2014) Mineral Filler for Bituminous Paving Mixtures
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures
ASTM D2041/D2041M	(2011) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2172/D2172M	(2017; E 2018) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2419	(2014) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489/D2489M	(2016) Standard Test Method for Estimating Degree of Particle Coating of Asphalt Mixtures
ASTM D2726/D2726M	(2019) Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D3203/D3203M	(2017) Standard Test Method for Percent

	Air Voids in Compacted Asphalt Mixtures
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4125/D4125M	(2010) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867/D4867M	(2009; R 2014) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5361/D5361M	(2016) Standard Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
ASTM D5444	(2015) Mechanical Size Analysis of Extracted Aggregate
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6084/D6084M	(2018) Standard Test Method for Elastic Recovery of Asphalt Materials by Ductilometer
ASTM D6307	(2019) Standard Test Method for Asphalt Content of Asphalt Mixture by Ignition Method
ASTM D6373	(2023) Standard Specification for Performance Graded Asphalt Binder
ASTM D6925	(2014) Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
ASTM D6926	(2020) Standard Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus
ASTM D6927	(2015) Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1.4 AIRFIELD ASPHALT PAVING WORKSHOP

Attend a one day paving workshop held in advance of asphalt paving. Acquire a facility for the workshop in the vicinity of the installation, or other appropriate location, as approved by the Government. Provide a facility that includes at a minimum, parking and seating for forty attendees, audio/visual with standard connections, including TV, projector, screen and any other items as required for display of digital presentations, and access to Wi-Fi. Coordinate schedule with the Government. Attendance requirements apply to each paving crew anticipated to be on the project. At a minimum, the following attendees are required.

a. Project Superintendent

b. Paving Superintendent or Foreman(s)

c. Paving Machine Operator(s)

d. Asphalt Plant Operator(s)

e. Airfield Asphalt Pavement Quality Control Manager

f. Airfield Asphalt Pavement Inspector

g. Airfield Asphalt Pavement Laboratory Technicians

h. Roller Operators

i. Aggregate Supplier(s)

j. MTV Operator(s)

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment; G

SD-02 Shop Drawings

Placement Plan; G

SD-03 Product Data

Diamond Grinding Plan; G

Mix Design; G

Contractor Quality Control; G

SD-04 Samples

Aggregates

Asphalt Binder

Warm-mix Additive

SD-06 Test Reports

Aggregates; G

QC Monitoring

Pavement Lots; G

SD-07 Certificates

Asphalt Binder; G

Testing Laboratory

Warm-mix Additive

Airfield Asphalt Pavement QC Manager

Airfield Asphalt Pavement Inspector

Airfield Asphalt Pavement Laboratory Technician

1.6 CONTRACTOR QUALITY CONTROL STAFF

Reference Section 01 45 00 QUALITY CONTROL for Contractor personnel qualification requirements along with the information included below. The Airfield Asphalt Pavement QC Manager is a separate person and is in addition to the CQC System Manager identified in Section 01 45 00 QC Manager identified in Section 01 45 00 QUALITY CONTROL. The Airfield Asphalt Pavement QC Manager will report to and assist the project CQC System Manager. Submit certifications for Contractor Quality Control Staff in the following areas:

a. Airfield Asphalt Pavement QC Manager(1): The QC manager will oversee all QC testing and inspection, review asphalt pavement transmittals prior to submission to the Government, be responsible for making mix design adjustments, and in charge of all other activities related to performance. The QC manager will also ensure that daily reports and necessary transmittals arrive for Government review as specified.

b. Airfield Asphalt Pavement Inspector(1): The Inspector will be available on the project during all paving operations. The Inspector is responsible for identifying observed paving issues and ensuring these issues are addressed by the Contractor Quality Control staff.

c. Airfield Asphalt Pavement Laboratory Technician(1): The Technician will be responsible for conducting laboratory tests. The Airfield Asphalt Pavement Technician will be present in the laboratory anytime laboratory testing is underway.

(1): Registration for the Airfield Asphalt Pavement Certification Program can be found at www.airfieldasphaltcert.com.

1.7 ACCEPTANCE

1.7.1 Acceptability of Work

Acquire the services of an independent commercial laboratory to perform acceptance testing. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. The materials and the pavement itself will be accepted on the basis of production testing. The Government may make check tests from split samples to validate the results of the production testing. Testing performed by the Government does not reduce the required testing of the independent commercial laboratory. Split samples will be taken for Government testing to reduce the variability between the independent commercial laboratory and the Government's test results. When the difference between the independent commercial laboratory and the Government's test results for split samples exceed the acceptable range of two results for multi-laboratory precision for the appropriate test method (i.e. ASTM) then at least one of the laboratories is determined to be in error. An evaluation of procedures and equipment in both laboratories will be made to determine the cause(s) for the differences. Develop steps to correct procedures and equipment to bring multi-laboratory precision to within acceptable limits.

1.7.2 Acceptance Requirements

Provide all sampling and testing required for acceptance and payment adjustment. Where appropriate, adjustments in payment for individual lots of asphalt pavement will be made based on laboratory air voids, in-place density, smoothness, and grade in accordance with the following paragraphs. Surface smoothness and grade determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus smoothness and grade measurements for the entire lot cannot be made.

1.7.3 Pavement Lots

A standard lot for all requirements is equal to one day's production or 2,000 tons, whichever is smaller. Divide each lot into four equal sublots in order to evaluate laboratory air voids and in-place density. When operational conditions cause a lot to be terminated before the specified four sublots have been completed, use the following procedure to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they constitute a lot. Where one or two sublots have been completed, incorporate them into the next lot and the total number of sublots (i.e. 5 or 6 sublots) is used for acceptance criteria. Maintain 4 sublots when possible. Include partial lots at the end of asphalt production into the previous lot. When more than one plant is simultaneously producing asphalt for the project, apply the lot size separately for each plant. Complete and report all asphalt testing including but not limited to aggregate gradation, asphalt content, theoretical maximum density, laboratory air voids, and in-place density testing within 24 hours, unless otherwise stated, after construction of each lot.

1.7.4 Sublot Sampling

Obtain one random mixture sample from each sublot in accordance with ASTM D979/D979M from a loaded truck or another approved location for determining laboratory air voids, theoretical maximum density, Contractor

Quality Control, and for any additional testing as directed the Government. Representative samples will be selected from random trucks, using commonly recognized methods of assuring randomness conforming to ASTM D3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D3203/D3203M. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

1.7.5 Additional Sampling and Testing

The Government reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Contractor. Testing in these areas will be treated as a separate lot. Payment will be made for the quantity of asphalt pavement represented by these tests in accordance with the provisions of this section.

1.7.6 Theoretical Maximum Density (TMD)

Measure theoretical maximum density one time for each sublot in accordance with ASTM D2041/D2041M for purposes of calculating laboratory air voids and determining in-place density. The average TMD for each lot will be determined as the average TMD of the random sublot samples. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD values will be used as the TMD needed to calculate the percent joint density.

1.7.7 Laboratory Air Voids

Prepare one set of laboratory compacted specimens for each sublot in accordance with ASTM D6926 using the hand-held hammer for the Marshall Method.Prepare one set of laboratory compacted specimens for each sublot in accordance with ASTM D6925 using the Superpave gyratory compactor. Provide three test specimens prepared from the same sample for each set of laboratory compacted specimens. Compact the specimens within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Do not reheat samples prior to compaction. Provide insulated containers as necessary to maintain the sample temperature. Measure the bulk density of laboratory compacted specimens in accordance with ASTM D2726/D2726M. Determine laboratory air voids from one set (three laboratory compacted specimens) for each sublot sample in accordance with ASTM D3203/D3203M.

1.7.8 In-place Density

Obtain one random 6 inch diameter core from the mat and joint of each sublot in accordance with ASTM D5361/D5361M for determining in-place density. Where different job mix formulas are required as part of the same project, and are adjacent to one another, follow the same joint density sampling and joint density testing instructions of this specification. Cut samples neatly with a diamond core drill bit. Obtain random cores that are the full thickness of the layer being placed. Select core locations randomly using the procedures contained in ASTM D3665. Locate cores for mat density no closer than 12 inches from a transverse or longitudinal joint. Center all cores for joint density on the joint. Discard samples that are clearly defective as a result of sampling and take an additional random core. When the random core is less than 1 inch thick, it will not

be included in the analysis. In this case, obtain another random core sample. Clean and tack coat dry core holes before filling with asphalt mixture. Fill all core holes with asphalt mixture and compact using a manual (hand-held) Marshall hammer to the density specified. Provide all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Measure in-place density in accordance with ASTM D2726/D2726M using each core obtained from the mat and joint.

1.7.9 Surface Smoothness

After the final rolling, but not later than 24 hours after placement, test the surface of the pavement in each entire lot by use of a straightedge and/or profilograph to reveal surface irregularities exceeding the tolerances specified. Straightedge is used for all lifts. Use the profilograph method for testing longitudinal smoothness on surface lifts only, except for paving lanes less than 0.10 miles, and at the ends of the paving limits for the project. Use straightedge method for all other measurements. If any pavement areas are diamond ground, retest these areas immediately after diamond grinding and submit results to the Government for evaluation. At a minimum, provide enough information to determine exact location of grinding (station and offset from centerline), smoothness results, and the associated lot(s) pay factor for smoothness. Follow requirements of paragraph DIAMOND GRINDING if diamond grinding is required to correct smoothness. Where drawings show required deviations from a plane surface (for instance crowns, drainage inlets), finish the surface to meet the approval of the Government.

1.7.9.1 Straightedge Testing

Provide finished surfaces of the pavements within the tolerances specified in Table 5 when checked with an approved 12 foot straightedge. Start longitudinal and transverse straightedge testing with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurements. Perform continuous tests across all joints. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Use the straightedge to also measure abrupt changes in surface smoothness. Abrupt changes in the surface can be visually observed where the surface exhibits irregularities or discontinuities. Surface areas with obvious smoothness defects will be tested with the straightedge to determine the limits of the surface not meeting the tolerance requirements in Table 5. Do not perform straightedge measurements across grade changes or cross slope transitions.

After two full lots have been placed with an average of less than five percent of measurements out, a request can be made to reduce the testing frequency at a rate approved by the Government. Report all individual straightedge measurements coinciding with project stationing in each paving lot report.

Table 5		
Straightedge Surface Smoothness		
Pavement Category	Direction of Testing	Tolerance, inch
Shoulders (outside edge stripe)	Longitudinal	1/4
	Transverse	1/4

1.7.10 Plan Grade

Within 5 working days after completion of a particular lot incorporating the final wearing course, test the lot for conformance with specified plan grade requirements. Provide a final wearing surface of pavement conforming to the elevations and cross sections and not vary more than 0.03 foot for runways and landing zones or 0.05 foot for taxiways, aprons and shoulders. Deviation from the plan elevations will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined by running lines of levels at intervals of 50 feet, or less, longitudinally that coincides with the project spot elevations and lateral spacing to match the paving lane width (after cut back). In areas where the grade exceeds the tolerance by more than 50 percent, remove the surface lift full depth and replace the lift with asphalt pavement to meet specification requirements, at no additional cost to the Government. Match finished surfaces at juncture with other pavements with finished surfaces of abutting pavements except for where paragraph ASPHALT PAVEMENT-PORTLAND CEMENT CONCRETE JOINTS apply. Diamond grinding can be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas is not permitted. Provide finished surface grades in record drawing format showing design and constructed elevations which are stamped and signed by a licensed surveyor. Provide a comparison of the as-built grades to the design grades and determine a percentage of individual measurements exceeding the tolerances specified and determine pay factor per paragraph PAY FACTOR BASED ON PLAN GRADE. Submit the survey CAD files to the Government for record purposes. Submit all files including the calculation for percent measurements in each paving lot report.

1.8 LABORATORY ACCREDITATION AND VALIDATION

Provide laboratories used to develop the Job Mix Formula (JMF), perform acceptance testing, and Contractor Quality Control testing that meet the requirements of ASTM D3666. Perform all required test methods by an accredited and validated laboratory including field standards. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory accreditation is not allowed. The Government will inspect the laboratory equipment and test procedures prior to the start of asphalt pavement operations for conformance with ASTM D3666. In addition, all testing laboratories performing JMF, acceptance testing and Contractor Quality Control requires USACE validation by the Material Testing Center (MTC) for both parent laboratory and plant testing laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Contact the MTC manager listed at https://mtc.erdc.dren.mil/ for costs and scheduling. Submit a certificate of compliance signed by the manager of the laboratory stating that it

meets these requirements to the Government prior to the start of construction. At a minimum, include the following certifications:

a. Qualification(s) and certification(s) of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment, with calibration dates, to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

1.9 ENVIRONMENTAL REQUIREMENTS

Do not place asphalt pavement upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 6. The temperature requirements may be waived by the Government, if requested; provided all other requirements, including in-place density, are met.

Table 6

Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40
Less than 3	45

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of asphalt pavement. However, where the construction covered herein interfaces with other sections, construct each interface to conform to the requirements of both this section and the other section, including tolerance for both.

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. Provide hot-mix asphalt (HMA)warm-mix asphalt (WMA) pavement designed and constructed in accordance with this section conforming to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Construct each course to the depth, section, or elevation required by the drawings and rolled, finished, and approved before the placement of the next course (adjacent to or above). Submit proposed Placement Plan, indicating lane widths, longitudinal joints, and transverse joints for each course or lift.

2.2 EQUIPMENT

Provide product data for all components below.

2.2.1 Asphalt Mixing Plant

Provide plants used for the preparation of asphalt mixture conforming to the requirements of AASHTO M 156, including calibration data.

2.2.1.1 Truck Scales

Weigh the asphalt mixture on approved scales, or on certified public scales at no additional expense to the Government. Inspect and seal scales at least annually by an approved calibration laboratory.

2.2.1.2 Inspection of Plant

Provide access to the Government at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. Provide assistance as requested, for the Government to procure any desired samples.

2.2.1.3 Storage Silos

The asphalt mixture may be stored in non-insulated storage silos for a period of time not exceeding 3 hours. The asphalt mixture may be stored in insulated storage silos for a period of time not exceeding 8 hours. No differences in the mix removed from silos and the mix loaded into trucks are allowed.

2.2.2 Hauling Equipment

Provide trucks used for hauling asphalt mixture that have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, lightly coat the truck beds with a minimum amount of paraffin oil, lime solution, or other approved material. Do not use petroleum based products as a release agent. Cover the bed of each truck with a tarp or other suitable cover at all times during transport. When necessary to ensure that the mixture is delivered to the site at the specified temperature, provide insulated or heated truck beds with covers (tarps) that are securely fastened.

2.2.3 Material Transfer Vehicle (MTV)

Provide a self-propelled MTV with a swing conveyor that delivers material to the paver from outside the paving lane and without making contact with the paver. Provide MTV capable to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. Provide Material Transfer Vehicle with remixing and a minimum onboard storage capability of 13 tons.

2.2.4 Asphalt Pavers

Provide mechanical spreading and finishing equipment consisting of a self-powered paver, capable of spreading and finishing the mixture to the specified line, grade, and cross section. Provide paver with a vibrating screed capable of placing a uniform mixture to meet the specified thickness, smoothness, and grade without physical or temperature segregation, the full width of the material being placed. Provide a screed that effectively produces a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Provide information on the tractor(s) and screed(s) proposed for use.

2.2.4.1 Receiving Hopper

Provide paver with a receiving hopper of sufficient capacity to permit a uniform spreading operation and a distribution system to place the mixture uniformly in front of the screed without segregation.

2.2.4.2 Automatic Grade Controls

If an automatic grade control device is used, provide a paver equipped with a control system capable of automatically maintaining the specified screed elevation that is automatically actuated from either a reference line or through a system of mechanical sensors or sensor-directed mechanisms or devices which maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. Provide transverse slope controller capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. Do not use the transverse slope controller to control grade. Provide controls capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 30 feet in length.

b. Taut stringline set to grade.

c. Short ski or shoe for joint matching.

d. Laser control.

e. GPS control.

2.2.5 Rollers

Provide rollers in good condition and operated at slow speeds to avoid displacement of the asphalt mixture. Provide sufficient number, type, and weight of rollers to compact the mixture to the required density while it is still in a workable condition. Do not use equipment which causes excessive crushing of the aggregate.

2.2.6 Diamond Grinding

Those performing diamond grinding are required to have a minimum of three years experience in diamond grinding of airfield pavements. In areas not meeting the specified limits for surface smoothness and plan grade, reduce high areas to attain the required smoothness and grade, except as depth is limited below. Reduce high areas by diamond grinding the asphalt pavement with approved equipment after the asphalt pavement is at a minimum age of 14 days. Perform diamond grinding by sawing with saw blades impregnated with an industrial diamond abrasive. Assemble the saw blades in a cutting head mounted on a machine designed specifically for diamond grinding that produces the required texture and smoothness level without damage to the asphalt pavement. Provide diamond grinding equipment with saw blades that are 1/8-inch wide, a minimum of 60 blades per 12 inches of cutting head width, and capable of cutting a path a minimum of 3 feet wide. Diamond grinding equipment that causes raveling, fracturing of aggregate , or disturbance to the underlying material will not be allowed. The maximum area corrected by diamond grinding the surface of the asphalt pavement is 10 percent of the total area of any sublot. The maximum depth of diamond grinding is 1/2 inch. Provide diamond grinding machine equipped to flush and vacuum the pavement surface. Dispose of all debris from diamond grinding operations off Government property. Prior to diamond grinding,

submit a Diamond Grinding Plan for review and approval. At a minimum, include the daily reports for the deficient areas, the location and extent of deficiencies, corrective actions, and equipment. Remove and replace all pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified.

Prior to production diamond grinding operations, perform a test section at the approved location, consisting of a minimum of two adjacent passes with a minimum length of 40 feet to allow evaluation of the finish and transition between adjacent passes. Production diamond grinding operations cannot be performed prior to approval.

2.3 AGGREGATES

Sample aggregates in the presence of a Government Representative. Obtain samples in accordance with ASTM D75/D75M and be representative of the materials to be used for the project. Provide aggregates consisting of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. Submit sufficient materials to produce 200 pounds 400 pounds of blended mixture for mix design verification. Submit all aggregate test results and samples to the Government at least 14 days prior to start of construction. Aggregate tests can be no older than 6 months prior to contract award.

2.3.1 Coarse Aggregate

Provide coarse aggregate consisting of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. Provide coarse aggregate particles meeting the following requirements:

a. The percentage of loss not greater than 40 percent after 500 revolutions when tested in accordance with ASTM C131/C131M.

b. The sodium sulfate soundness loss not exceeding 12 percent, or the magnesium sulfate soundness loss not exceeding 18 percent after five cycles when tested in accordance with ASTM C88.

c. At least 75 percent by weight of coarse aggregate contain at least two or more fractured faces when tested in accordance with ASTM D5821 with fractured faces produced by crushing.

d. The particle shape essentially cubical and the aggregate containing not more than 5 percent, by weight, of flat particles, elongated particles, or flat and elongated particles (5:1 ratio of maximum to minimum) when tested in accordance with ASTM D4791 Method A.

e. Slag consisting of air-cooled, blast furnace slag, with a compacted weight of not less than 75 pounds per cubic foot when tested in accordance with ASTM C29/C29M.

f. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.3.2 Fine Aggregate

Provide fine aggregate consisting of clean, sound, tough, durable particles. Provide aggregate particles that are free from coatings of clay, silt, or any objectionable material, contain no clay balls, and meet the following requirements:

a. Quantity of natural sand (noncrushed material) added to the aggregate blend not exceeding 15 percent by weight of total aggregate.

b. Individual fine aggregate sources with a sand equivalent value greater than 45 when tested in accordance with ASTM D2419.

c. Fine aggregate portion of the blended aggregate with an uncompacted void content greater than 45.0 percent when tested in accordance with ASTM C1252 Method A.

d. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.3.3 Mineral Filler

Provide mineral filler consisting of a nonplastic material meeting the requirements of ASTM D242/D242M.

2.3.4 Aggregate Gradation

Provide a combined aggregate gradation that conforms to gradations specified in Table 7, when tested in accordance with ASTM C136/C136M and ASTM C117, and does not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grades uniformly from coarse to fine. Provide a JMF within the specification limits; however, the gradation can exceed the limits when the allowable deviation from the JMF shown in Tables 10 and 11 are applied.

Table 7

Aggregate Gradations

	Gradation 2
Sieve Size, inch	Percent Passing by Mass
1	---
3/4	100
1/2	90-100
3/8	69-89
No. 4	53-73
No. 8	38-60
No. 16	26-48

Table 7	
Aggregate Gradations	
	Gradation 2
Sieve Size, inch	Percent Passing by Mass
No. 30	18-38
No. 50	11-27
No. 100	6-18
No. 200	3-6

2.4 ASPHALT BINDER

Provide asphalt binder that conforms to ASTM D6373 for Performance Grade (PG) 76-22. Provide test data indicating grade certification by the supplier at the time of delivery of each load to the mix plant. For modified binders, perform PG Plus test requirements in ASTM D6084/D6084M Procedure B on RTFO aged binder, with a minimum elastic recovery of 75 percent. Submit copies of these certifications to the Government. The supplier is defined as the last source of any modification to the binder. The Government may sample and test the binder at the mix plant at any time before or during mix production.

2.5 MIX DESIGN

The mix design must be designed to meet the specs before it is processed through the plant. The baghouse must not be used to remove fines to meet specified gradations. The baghouses are intended to keep the plant from generating a large cloud of dust when under production, not to modify the gradation. Develop the mix design and provide results of the Job Mix formula (JMF) and aggregates testing performed no earlier than 6 months prior to contract award. Provide asphalt mixture composed of well-graded aggregate, mineral filler if required, and asphalt material. Provide aggregate fractions sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of Table 7. Do not produce asphalt pavement for payment until a JMF has been approved. Design the asphalt mixture using hand-held (manual) Marshall hammer procedures contained in AI MS-2 and the criteria shown in Table 8. Mechanical hammers are not permitted during JMF development. Design the asphalt mixture using the Superpave gyratory compactor set at 50 gyrations using the procedures contained in AI MS-2 and the criteria shown in Table 8. Prepare samples at various asphalt contents and compacted in accordance with ASTM D6925ASTM D6926. Use laboratory compaction temperatures for Polymer Modified Asphalts as recommended by the asphalt binder supplier. For tensile strength ratio (TSR) testing, adjust the compactive effort, as required, to provide specimens with an air void content of 7 plus or minus 1 percent. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D4867/D4867M is less than 75, reject the aggregates or treat the asphalt mixture with an anti-stripping agent. Add a sufficient amount of anti-stripping agent to produce a TSR of not less than 75. If an

antistrip agent is required, provide it at no additional cost to the Government. Provide sufficient materials to produce 200 pounds 400 pounds of blended mixture to the Government for verification of mix design at least 14 days prior to construction of test section.

2.5.1 JMF Requirements

Submit the proposed JMF in writing, for approval, at least 14 days prior to the start of the test section, including as a minimum:

a. Percent passing each sieve size.

b. Optimum asphalt content.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt viscosity grade, penetration grade, or performance grade and additional test requirements as specified in paragraph ASPHALT BINDER.

e. Number of blows of hammer per side of molded specimen.

f. Laboratory mixing and compaction temperatures.

g. Supplier-recommended field mixing and compaction temperatures.

h. Percentage and properties (asphalt content aggregate gradation, and aggregate properties) of RAP in accordance with paragraph RECYCLED ASPHALT PAVEMENT, if RAP is used.

i. Temperature-viscosity relationship of the asphalt binder.

j. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

k. Graphical plots and summary tabulation of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2. Include summary tabulation that includes individual specimen data for each specimen tested.

l. Specific gravity and absorption of each aggregate.

m. Percent natural sand.

n. Percent particles with two or more fractured faces (in coarse aggregate).

o. Fine aggregate angularity.

p. Percent flat or elongated particles (in coarse aggregate).

q. Tensile Strength Ratio and wet/dry specimen test results.

r. Type and amount of antistrip agent (if required).

s. List of all modifiers.

t. Percentage and properties (asphalt content aggregate gradation, and aggregate properties) of RAP in accordance with paragraph RECLAIMED ASPHALT PAVEMENT, if RAP is used.

u. Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season may not be accepted.

v. Warm-mix additive.

Table 8	
Marshall Design Criteria	
Test Property	50 Blow Mix
Stability, pounds minimum	1350(1)
Flow, 0.01 inch	8-18(2)
Air voids, percent	4(4)
Percent Voids in mineral aggregate (minimum)	See Table 9
Dust Proportion(3)	0.8-1.2
TSR, minimum percent	75
TSR Conditioned Strength (minimum psi)	60
(1) This is a minimum requirement. Provide significantly higher average during construction to ensure compliance with the specifications.	
(2) The flow requirement is not applicable for Polymer Modified Asphalts	
(3) Dust Proportion is calculated as the aggregate content, expressed as a percent of mass, passing the No. 200 sieve, divided by the effective asphalt content, in percent of total mass of the mixture.	
(4) Select the JMF asphalt content corresponding to an air void content of 4 percent. Verify the other properties of Table 8 meet the specification requirements at this asphalt content.	

Table 8	
Superpave Gyratory Compaction Criteria	
Test Property	Value
Air voids, percent	4(1)

Table 8	
Superpave Gyratory Compaction Criteria	
Test Property	Value
Percent Voids in mineral aggregate (minimum)	See Table 9
Dust Proportion(2)	0.8-1.2
TSR, minimum percent	75
TSR Conditioned Strength (minimum psi)	60
(1) Select the JMF asphalt content corresponding to an air void content of 4 percent. Verify the other properties of Table 8 meet the specification requirements at this asphalt content.	
(2) Dust Proportion is calculated as the aggregate content, expressed as a percent of mass, passing the No. 200 sieve, divided by the effective asphalt content, in percent of total mass of the mixture.	

Table 9	
Minimum Percent Voids in Mineral Aggregate (VMA)(1)	
Aggregate (See Table 7)	Minimum VMA, percent
Gradation 2	14.0
(1) Calculate VMA in accordance with AI MS-2, based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate.	

2.5.2 Adjustments to JMF

The JMF for each mixture is in effect until a new formula is approved in writing by the Government. Should a change in sources of any materials be made, perform a new mix design and a new JMF approved before the new material is used. Make minor adjustments within the specification limits to the JMF to optimize mix volumetric properties. Adjustments to the original JMF are limited to plus or minus 4 percent on the No. 4 and coarser sieves; plus or minus 3 percent on the No. 8 to No. 50 sieves; and plus or minus 1 percent on the No. 100 sieve. Adjustments to the JMF are limited to plus or minus 1.0 percent on the No. 200 sieve. Asphalt content adjustments are limited to plus or minus 0.40 from the original JMF. If adjustments are needed that exceed these limits, develop a new mix design.

2.6 RECLAIMED ASPHALT PAVEMENT

Reclaimed asphalt is not allowed for the project.

2.7 RECYCLED ASPHALT SHINGLES

Recycled asphalt shingles (RAS) is not allowed for the project.

PART 3 EXECUTION

3.1 CONTRACTOR QUALITY CONTROL

3.1.1 General Quality Control Requirements

Submit the Pavement Quality Control Plan. The Quality Control Plan is specific to this specification and supplements the overall Quality Control Plan required by Section 01 45 00. Do not produce hot-mix warm-mix asphalt pavement for payment until the quality control plan has been approved. In the quality control plan, address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design and unique JMF identification code

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management and procedures to prevent contamination

e. Proportioning including percent of warm-mix additive

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction, including Asphalt Pavement-Portland Cement Concrete joints

l. Surface Smoothness

m. Truck bed release agent

n. Correlation of mechanical hammer to hand-held (manual) hammer. Determine the number of blows of the mechanical hammer required to provide the same density of the JMF as provided by the hand-held (manual) hammer. Use the average of three specimens per trial blow application.

3.1.2 Testing Laboratory

Provide a fully equipped asphalt laboratory located at the plant or job site that is equipped with heating and air conditioning units to maintain a temperature of 75 plus or minus 5 degrees F. Provide laboratory facilities that are kept clean and all equipment maintained in proper working condition. Provide the Government with unrestricted access to inspect the laboratory facility, to witness quality control activities, and to perform any check testing desired. The Government will advise in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, immediately suspend the incorporation of the materials into the work. Incorporation of the materials into the work will not be permitted to

resume until the deficiencies are corrected.

3.1.3 Quality Control Testing

Perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The quality control (QC) testing is separate and distinct from the acceptance testing in paragraph ACCEPTANCE. Use in-house capabilities or the independent commercial laboratory for quality control testing. Required elements of the testing program include, but are not limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. Develop a Quality Control Testing Plan as part of the Quality Control Program.

3.1.3.1 Asphalt Content

Determine asphalt content a minimum of twice per lot (a lot is defined in paragraph PAVEMENT LOTS) by one of the following methods: extraction method in accordance with ASTM D2172/D2172M, Method A or B, the ignition method in accordance with ASTM D6307, or the nuclear method in accordance with ASTM D4125/D4125M, provided each method is calibrated for the specific mix being used. For the extraction method, determine the weight of ash, as described in ASTM D2172/D2172M, as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. Use the last weight of ash value in the calculation of the asphalt content for the mixture. The asphalt content for the lot will be determined by averaging the test results.

3.1.3.2 Aggregate Properties

Determine aggregate gradations a minimum of twice per lot (a lot is defined in paragraph PAVEMENT LOTS) from mechanical analysis of recovered aggregate in accordance with ASTM D5444, ASTM C136/C136M, and ASTM C117. Determine the specific gravity of each aggregate size grouping for each 20,000 tons in accordance with ASTM C127 or ASTM C128. Determine fractured faces for gravel sources for each 20,000 tons in accordance with ASTM D5821. Determine the uncompacted void content of fine aggregate (including manufactured sand and blending aggregate) for each 20,000 tons in accordance with ASTM C1252 Method A.

3.1.3.3 Temperatures

Check temperatures at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt binder in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.1.3.4 Moisture Content of Aggregate

Determine the moisture content of aggregate used for production a minimum of once per lot in accordance with ASTM C566.

3.1.3.5 Moisture Content of Mixture

Determine the moisture content of the mixture at least once per lot in accordance with AASHTO T 329.

3.1.3.6 Laboratory Air Voids, TMD, and VMA VMA, Marshall Stability and Flow

Obtain mixture samples at least four times per lot and compacted into specimens, using 50 blows per side with the Marshall hand-held (manual) hammer as described in ASTM D6926. The mechanical Marshall hammer can be used only after JMF development and after correlation from hand-held (manual) Marshall hammer to mechanical Marshall hammer per guidance in AI MS-2. After compaction, measure the bulk density of laboratory compacted specimens in accordance with ASTM D2726/D2726M. Determine the laboratory air voids from the set (three laboratory compacted specimens) for each sample in accordance with ASTM D3203/D3203M. Also calculate the VMA of each specimen in accordance with AI MS-2 based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate, as well as the Marshall stability and flow, as described in ASTM D6927. Provide VMA within the limits of Table 9.

3.1.3.7 In-Place Density

Conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge or other non-destructive testing device may be used to monitor pavement density for Contractor Quality Control purposes only.

3.1.3.8 Grade and Smoothness

Conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph ACCEPTANCE.

3.1.3.9 Additional Testing

Perform any additional testing, deemed necessary to control the process.

3.1.3.10 QC Monitoring

Submit all QC test results to the Government on a daily basis as the tests are performed. The Government reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.1.4 Sampling

When directed by the Government, sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected. Perform all sampling in accordance with standard procedures specified.

3.1.5 Control Charts

For process control, establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 10, as a minimum. Post the control charts as directed by the Government and maintain current at all times. Identify the following on the control charts, the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 10 applicable to the test parameter being plotted, and the test results. Also show target values (JMF) on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, take immediate steps to bring the

process back in control. When the test results exceed either applicable Suspension Limit, halt production until the problem is solved. When the Suspension Limit is exceeded for individual values or running average values, the Government has the option to require removal and replacement of the material represented by the samples or to leave in place and base acceptance on mixture volumetric properties and in place density. Use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Make decisions concerning mix modifications based on analysis of the results provided in the control charts. In the Quality Control Plan, indicate the appropriate action to be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 10

Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of Last Four Samples	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
No. 4 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	6	8	4	5
No. 30 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	4	6	3	4
No. 200 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Asphalt content, percent deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, percent deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, percent of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, percent of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
VMA, percent deviation from JMF target				
Gradation 1, 2 & 3	-0.5	-1.0	-0.25	-0.5
$P_{0.075}/P_{be}$ Ratio, deviation from 1.0; plus or minus values	0.7	0.8	0.3	0.4

Table 10 cont'd				
Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts - Marshall Compaction				
Stability, pounds (minimum)				
50 blow JMF	950	830	1350	1230
Flow, 0.01 inch				
50 blow JMF	8 min.	7 min.	9 min.	8 min.
	18 max.	19 max.	17 max.	18 max.

3.2 PREPARATION OF ASPHALT BINDER MATERIAL

Heat the asphalt binder material while avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. Maintain the temperature of unmodified asphalts to no more than 325 degrees F when added to the aggregates. The temperature of modified asphalts is not to exceed 350 degrees F.

3.3 PREPARATION OF MINERAL AGGREGATE

Heat and dry the aggregate for the mixture prior to mixing. No damage to the aggregates due to the maximum temperature and rate of heating used is allowed. Maintain the temperature no lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.4 PREPARATION OF ASPHALT MIXTURE

Weigh or meter the aggregates and the asphalt binder and introduce into the mixer in the amount specified by the JMF. Limit the temperature of the asphalt mixture to 350 degrees F 270 degrees F when the asphalt binder is added. Mix the combined materials until the aggregate obtains a thorough and uniform coating of asphalt binder (testing in accordance with ASTM D2489/D2489M may be required by the Contracting Officer) and is thoroughly distributed throughout the mixture. The moisture content of all asphalt mixture upon discharge from the plant is not to exceed 0.5 percent by total weight of mixture as measured by AASHTO T 329.

3.5 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing asphalt pavement, clean the underlying course of dust and debris. Apply a prime coat or tack coat in accordance with Section 32 12 13 BITUMINOUS TACK AND PRIME COATS.

3.6 TEST SECTION

Prior to full production, place a test section for each JMF used. Construct a test section 500 feet long and two paver passes wide with a longitudinal cold joint. Do not place the second lane of test section until the temperature of pavement edge is less than 175 degrees F. Construct the test section with the same depth as the course which it represents. Ensure the underlying grade or pavement structure upon which

the test section is to be constructed is the same or very similar to the underlying layer for the project. Use the same equipment in construction of the test section as on the remainder of the course represented by the test section. Construct the test section as part of the project pavement as approved by the Government.

3.6.1 Sampling and Testing for Test Section

Obtain one representative sample from random trucks at the plant, compact triplicate specimens, and test for stability, flow, and laboratory air voids. Test a portion of the same sample for theoretical maximum density (TMD), aggregate gradation and asphalt content. Test an additional portion of the sample to determine the TSR. Adjust the compactive effort as required to provide TSR specimens with an air void content of 7 plus or minus 1 percent. Obtain four randomly selected cores from the finished pavement mat, and four from the longitudinal joint, and test for density. Perform random sampling in accordance with procedures contained in ASTM D3665. Construction may continue provided the test results are within the tolerances or exceed the minimum values shown in Table 11. If all test results meet the specified requirements, the test section may remain as part of the project pavement. If test results exceed the tolerances shown, remove and replace the test section and construct another test section at no additional cost to the Government.

Table 11

Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	
No. 4 and larger	JMF plus or minus 8
No. 8, No. 16, No. 30, and No. 50	JMF plus or minus 6
No. 100 and No. 200	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	See Table 9
Tensile Strength Ratio (TSR) (At 7 percent plus/minus 1 percent air void content)	75 percent minimum
Conditioned Strength	60 psi minimum
Mat Density, Percent of TMD (Average of 4 Random Cores)	92.0 - 96.0

Table 11	
Test Section Requirements for Material and Mixture Properties	
Property	Specification Limit
Joint Density, Percent of TMD (Average of 4 Random Cores)	90.5 minimum

Table 11 cont'd	
Test Section Requirements for Material and Mixture Properties Marshall Compaction	
Stability, (Average of 3 specimens)	1350 pounds minimum for 50-blow
Flow, 0.01 inch (Average of 3 specimens)	8 - 18 for 50-blow

3.6.2 Additional Test Sections

If the initial test section proves to be unacceptable, make the necessary adjustments to the JMF, plant operation, placing procedures, and rolling procedures before beginning construction of a second test section. Construct and evaluate additional test sections, as required, for conformance to the specifications. Full production paving is not allowed to begin until an acceptable test section has been constructed and accepted.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

Transport asphalt mixture from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Provide adequate artificial lighting for night placements. Hauling over freshly placed material is not permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F.

3.7.2 Placing

Place the mix in lifts of adequate thickness and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Place the mixture to the full width by an asphalt paver; strike off in a uniform layer of such depth that, when the work is complete, the required thickness conforms to the grade and contour indicated. Do not broadcast waste mixture onto the mat or recycle it into the paver hopper. Collect waste mixture and dispose off site. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Begin placement of the mixture along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width of 10 feet. Offset the longitudinal joint in one course from the longitudinal joint in the course immediately below by at least 1 foot; however, locate the joint

in the surface course at the centerline of the pavement. Offset transverse joints in one course by at least 10 feet from transverse joints in the previous course. Offset transverse joints in adjacent lanes a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools. Construct the free edge of shoulder pavements following a guide (e.g. plumb-bob, stringline, etc.) to prevent various widths of the asphalt shoulder. Contractor may elect to cut-back the asphalt edge to maintain consistent shoulder dimensions shown on the plans.

3.8 COMPACTION OF MIXTURE

3.8.1 General

a. After placing, thoroughly and uniformly compact the mixture by rolling. Compact the surface as soon as possible without causing displacement, cracking or shoving. Determine the sequence of rolling operations and the type of rollers used, except as specified in paragraph ASPHALT PAVEMENT-PORTLAND CEMENT CONCRETE JOINTS. Maintain the speed of the roller, at all times, sufficiently slow to avoid displacement of the asphalt mixture and be effective in compaction. Correct at once any displacement occurring as a result of reversing the direction of the roller, or from any other cause.

b. Furnish sufficient rollers to handle the output of the plant. Continue rolling until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, keep the drums properly moistened, but excessive water is not permitted. In areas not accessible to the roller, thoroughly compact the mixture with hand tampers. Remove the full depth of any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective, replace with fresh asphalt mixture and immediately compact to conform to the surrounding area. Perform this work at no expense to the Government. Skin patching is not allowed.

3.8.2 Segregation

The Government can sample and test any material that looks deficient. When the in-place material appears to be segregated, the Government has the option to sample the material and have it tested and compared to the aggregate gradation, asphalt content, and in-place density requirements in Table 11. If the material fails to meet these specification requirements, remove and replace the extent of the segregated material the full depth of the layer of asphalt mixture at no additional cost to the Government. When segregation occurs in the mat, take appropriate action to correct the process so that additional segregation does not occur.

3.9 JOINTS

Construct joints to ensure a continuous bond between the courses and to obtain the required density. Provide all joints with the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

Do not pass the roller over the unprotected end of the freshly laid

mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, construct by means of placing a bulkhead or by tapering the course. Utilize a dry saw cut on the transverse joint full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. Neither cutting equipment that uses water as a cooling or cutting agent nor milling equipment is permitted. Remove the cutback material and cutting debris from the project. Provide a tack coat in accordance with Section 32 12 13 BITUMINOUS TACK AND PRIME COATS to all contact surfaces before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Cut back longitudinal joints which are irregular, damaged, uncompacted, cold (less than 175 degrees F at the time of placing the adjacent lane), or otherwise defective, a minimum of 3 inches and a maximum of 6 inches from the top edge of the lift with a cutting wheel to expose a clean, sound, near vertical surface for the full depth of the course. Remove all cutback material from the project. Neither cutting equipment that uses water as a cooling or cutting agent nor milling equipment is permitted. Remove the cutback material and cutting debris from the project. Provide tack coat in accordance with Section 32 12 13 BITUMINOUS TACK AND PRIME COATS to all contact surfaces prior to placing any fresh mixture against the joint.

3.9.3 Asphalt Pavement-Portland Cement Concrete Joints

Joints between asphalt pavement and Portland Cement Concrete (PCC) require specific construction procedures for the asphalt pavement. The following criteria are applicable to the first 10 feet or paver width of asphalt pavement adjacent to the PCC.

a. For all lifts, place the asphalt pavement side of the joint in a direction parallel to the joint.

b. For non-surface lifts (e.g. base or intermediate lifts), compact the mixture per paragraph MAT AND JOINT DENSITIES.

b. For the surface lift place the asphalt pavement side sufficiently high so that when fully compacted the asphalt pavement is greater than 1/8 inch but less than 1/4 inch higher than the PCC side of the joint.

c. For the surface lift, compact with steel wheel rollers and at least one rubber tire roller. Compact with a rubber tire roller that weights at least 20 tons with tires inflated to at least 90 psi. Avoid spalling the PCC during placement and compaction of the asphalt pavement. Operate steel wheel rollers in a way that prevents spalling the PCC. Repair any damage to PCC edges or joints as directed by the Government. If damage to the PCC joint or panel edge exceeds a total of 3 feet, remove and replace the PCC panel at no additional expense to the Government.

d. For the surface lift, after compaction is finished, diamond grind a minimum width of 3 feet of the asphalt pavement so that the asphalt pavement side is less than 1/8 inch higher than the PCC side. Perform diamond grinding in accordance with subparagraph DIAMOND GRINDING above. The asphalt pavement immediately adjacent to the joint is not allowed to be lower than the PCC after the grinding operation. Transition the grinding into the asphalt pavement in a way that ensures good smoothness and provides drainage of water. The joint and

adjacent materials when completed is required to meet all of the requirements for grade and smoothness. Measure smoothness across the asphalt pavement-PCC joint using a 12 feet straightedge. The acceptable tolerance is 1/8 inch.

e. For all lifts, consider the asphalt pavement next to the PCC as a separate weighted pay factor associated with the lot being placed for evaluation. Lots are based on individual lifts. Do not commingle cores from different lifts for density evaluation purposes. Take four cores for each lot of material placed adjacent to the asphalt pavement-PCC joint. The size of lot is 10 feet wide by the length of the joint being paved. Perform the same computation as displayed in paragraph PAY FACTOR BASED ON IN-PLACE DENSITY above to determine the weighted pay factor. Select the lowest computed pay factor for the lot. Locate the center of each of the four cores 6 inches from the edge of the concrete. Take each core at a random location along the length of the joint. The requirements for joint density, adjacent to the PCC joint, are the same as that for the mat density specified in Table 1. For asphalt pavement-PCC joints at taxiways abutting runways, aprons, or other taxiways, take two additional randomly located cores along each taxiway intersection.

f. All procedures, including repair of damaged PCC, are required to be in accordance with the approved Quality Control Plan.

-- End of Section --

SECTION 32 12 16.16

ROAD-MIX ASPHALT PAVING
11/20

PART 1 GENERAL

1.1 PERCENT PAYMENT

1.1.1 Method of Measurement

Measurement of the quantity of hot-mix warm-mix asphalt pavement, per ton placed and accepted, will be made for the purposes of assessing the pay factors stipulated below.

1.1.2 Basis of Payment

The measured quantity of hot-mixed warm-mixed asphalt pavement will be paid for and included in the lump sum contract price. If less than 100 percent payment is due based on the pay factors stipulated in paragraph PERCENT PAYMENT, a unit price of $915.00 per ton will be used for purposes of calculating the payment reduction.

1.1.3 Lot Pay Factor

The lot pay factor is determined by taking the lowest computed pay factor based on either laboratory air voids, in-place density, smoothness, or grade (each discussed below). Remove and replace lots when the lowest computed pay factor requires rejection. At the end of the project calculate the average pay factor for all lots. If this average lot pay factor exceeds 95.0 percent and no individual lot has a pay factor less than 75.0 percent, then the percent payment for the entire project will be 100 percent of the unit bid price. If the average lot pay factor is less than 95.0 percent, then each lot will be paid for at the unit price multiplied by the lot's pay factor. For any lots which are less than 2,000 tons, a weighted lot pay factor will be used to calculate the average lot pay factor. When work on a lot is required to be terminated before all four sublots are completed, the results from the completed sublots will be analyzed to determine the percent payment for the lot following the same procedures and requirements for full lots but with fewer or more test results as determined in paragraph PAVEMENT LOTS.

1.1.4 Payment Adjustment for Laboratory Air Voids

Laboratory air void calculations for each lot will use the average theoretical maximum density values obtained for the lot. Determine the average TMD in accordance with paragraph THEORETICAL MAXIMUM DENSITY (TMD). The mean absolute deviation of the laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated as shown in the example below and a pay factor will be determined from Table 1. When 0 percent payment is determined, remove and replace the rejected lot at least 4 inches into the cold (existing) lane adjacent to the longitudinal joint.

Table 1. Pay Factor Based on Laboratory Air Voids	
Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, percent
0.60 or less	100
0.61 - 0.80	98
0.81 - 1.00	95
1.01 - 1.20	90
Above 1.20	reject (0)

1.1.4.1 Pay Factor Example for Laboratory Air Voids

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 sublots where one set of laboratory compacted specimens is from a single sublot. The laboratory air voids for the 4 sublots are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

Mean Absolute Deviation = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|)/4

Mean Absolute Deviation = (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 1 that the lot's pay factor based on laboratory air voids is 100 percent.

1.1.5 Payment Adjustment for In-place Densities

The average in-place mat and joint densities are expressed as a percentage of the average theoretical maximum density (TMD) for the lot. Determine the average TMD in accordance with paragraph THEORETICAL MAXIMUM DENSITY (TMD). The average in-place mat density and joint density for a lot are determined and compared with Table 2 to calculate a single pay factor per lot. Use the following process to determine the single pay factor for in-place density:

a. Step 1: Determine the pay factors for mat density and joint density using Table 2.

b. Step 2: Determine ratio of joint area to mat area. The area associated with the joint is considered to be 10 feet wide times the length of completed longitudinal construction joint in the lot. This joint area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of asphalt pavement, either an adjacent freshly paved lane or one paved at any time previously.

c. Step 3: Compute the weighted pay factor for the joint using the formula in the example below.

d. Step 4: Compare weighted pay factor for joint density to pay factor

for mat density and select the smaller. This selected pay factor is the pay factor based on density for the lot.

When 0 percent payment is determined for mat density, remove and replace the rejected lot at least 4 inches into the cold (existing) lane adjacent to the longitudinal joint. When 0 percent payment is determined for joint density, remove and replace the rejected longitudinal joint with a 10 feet wide paving lane that is centered over the joint.

Table 2. Pay Factor Based on In-place Density

Average Mat Density (4 Cores) (Percent of TMD)	Pay Factor, Percent	Average Joint Density (4 Cores) (Percent of TMD)
93.0 - 96.0	100.0	91.5 or above
92.9	100.0	91.4
92.8 or 96.1	99.9	91.3
92.7	99.8	91.2
92.6 or 96.2	99.6	91.1
92.5	99.4	91.0
92.4 or 96.3	99.1	90.9
92.3	98.7	90.8
92.2 or 96.4	98.3	90.7
92.1	97.8	90.6
92.0 or 96.5	97.3	90.5
91.9	96.3	90.4
91.8 or 96.6	94.1	90.3
91.7	92.2	90.2
91.6 or 96.7	90.3	90.1
91.5	87.9	90.0
91.4 or 96.8	85.7	89.9
91.3	83.3	89.8
91.2 or 96.9	80.6	89.7
91.1	78.0	89.6
91.0 or 97.0	75.0	89.5
below 91.0, above 97.0	0.0 (reject)	below 89.5

1.1.5.1 Pay Factor Example for In-place Density

An example of the computation of a pay factor (in I-P units only) based on in-place density, is as follows: Assume the following test results for field density made on the lot: (1) Average mat density = 92.2 percent (of lab TMD). (2) Average joint density = 90.5 percent (of lab TMD). (3) Total area of lot = 30,000 square feet. (4) Length of completed longitudinal construction joint = 2,000 feet.

a. Step 1: Determine pay factor based on mat density and on joint density, using Table 2:

Mat density of 92.2 percent = 98.3 pay factor.

Joint density of 90.5 percent = 97.3 pay factor.

b. Step 2: Determine ratio of joint area to mat area. Multiply the length of completed longitudinal construction joint by the specified 10 foot width and divide by the mat area (total paved area in the lot).

Ratio = Ratio of joint area to mat area

Ratio = (2,000 feet x 10 feet)/30,000 square feet

Ratio = 0.6667

c. Step 3: Weighted pay factor (wpf) for joint is determined as indicated below:

wpf = joint pay factor + (100 - joint pay factor) x (1 - ratio)

wpf = 97.3 + (100-97.3) x (1-0.6667) = 98.2 percent

d. Step 4: Compare weighted pay factor for joint density to pay factor for mat density and select the smaller:

Pay factor for mat density: 98.3 percent.

Weighted pay factor for joint density: 98.2 percent

Selected pay factor: 98.2 percent

1.1.6 Payment Adjustment for Smoothness (Final Wearing Surface Only)

Profilograph Testing. Record the location and data from all profilograph measurements. When the Profile Index of a lot exceeds the tolerance specified in paragraph SMOOTHNESS REQUIREMENTS by 1.0 inch per mile, but less than 2.0 inches per mile, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness will be 95 percent. When the Profile Index exceeds the tolerance by 2.0 inches per mile, but less than 3.0 inches per mile, the computed pay factor will be 90 percent. When the Profile Index exceeds the tolerance by 3.0 inches per mile, but less than 4.0 inches per mile, the computed pay factor will be 75 percent. Remove and replace the lot when the Profile Index exceeds the tolerance by 4.0 inches per mile or more, at no additional cost to the Government. Regardless of the above, correct any small individual area with surface deviation which exceeds the tolerance given above by more than 5.0 inches per mile or more, by grinding to meet the specification requirements above or remove and replace at no additional cost to the Government.

1.1.7 Payment Adjustment for Plan Grade

When more than 5 percent of all measurements made within a lot are outside the 0.05 foot tolerance, the pay factor based on grade for that lot will be 95 percent. For individual locations where the grade exceeds 0.075 foot tolerance, remove the surface lift full depth and replace the lift with asphalt pavement to meet specification requirements at no additional cost to the Government. High spots can be diamond ground as an alternative to remove and replace in order to meet grade requirements for the lot and at

individual locations.

1.2 PAYMENT

1.2.1 Method of Measurement

Measurement of the quantity of hot-mix warm-mix asphalt pavement per lot will be made for the purposes of assessing acceptance stipulated in paragraph ACCEPTANCE.

1.2.2 Basis of Payment

The measured quantity of hot-mixed warm-mixed asphalt pavement will be paid for and included in the lump sum contract price.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 156	(2013; R 2017) Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
AASHTO T 304	(2011; R 2015) Standard Method of Test for Uncompacted Void Content of Fine Aggregate
AASHTO T 329	(2015) Standard Test Method for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method

ASPHALT INSTITUTE (AI)

AI MS-2	(2015) Asphalt Mix Design Methods

ASTM INTERNATIONAL (ASTM)

ASTM C29/C29M	(2023) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2022) Standard Test Method for Density,

	Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017; R 2023) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D242/D242M	(2009; R 2014) Mineral Filler for Bituminous Paving Mixtures
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures
ASTM D2041/D2041M	(2011) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2172/D2172M	(2017; E 2018) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2419	(2014) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2726/D2726M	(2019) Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D3203/D3203M	(2017) Standard Test Method for Percent Air Voids in Compacted Asphalt Mixtures
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867/D4867M	(2009; R 2014) Effect of Moisture on Asphalt Concrete Paving Mixtures

ASTM D5361/D5361M	(2016) Standard Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
ASTM D5444	(2015) Mechanical Size Analysis of Extracted Aggregate
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6307	(2019) Standard Test Method for Asphalt Content of Asphalt Mixture by Ignition Method
ASTM D6373	(2023) Standard Specification for Performance Graded Asphalt Binder
ASTM D6926	(2020) Standard Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus
ASTM D6927	(2015) Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures
ASTM E1274	(2018); R 2024 Standard Test Method for Measuring Pavement Roughness Using a Profilograph

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Placement Plan; G

SD-03 Product Data

Diamond Grinding Plan; G

Mix Design; G

Contractor Quality Control; G

SD-04 Samples

Aggregates

Asphalt Cement Binder

Warm-mix Additive

SD-06 Test Reports

Aggregates; G

QC Monitoring

SD-07 Certificates

Asphalt Cement Binder; G

Laboratory Accreditation and Validation

Warm-mix Additive

1.5 ACCEPTANCE

1.5.1 Acceptability of Work

Acquire the services of an independent commercial laboratory to perform acceptance testing. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. The materials and the pavement itself will be accepted on the basis of production testing. The Government may make check tests from split samples to validate the results of the production testing. Testing performed by the Government does not reduce the required testing of the independent commercial laboratory. Split samples will be taken for Government testing to reduce the variability between the independent commercial laboratory and the Government's test results. When the difference between the independent commercial laboratory and the Government's test results for split samples exceed the acceptable range of two results for multilaboratory precision for the appropriate test method (i.e. ASTM) then at least one of the laboratories is determined to be in error. An evaluation of procedures and equipment in both laboratories will be made to determine the cause(s) for the differences. Develop steps to correct procedures and equipment to bring multilaboratory precision to within acceptable limits.

1.5.2 Acceptance Requirements

Provide all sampling and testing required for acceptance and payment adjustment. Where appropriate, adjustments in percent payment acceptance for individual lots of asphalt pavement will be made based on laboratory air voids, in-place density, smoothness, and grade in accordance with the following paragraphs. Surface smoothness and grade determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus smoothness and grade measurements for the entire lot cannot be made.

1.5.3 Pavement Lots

A standard lot for all requirements is equal to one day's production or 2,000 tons, whichever is smaller. Divide each lot into four equal sublots in order to evaluate laboratory air voids and in-place density. When operational conditions cause a lot to be terminated before the specified four sublots have been completed, use the following procedure to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they constitute a lot. Where one or two sublots have been completed, incorporate them into the next lot and the total number of sublots (i.e. 5 or 6 sublots) is used for acceptance criteria. Include partial lots at the end of asphalt production into the previous lot. Complete and report all theoretical maximum density, laboratory air voids,

and in-place density testing within 24 hours after construction of each lot.

1.5.4 Sublot Sampling

Take one mixture sample for each sublot in accordance with ASTM D979/D979M from a random truck or another location for determining theoretical maximum density, laboratory air voids, any additional testing the Government desires, and Contractor Quality Control. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D3665 and employing tables of random numbers or computer programs.

1.5.5 Additional Sampling and Testing

The Government reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be treated as a separate lot. Payment Acceptance will be made for the quantity of asphalt pavement represented by these tests in accordance with the provisions of this section.

1.5.6 Theoretical Maximum Density (TMD)

Measure theoretical maximum density one time for each sublot in accordance with ASTM D2041/D2041M for purposes of calculating laboratory air voids and determining in-place density. The average TMD for each lot will be determined as the average TMD of the random sublot samples. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD values will be used as the TMD needed to calculate the percent joint density.

1.5.7 Laboratory Air Voids

Prepare one set of laboratory compacted specimens for each sublot in accordance with ASTM D6926 using the hand-held hammer for the Marshall Method. Provide three test specimens prepared from the same sample for each set of laboratory compacted specimens. Compact the specimens within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Do not reheat samples prior to compaction. Provide insulated containers as necessary to maintain the sample temperature. Measure the bulk density of laboratory compacted specimens in accordance with ASTM D2726/D2726M. Determine laboratory air voids from one set (three laboratory compacted specimens) for each sublot sample in accordance with ASTM D3203/D3203M.

1.5.7.1 Tolerance

Provide laboratory air voids with a mean absolute deviation of 1.00 percent or less from the JMF for each lot. Remove and replace lots that do not meet the laboratory air voids requirement at least 4 inches into the cold (existing) lane adjacent to the longitudinal joint, at no additional cost to the Government. The mean absolute deviation of the laboratory air void contents from the JMF air void content will be evaluated as shown in the example below.

1.5.7.2 Calculating Laboratory Air Voids

Laboratory air void calculations for each lot will use the average theoretical maximum density values obtained for the lot. Determine the average TMD in accordance with paragraph THEORETICAL MAXIMUM DENSITY (TMD). The mean absolute deviation of the laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated as in the following example:

Assume that the laboratory air voids are determined from 4 sublots where one set of laboratory compacted specimens is from a single sublot. The laboratory air voids for the 4 sublots are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

Mean Absolute Deviation = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|)/4

Mean Absolute Deviation = (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen that 0.45 is less than 1.00 percent. The lot is acceptable for laboratory air voids.

1.5.8 In-place Density

Obtain one random 4 inch or 6 inch diameter core from the mat and joint of each sublot in accordance with ASTM D5361/D5361M for determining in-place density. Cut samples neatly with a diamond core drill bit. Obtain random cores that are the full thickness of the layer being placed. Select core locations randomly using the procedures contained in ASTM D3665. Locate cores for mat density no closer than 12 inches from a transverse or longitudinal joint including the pavement edge. Center all cores for joint density on the joint. Discard samples that are clearly defective as a result of sampling and take an additional random core. When the random core is less than 1 inch thick, it will not be included in the analysis. In this case, obtain another random core sample. Clean and tack coat dry core holes before filling with asphalt mixture. Fill all core holes with asphalt mixture and compact using a standard Marshall hammer to the density specified. Provide all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Measure in-place density in accordance with ASTM D2726/D2726M using each core obtained from the mat and joint.

1.5.8.1 Tolerance

Provide a minimum in-place mat density of 93.0 percent and a minimum in-place joint density of 90.0 percent for each lot. The average in-place mat and joint densities are expressed as a percentage of the average theoretical maximum density (TMD) for the lot. Determine the average TMD in accordance with paragraph THEORETICAL MAXIMUM DENSITY (TMD). Remove and replace lots that do not meet the in-place mat density requirement at least 4 inches into the cold (existing) lane adjacent to the longitudinal joint, at no additional cost to the Government. Remove and replace the longitudinal joint when the lot does not meet the in-place joint density, at no additional cost to the Government. Use a 10 feet wide paving lane that is centered over the joint.

1.5.9 Surface Smoothness

Use a straightedge and profilograph for measuring surface smoothness. Use the profilograph method for all longitudinal testing, except for paving lanes less than 0.25 miles in length. Use the straightedge method for transverse testing, for longitudinal testing where the length of each pavement lane is less than 0.25 miles, and at the ends of the paving limits for the project. Smoothness requirements do not apply over crowns or grade breaks. Maintain detailed notes of the testing results and provide a copy to the Government immediately after each day's testing.

1.5.9.1 Smoothness Requirements

1.5.9.1.1 Straightedge Testing

Provide finished surfaces of the pavements with no abrupt change of 1/4 inch or more when checked with an approved 12 foot straightedge. Remove and replace surface lift lots when the surface smoothness exceeds 3/8 inch, at no additional cost to the Government. High spots can be diamond ground as an alternative to remove and replace in order to meet surface smoothness requirements at individual locations.

1.5.9.1.2 Profilograph Testing

Provide finished surfaces with a Profile Index not greater than 9 inches per mile when tested with an approved California-type profilograph. Remove and replace the lot when the Profile Index exceeds the tolerance by 4.0 inches per mile or more, at no additional cost to the Government. Correct any small individual area with surface deviation which exceeds the tolerance given above by more than 5.0 inches per mile or more by diamond grinding to meet the specification requirements above or remove and replace at no additional cost to the Government.

1.5.9.2 Testing Method

After the final rolling, but not later than 24 hours after placement, test the surface of the pavement in each entire lot in a manner to reveal surface irregularities exceeding the tolerances specified above. If any pavement areas are diamond ground, retest these areas immediately after diamond grinding. The maximum area allowed to be corrected by diamond grinding is 10 percent of the total area of the lot. Test the entire area of the pavement with a profilograph. Check a number of random locations along with any observed suspicious locations primarily at transverse and longitudinal joints with the straightedge.

1.5.9.2.1 Straightedge Testing

Use the straightedge to measure abrupt changes in surface smoothness. Hold the straightedge in contact with the pavement surface and measure the maximum distance between the straightedge and the pavement surface. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

1.5.9.2.2 Profilograph Testing

Perform profilograph testing using an approved California profilograph and

procedures described in ASTM E1274. Provide equipment that utilizes electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. Use a "blanking band" that is 0.2 inch wide and the "bump template" spanning 1 inch with an offset of 0.4 inch. Provide profilograph operated by an approved, factory-trained operator on the alignments specified above. Provide a copy of the reduced tapes to the Government at the end of each day's testing.

1.5.9.2.3 Bumps ("Must Grind" Areas)

Reduce any bumps ("must grind" areas) shown on the profilograph trace which exceed 0.4 inch in height by diamond grinding until they do not exceed 0.3 inch when retested. Taper diamond grinding in all directions to provide smooth transitions to areas not requiring diamond grinding. The following will not be permitted: (1) skin patching for correcting low areas, (2) planing or milling for correcting high areas. Perform additional profilograph testing in all areas corrected by diamond grinding.

1.5.10 Plan Grade

Provide a final wearing surface of pavement conforming to the elevations and cross sections shown and not vary more than 0.05 foot from the plan grade established and approved at site of work. Within 5 working days after completion of a particular lot incorporating the final wearing course, test the final wearing surface of the pavement for conformance with specified plan grade requirements. Match finished surfaces at juncture with other pavements with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. For roads, the grade will be determined by running lines of levels along the centerline at intervals of 25 feet or less longitudinally to determine the elevation of the completed pavement surface. Measure transverse grades at appropriate intervals. For parking lots, the grade will be determined by running lines of levels at intervals of 25 feet or less longitudinally and transversely to determine the elevation of the completed pavement surface. Diamond grinding can be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted. Maintain detailed notes of the results of the testing and provide a copy to the Government immediately after each day's testing.
Remove and replace surface lift lots when individual locations exceed 0.05 foot tolerance, at no additional cost to the Government. High spots can be diamond ground as an alternative to remove and replace in order to meet plan grade requirements at individual locations.

1.5.11 Laboratory Accreditation and Validation

Provide laboratories used to develop the Job Mix Formula (JMF), perform acceptance testing, and Contractor Quality Control testing that meet the requirements of ASTM D3666. Provide laboratories with a masonry saw having a diamond blade for trimming pavement cores and samples. Perform all required test methods by an accredited laboratory. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory accreditation is not allowed. Submit a certificate of compliance signed by the manager of the laboratory stating that it meets these requirements to the Government prior to the start of construction. At a minimum, include the

following certifications:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not place the asphalt mixture upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 3 Table 1. The temperature requirements may be waived by the Government, if requested; however, meet all other requirements including compaction.

Table 3. Table 1. Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40
Less than 3	45

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. Provide asphalt pavement designed and constructed in accordance with this section conforming to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Construct each course to the depth, section, or elevation required by the drawings and rolled, finished, and approved before the placement of the next course. Submit proposed Placement Plan indicating lane widths and longitudinal joints for each course or lift.

2.1.1 Asphalt Mixing Plant

Provide plants used for the preparation of asphalt mixture conforming to the requirements of AASHTO M 156 with the following changes:

2.1.1.1 Truck Scales

Weigh the asphalt mixture on approved scales, or on certified public scales at no additional expense to the Government. Inspect and seal scales at least annually by an approved calibration laboratory.

2.1.1.2 Inspection of Plant

Provide access to the Government at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. Provide assistance as requested, for the Government to procure any desired samples.

2.1.1.3 Storage bins

The asphalt mixture can be stored in non-insulated storage bins for a period of time not exceeding 3 hours. The asphalt mixture can be stored in insulated storage bins for a period of time not exceeding 8 hours. Provide the mix drawn from bins that meets the same requirements as mix loaded directly into trucks.

2.1.2 Hauling Equipment

Provide trucks used for hauling asphalt mixture that have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, lightly coat the truck beds with a minimum amount of paraffin oil, lime solution, or other approved material. Do not use petroleum based products as a release agent. Provide each truck with a suitable cover to protect the mixture from adverse weather, contamination, and loss of material during hauling. When necessary due to long haul distance and cold weather, provide insulated truck beds with covers (tarps) that are securely fastened.

2.1.3 Material Transfer Vehicle (MTV)

Provide Material Transfer Vehicle for placement of the asphalt mixture. Transfer the material from the hauling equipment to the paver using a self-propelled, material transfer vehicle with a swing conveyor that is capable of delivering material to the paver without making contact with the paver. Provide MTV capable to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. Provide Material Transfer Vehicle with remixing and storage capability to prevent physical and thermal segregation.

2.1.4 Asphalt Pavers

Provide mechanical spreading and finishing equipment consisting of a self-powered paver, capable of spreading and finishing the mixture to the specified line, grade, and cross section. Provide paver screed capable of laying a uniform mixture to meet the specified thickness, smoothness, and grade without physical or temperature segregation, the full width of the material being placed. Provide a paver with a vibrating screed to be used during all placement.

2.1.4.1 Receiving Hopper

Provide paver with a receiving hopper of sufficient capacity to permit a uniform spreading operation and a distribution system to place the mixture uniformly in front of the screed without segregation. Provide a screed that effectively produces a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

2.1.4.2 Automatic Grade Controls

Provide a paver equipped with a control system capable of maintaining the specified screed elevation. One of three methods can be used to control grade: stringline, laser, or computerized elevations along with GPS. For multiple layers it is acceptable to control the grade in the underlying layer and control the grade of the surface layer by applying a constant thickness over the underlying layer which has been placed to the desired

grade. Slope control can also be used to control the grade of the surface for roads, but is not acceptable for wide pavements such as parking lots. Provide transverse slope controller capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A ski-type device of not less than 30 ft can be used to provide improved smoothness. Use a shoe on one side of the paver to match an existing paved surface to provide a smooth joint.

2.1.5 Rollers

Provide rollers in good condition and operate at slow speeds to avoid displacement of the asphalt mixture. Provide sufficient number, type, and weight of rollers to compact the mixture to the required density while it is still in a workable condition. Do not use equipment which causes excessive crushing of the aggregate.

2.1.6 Diamond Grinding

Those performing diamond grinding are required to have a minimum of three years experience in diamond grinding. In areas not meeting the specified limits for surface smoothness and plan grade, reduce high areas to attain the required smoothness and grade, except as depth is limited below. Reduce high areas by diamond grinding the asphalt pavement with approved equipment. Perform diamond grinding by sawing with saw blades impregnated with an industrial diamond abrasive. Assemble the saw blades in a cutting head mounted on a machine designed specifically for diamond grinding that produces the required texture and smoothness level without damage to the asphalt pavement or joint faces. Provide diamond grinding equipment with saw blades that are 1/8-inch wide, a minimum of 60 blades per 12 inches of cutting head width, and capable of cutting a path a minimum of 3 feet wide. Diamond grinding equipment that causes raveling, fracturing of aggregate, or disturbance to the underlying material will not be allowed. The maximum area corrected by diamond grinding the surface of the asphalt pavement is 10 percent of the total area of any lot. The maximum depth of diamond grinding is 1/2 inch. Provide diamond grinding machine equipped to flush and vacuum the pavement surface. Dispose of all debris from diamond grinding operations off Government property. Prior to diamond grinding, submit a Diamond Grinding Plan for review and approval. At a minimum, include the daily reports for the deficient areas, the location and extent of deficiencies, corrective actions, and equipment. Remove and replace all pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified.

Prior to production diamond grinding operations, perform a test section at the approved location, consisting of a minimum of two adjacent passes with a minimum length of 40 feet to allow evaluation of the finish and transition between adjacent passes. Production diamond grinding operations cannot be performed prior to approval.

2.2 AGGREGATES

Notify the Government at least 7 days before sampling aggregates. Obtain samples in accordance with ASTM D75/D75M that are representative of the materials to be used for the project. Provide aggregates consisting of crushed stone, crushed gravel, crushed slag, screenings, natural sand, and mineral filler as required. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. Submit sufficient

materials to produce 200 pounds of blended mixture for mix design verification. Submit all aggregate test results and samples to the Government at least 14 days prior to start of construction. Perform job aggregate testing no earlier than 6 months before contract award.

2.2.1 Coarse Aggregate

Provide coarse aggregate consisting of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. Provide coarse aggregate particles meeting the following requirements:

a. The percentage of loss not greater than 40 percent after 500 revolutions when tested in accordance with ASTM C131/C131M.

b. The sodium sulfate soundness loss not exceeding 12 percent, or the magnesium sulfate soundness loss not exceeding 18 percent after five cycles when tested in accordance with ASTM C88.

c. At least 75 percent by weight of coarse aggregate containing two or more fractured faces when tested in accordance with ASTM D5821 with fractured faces produced by crushing.

d. The particle shape essentially cubical and the aggregate containing not more than 10 percent, by weight, of flat and elongated particles (5:1 ratio of length to thickness) when tested in accordance with ASTM D4791, Method B.

e. Slag consisting of air-cooled, blast furnace slag with a compacted weight of not less than 75 lb/cu ft when tested in accordance with ASTM C29/C29M.

f. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.2.2 Fine Aggregate

Provide fine aggregate consisting of clean, sound, tough, durable particles. Provide aggregate particles that are free from coatings of clay, silt, or any objectionable material, contain no clay balls, and meet the following requirements:

a. Quantity of natural sand (noncrushed material) added to the aggregate blend not exceeding 15 percent by weight of total aggregate.

b. Individual fine aggregate sources with a sand equivalent value greater than 45 when tested in accordance with ASTM D2419.

c. Fine aggregate portion of the blended aggregate with an uncompacted void content greater than 45.0 percent when tested in accordance with AASHTO T 304 Method A.

d. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.2.3 Mineral Filler

Provide mineral filler consisting of a nonplastic material meeting the

requirements of ASTM D242/D242M.

2.2.4 Aggregate Gradation

Provide a combined aggregate gradation that conforms to gradations specified in Table 4 Table 2, when tested in accordance with ASTM C136/C136M and ASTM C117, and does not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grades uniformly from coarse to fine. Provide a JMF within the specification limits; however, the gradation can exceed the limits when the allowable deviation from the JMF shown in Tables 6 and 7 Tables 4 and 5 are applied.

Table 4. Table 2. Aggregate Gradations

Sieve Size, inch	Gradation 2 Percent Passing by Mass
1	---
3/4	100
1/2	90-100
3/8	69-89
No. 4	53-73
No. 8	38-60
No. 16	26-48
No. 30	18-38
No. 50	11-27
No. 100	6-18
No. 200	3-6

2.3 ASPHALT CEMENT BINDER

Provide asphalt cement binder that conforms to ASTM D6373 Performance Grade (PG) 70-10. Provide test data indicating grade certification by the supplier at the time of delivery of each load to the mix plant. When warm-mix asphalt technology involves additives, grade the asphalt binder with the asphalt binder additive included. Submit copies of these certifications to the Government. The supplier is defined as the last source of any modification to the binder. The Government may sample and test the binder at the mix plant at any time before or during mix production.

2.4 MIX DESIGN

The mix design must be designed to meet the specs before it is processed through the plant. The baghouse must not be used to remove fines to meet specified gradations. The baghouses are intended to keep the plant from generating a large cloud of dust when under production, not to modify the gradation. Develop the mix design. Perform Job Mix formula (JMF) and aggregates testing no earlier than 6 months before contract award. Provide asphalt mixture composed of well-graded aggregate, mineral filler if required, and asphalt material. Provide aggregate fractions sized, handled in separate size groups, and combined in such proportions that the

resulting mixture meets the grading requirements of Table 4 Table 2. Do not produce asphalt pavement for payment acceptance until a JMF has been approved. Design the asphalt mixture using 50 blows with the Marshall hand-held hammer procedures contained in AI MS-2 and the criteria shown in Table 5 Table 3. Use laboratory compaction temperatures for Polymer Modified Asphalts as recommended by the asphalt binder manufacturer. Determine the Tensile Strength Ratio (TSR) of the composite mixture in accordance with ASTM D4867/D4867M. Compact the TSR specimens to an air void content of 7 percent plus or minus 1 percent. If the Tensile Strength Ratio (TSR) of the composite mixture is less than 75, reject the aggregates or treat the asphalt mixture with an anti-stripping agent. Add a sufficient amount of anti-stripping agent to produce a TSR of not less than 75. If an antistrip agent is required, provide it at no additional cost to the Government. Provide sufficient materials to produce 200 pound of blended mixture to the Government for verification of mix design at least 14 days prior to construction of test section.

2.4.1 JMF Requirements

Submit the proposed JMF in writing, for approval, at least 14 days prior to the start of the test section including, as a minimum:

a. Percent passing each sieve size.

b. Percent of asphalt cement.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt performance grade.

e. Number of blows of hammer per side of molded specimen.

f. Laboratory mixing temperature.

g. Laboratory compaction temperature.

h. Temperature-viscosity relationship of the asphalt cement

i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

j. Graphical plots and summary tabulation of Marshall stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2. Include summary tabulation that includes individual specimen data for each specimen tested.

k. Specific gravity and absorption of each aggregate.

l. Percent natural sand.

m. Percent particles with two or more fractured faces (in coarse aggregate).

n. Fine aggregate angularity.

o. Percent flat or elongated particles in coarse aggregate.

p. Tensile Strength Ratio and wet/dry specimen test results.

q. Antistrip agent (if required).

r. List of all modifiers.

s. Warm-mix additive or process.

Table 5. Table 3. Mix Design Criteria	
Test Property	Marshall (50 Blows)
Stability, pounds, minimum (NA for Superpave)	1000(1)
Flow, 0.01 inch, (NA for Superpave)	8-18
Air voids, percent	3-5
Minimum Percent Voids in Mineral Aggregate (VMA)(2)	
Gradation 1	13.0
Gradation 2	14.0
Gradation 3	15.0
TSR, minimum percent	75
(1) This is a minimum requirement. Provide significantly higher average during construction to ensure compliance with the specifications.	
(2) Calculate VMA in accordance with AI MS-2, based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate.	

2.4.2 Adjustments to JMF

The JMF for each mixture is in effect until a new formula is approved in writing by the Government. Should a change in sources of any materials be made, perform a new mix design and a new JMF approved before the new material is used. Make minor adjustments within the specification limits to the JMF to optimize mix volumetric properties. Adjustments to the original JMF are limited to plus or minus 4 percent on the No. 4 and coarser sieves; plus or minus 3 percent on the No. 8 to No. 50 sieves; and plus or minus 1 percent on the No. 100 sieve and No. 200 sieve. Asphalt content adjustments are limited to plus or minus 0.40 from the original JMF. If adjustments are needed that exceed these limits, develop a new mix design.

PART 3 EXECUTION

3.1 CONTRACTOR QUALITY CONTROL

3.1.1 General Quality Control Requirements

Submit the Quality Control Plan. Do not produce hot-mix warm-mix asphalt for payment acceptance until the quality control plan has been approved. In the quality control plan, address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design and unique JMF identification code

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management and procedures to prevent contamination

e. Mixing and Transportation

f. Mixture Volumetrics

g. Moisture Content of Mixtures

h. Placing and Compaction

i. Joints

j. Surface Smoothness

k. Truck bed release agent

m. Correlation of mechanical hammer to hand hammer. Determine the number of blows of the mechanical hammer required to provide the same density of the JMF as provided by the hand hammer. Use the average of three specimens per trial blow application.

3.1.2 Testing Laboratory

Provide a fully equipped asphalt laboratory located at the plant or job site that is equipped with heating and air conditioning units to maintain a temperature of 75 plus or minus 5 degrees F. Provide laboratory facilities that are kept clean and all equipment maintained in proper working condition. Provide the Government with unrestricted access to inspect the laboratory facility, to witness quality control activities, and to perform any check testing desired. The Government will advise in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, immediately suspend the incorporation of the materials into the work. Incorporation of the materials into the work will not be permitted to resume until the deficiencies are corrected.

3.1.3 Quality Control Testing

Perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. Use the independent commercial laboratory for acceptance testing in paragraph ACCEPTANCE. Use

in-house capabilities or the independent commercial laboratory for quality control testing. Required elements of the testing program include, but are not limited to tests for the control of asphalt content, aggregate gradation, aggregate moisture, moisture in the asphalt mixture, temperatures, VMA, Marshall stability, flow, and in-place density. Develop a Quality Control Testing Plan as part of the Quality Control Program.

3.1.3.1 Asphalt Content

Determine asphalt content a minimum of twice per lot (a lot is defined in paragraph PAVEMENT LOTS) using the ignition method in accordance with ASTM D6307. Use the extraction method in accordance with ASTM D2172/D2172M if the correction factor for the ignition method in ASTM D6307 is greater than 1.0. The asphalt content for the lot will be determined by averaging the test results.

3.1.3.2 Aggregate Properties

Determine aggregate gradations a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444, ASTM C136/C136M, and ASTM C117. Determine the specific gravity of each aggregate size grouping for each 20,000 tons in accordance with ASTM C127 or ASTM C128. Determine fractured faces for gravel sources for each 20,000 tons in accordance with ASTM D5821. Determine the uncompacted void content of natural sand, manufactured sand, and blended aggregate for each 20,000 tons in accordance with AASHTO T 304 Method A.

3.1.3.3 Moisture Content of Aggregate

Determine the moisture content of aggregate used for production a minimum of once per lot in accordance with ASTM C566.

3.1.3.4 Moisture Content of Asphalt Mixture

Determine the moisture content of the asphalt mixture at least once per lot in accordance with AASHTO T 329.

3.1.3.5 Temperatures

Check temperatures at least four times per lot, at necessary locations to determine the temperature at the dryer, the asphalt cement binder in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.1.3.6 VMA, Marshall Stability, and Flow

Obtain mixture samples at least four times per lot. Calculate the VMA of each specimen in accordance with AI MS-2 based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate, as well as the Marshall stability and flow, as described in ASTM D6927. Provide VMA within the limits of Table 5 Table 3.

3.1.3.7 In-Place Density

Conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge or other non-destructive testing device can be used to monitor pavement density.

3.1.3.8 Additional Testing

Perform any additional testing deemed necessary to control the process.

3.1.3.9 QC Monitoring

Submit all QC test results to the Government on a daily basis as the tests are performed. The Government reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.1.4 Sampling

When directed by the Government, sample and test any material which appears to not meet specification requirements unless such material is voluntarily removed and replaced or deficiencies corrected. Perform all sampling in accordance with standard procedures specified.

3.1.5 Control Charts

For process control, establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 6 Table 4, as a minimum. Post the control charts as directed by the Government and maintain current at all times. Identify the following on the control charts: the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 6 Table 4 applicable to the test parameter being plotted, and the test results. Also show target values (JMF) on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, halt production until the problem is solved. When the Suspension Limit is exceeded for individual values or running average values, the Government has the option to require removal and replacement of the material represented by the samples or to leave in place and base acceptance on mixture volumetric properties and in place density. Use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Make decisions concerning mix modifications based on analysis of the results provided in the control charts. In the Quality Control Plan, indicate the appropriate action to be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 6. Table 4. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
No. 4 sieve, Cumulative percent passing, deviation for JMF target; plus or minus values	6	8	4	5

Table 6. Table 4. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
No. 30 sieve, Cumulative percent passing, deviation for JMF target; plus or minus values	4	6	3	4
No. 200 sieve, Cumulative percent passing, deviation for JMF target; plus or minus values	1.4	2.0	1.1	1.5
Asphalt content, percent deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Stability, pounds (minimum) (NA for Superpave)				
50 Blow JMF	1000	900	1100	1000
Flow, 0.01 inch (NA for Superpave)				
50 Blow JMF	8 min.	7 min.	9 min.	8 min.
	18 max.	19 max.	17 max.	18 max.
Laboratory Air Voids, percent deviation from JMF target value	No specific action and suspension limits set since this parameter is used for acceptance			
In-place Mat Density, percent of TMD	No specific action and suspension limits set since this parameter is used for acceptance			
In-place Joint Density, percent of TMD	No specific action and suspension limits set since this parameter is used for acceptance			
VMA				
Gradation 2	14.5	14.0	14.3	14.0

3.2 PREPARATION OF ASPHALT BINDER MATERIAL

Heat the asphalt cement material while avoiding local overheating. Provide a continuous supply of the asphalt material to the mixer at a uniform temperature. Maintain the temperature of the asphalt delivered to the mixer to provide a suitable viscosity for adequate coating of the aggregate particles. For hot-mix, do not heat unmodified asphalt to a temperature exceeding 325 degrees F when added to the aggregate. Do not heat modified asphalt to a temperature exceeding 350 degrees F when added to the aggregate. For warm-mix, do not heat asphalt binder to a temperature exceeding 270 degrees F when added to the aggregate.

3.3 PREPARATION OF MINERAL AGGREGATE

Heat and dry the aggregate prior to mixing. Provide a rate of heating and a maximum temperature that does not damage the aggregates. Do not heat the aggregate to a temperature exceeding 350 degrees F when the asphalt binder is added. Maintain the temperature no lower than is required to

obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.4 PREPARATION OF ASPHALT MIXTURE

Weigh or meter the aggregates and the asphalt cement and introduce into the mixer the amount specified by the JMF. Mix the combined materials until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. The moisture content of all asphalt mixture upon discharge from the plant is not to exceed 0.5 percent by total weight of mixture as measured by AASHTO T 329.

3.5 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the asphalt mixture, clean the underlying course of dust and debris. Apply a prime coat or tack coat in accordance with Section 32 12 13 BITUMINOUS TACK AND PRIME COATS.

3.6 TEST SECTION

Prior to full production, place a test section for each JMF used. Construct a test section 250 to 500 feet long and two paver passes wide with a longitudinal cold joint. Do not place the second lane of test section until the temperature of pavement edge is less than 175 degrees F. Construct the test section with the same depth as the course which it represents. Ensure the underlying grade or pavement structure upon which the test section is to be constructed is the same or very similar to underlying layer for the project. Use the same equipment and procedures in construction of the test section as on the remainder of the course represented by the test section. Construct the test section as part of the project pavement, as approved by the Government.

3.6.1 Sampling and Testing for Test Section

Obtain one sample at the plant from a random truck. Compact three specimens and test for laboratory air voids as well as the Marshall stability and flow. Test a portion of the same sample for theoretical maximum density (TMD), aggregate gradation, asphalt content, and TSR. Adjust the compactive effort as required to provide TSR specimens with an air void content of 7 plus or minus 1 percent. Obtain four randomly selected cores from each finished pavement mat (eight total), four from the longitudinal joint, and test for density. Perform random sampling in accordance with procedures contained in ASTM D3665. Construction may continue provided the test results are within the tolerances or exceed the minimum values shown in Table 7 Table 5. If all test results meet the specified requirements, the test section may remain as part of the project pavement. If test results exceed the tolerances shown, remove and replace the test section and construct another test section at no additional cost to the Government.

Table 7. Table 5. Test Section Requirements for Material and Mixture Properties	
Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	

Table 7. Table 5. Test Section Requirements for Material and Mixture Properties	
Property	Specification Limit
No. 4 and larger	JMF plus or minus 8
No. 8, No. 16, No. 30, and No. 50	JMF plus or minus 6
No. 100 and No. 200	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	See Table 5 Table 3
Tensile Strength Ratio (TSR) (At 7 percent plus/minus 1 percent air void content)	75 percent minimum
Conditioned Strength	60 psi minimum
Mat Density, Percent of TMD (Average of 4 Random Cores)	92.0 - 96.0 93.0 minimum
Joint Density, Percent of TMD (Average of 4 Random Cores)	89.5 minimum 90.0 minimum
Stability, pounds (Average of 3 specimens) (for Marshall only)	1000 minimum for 50 blows
Flow, 0.01 inch (Average of 3 specimens) (for Marshall only with non-modified asphalt)	8 - 18 for 50 blows

3.6.2 Additional Test Sections

If the initial test section should prove to be unacceptable, make the necessary adjustments to the JMF, plant operation, placing procedures, and rolling procedures before beginning construction of a second test section. Construct and evaluate additional test sections, as required, for conformance to the specifications. Full production paving is not allowed until an acceptable section has been constructed and accepted.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

Transport asphalt mixture from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver.

Provide adequate artificial lighting for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F.

3.7.2 Placing

Place the mix in lifts of adequate thickness and compact at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, place the mixture to the full width by an asphalt paver; strike off in a uniform layer of such depth that, when the work is completed, the required thickness is obtained and the surface conforms to the grade and contour indicated. Do not broadcast waste mixture onto the mat or recycle into the paver hopper. Collect waste mixture and dispose off site. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Begin placement of the mixture along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width of 10 feet. Offset the longitudinal joint in one course from the longitudinal joint in the course immediately below by at least 1 foot; however, locate the joint in the surface course at the centerline of the pavement. Offset transverse joints in one course by at least 10 feet from transverse joints in the previous course. Offset transverse joints in adjacent lanes a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture can be spread and luted by hand tools.

3.8 COMPACTION OF MIXTURE

3.8.1 General

a. After placing, thoroughly and uniformly compact the mixture by rolling. Compact the surface as soon as possible without causing displacement, cracking, or shoving. Determine the sequence of rolling operations and the type of rollers used with the exception that application of more than three passes with a vibratory roller in the vibrating mode is prohibited. Maintain the speed of the roller, at all times, sufficiently slow to avoid displacement of the asphalt mixture and to be effective in compaction. Correct at once any displacement occurring as a result of reversing the direction of the roller, or from any other cause.

b. Furnish sufficient rollers to handle the output of the plant. Continue rolling until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, keep the wheels properly moistened, but excessive water is not permitted. In areas not accessible to the roller, thoroughly compact the mixture with hand tampers or small compactors. Remove the full depth of any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective. Replace with fresh asphalt mixture and immediately compact to conform to the surrounding area. Perform this work at no expense to the Government. Skin patching is not allowed.

3.8.2 Segregation

The Government can sample and test any material that looks deficient. When the in-place material appears to be segregated, the Government has

the option to sample the material and have it tested and compared to the aggregate gradation, asphalt content, and in-place density requirements in Table 7 Table 5. If the material fails to meet these specification requirements, remove and replace the extent of the segregated material the full depth of the layer of asphalt mixture at no additional cost to the Government. When segregation occurs in the mat, take appropriate action to correct the process so that additional segregation does not occur.

3.9 JOINTS

Construct joints to ensure a continuous bond between the courses and to obtain the required density. Provide all joints with the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

Do not pass the roller over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, construct by means of placing a bulkhead or by tapering the course. Utilize a dry saw cut on the transverse joint full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. Remove the cutback material from the project. In both methods, provide a light tack coat of asphalt material to all contact surfaces before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Provide a joint that meets density and smoothness requirements for joints and has uniform texture. Cut back longitudinal joints which are irregular, damaged, uncompacted, cold (less than 175 degrees F at the time of placing adjacent lanes), or otherwise defective, a maximum of 3 inches from the top of the course with a cutting wheel to expose a clean, sound, near vertical surface for the full depth of the course. Remove all cutback material from the project. Provide a light tack coat of asphalt material to all contact surfaces prior to placing any fresh mixture against the joint.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 13 14.13

CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS
11/22, CHG 1: 05/24

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Payments

1.1.1.1 Lump Sum

The quantity of concrete will be paid for and included in the lump-sum contract price. If less than 100 percent payment is due based on the pay factors stipulated below, a unit price of $700.00 per cubic yard will be used for purposes of calculating the payment reduction. Payment will constitute full compensation for all materials, equipment, plant and tools, and for all labor and other incidentals necessary to complete the concrete pavement, except for other items specified herein for separate payment.

1.1.2 Payment of Lots

When a lot of material fails to meet the specification requirements, that lot will be accepted at a reduced price or be removed and replaced. The lowest computed percent payment determined for any pavement characteristic discussed below (for example, thickness, grade, and surface smoothness) becomes the actual percent payment for that lot. The actual percent payment will be applied to the unit price and the measured quantity of concrete in the lot to determine actual payment. Use results of strength tests to control concreting operations. Strength will be evaluated, but will not be considered for payment adjustment. Remove and replace any sublot not meeting the required 'Concrete Strength for Final Acceptance' at no additional cost to the Government.

1.1.3 Payment Adjustment for Smoothness

1.1.3.1 Straightedge Testing

Record location and deviation from straightedge for all measurements. Determine the computed percent payment for straightedge testing by entering Table 1.

TABLE 1

PAYMENT ADJUSTMENT FOR SMOOTHNESS USING STRAIGHTEDGE

Deviation from straightedge for all measurements made within a lot exceed the tolerance specified in paragraph SURFACE SMOOTHNESS by:	Computed Percent Payment
Less than or equal to 5.0 percent	100

TABLE 1	
PAYMENT ADJUSTMENT FOR SMOOTHNESS USING STRAIGHTEDGE	
Deviation from straightedge for all measurements made within a lot exceed the tolerance specified in paragraph SURFACE SMOOTHNESS by:	Computed Percent Payment
More than 5.0 percent but Less than or equal to 10.0 percent, after any reduction of high spots or removal and replacement	95
More than 10.0 percent but Less than or equal to 15.0 percent	90
More than 15.0 percent but Less than or equal to 20.0 percent	75
More than 20.0 percent	Remove and Replace

1.1.4 Payment Adjustment for Plan Grade

Determine the computed percent payment for plan grade by entering TABLE 3.

TABLE 3	
PAYMENT ADJUSTMENT FOR PLAN GRADE	
Percent of all measurements made within a lot that are within the payment adjustment limits specified in paragraph Plan Grade	Computed Percent Payment
Less than or equal to 5.0	100
More than 5.0 but Less than or equal to 10.0	95
More than 10.0 but Less than 20	90
More than 20.0 but Less than 50	75

TABLE 3	
PAYMENT ADJUSTMENT FOR PLAN GRADE	
Percent of all measurements made within a lot that are within the payment adjustment limits specified in paragraph Plan Grade	Computed Percent Payment
50 or more	Remove and Replace

As an example, if 100 measurements are required for the specified lot, and 9 of the required measurements are within the Payment Adjustment limits identified in paragraph Plan Grade, 9 percent would be used to determine the computed percent payment of 95 percent.

1.1.5 Payment Adjustment for Thickness

Using the Average Thickness of the lot, determine the computed percent payment for thickness by entering Table 4.

TABLE 4		
PAYMENT ADJUSTMENT FOR THICKNESS		
Deficiency in Thickness Determined by cores inches	Computed Percent Payment	
	Pavements Equal To or Greater Than 8 inches Thick	Pavements Less Than 8 inches Thick
0.00 to 0.24	100	100
0.25 to 0.49	75	65
0.50 to 0.74	50	Remove and Replace
0.75 or greater	Remove and Replace	Remove and Replace

Where either of the two cores from a sublot show a thickness deficiency of 0.75 inch or greater, drill two more cores in the sublot and compute the average thickness of the four cores. If this average shows a thickness deficiency of 0.75 inch or more remove the entire sublot.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(2005; R 2021) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 214R	(2011) Evaluation of Strength Test Results of Concrete
ACI 305R	(2020) Guide to Hot Weather Concreting
ACI 325.14R	(2017) Guide for Design and Proportioning of Concrete Mixtures for Pavements

ASTM INTERNATIONAL (ASTM)

ASTM A184/A184M	(2024) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615/A615M	(2024) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2024) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1078/A1078M	(2019) Standard Specification for Epoxy-Coated Steel Dowels in Concrete Pavement
ASTM C31/C31M	(2025a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2024a) Standard Specification for Concrete Aggregates
ASTM C78/C78M	(2022) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C94/C94M	(2025) Standard Specification for Ready-Mixed Concrete
ASTM C114	(2024) Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123/C123M	(2023) Standard Test Method for Lightweight Particles in Aggregate
ASTM C125	(2025a) Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C138/C138M	(2024a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142/C142M	(2017; R 2023) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2024) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C174/C174M	(2017) Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C192/C192M	(2024) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2024) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2024) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C294	(2024) Standard Descriptive Nomenclature for Constituents of Concrete Aggregates

ASTM C295/C295M	(2019) Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C494/C494M	(2024) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2024) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2025a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064/C1064M	(2023) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	(2024) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1260	(2023) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1567	(2025) Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2022) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1895	(2020) Standard Test Method for Determination of Mohs Scratch Hardness
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2196	(2010) Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer

ASTM D2995	(2023) Determining Application Rate of Bituminous Distributors
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA QC 3	(2015) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 55	(1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete
COE CRD-C 130	(2001) Standard Recommended Practice for Estimating Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 143	(1962) Specifications for Meters for Automatic Indication of Moisture in Fine Aggregate
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 662	(2009) Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

U.S. DEPARTMENT OF DEFENSE (DOD)

TSPWG M 3-250-04.97-05	(2019) Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Proposed Techniques; G

Preliminary Proposed Proportioning; G

Pavement Quality Control Plan; G

Stringless Technology; G

SD-03 Product Data

Diamond Grinding Plan; G

Dowels; G

Dowel Bar Assemblies; G

Equipment; G

Concrete Patching Mixture; G

SD-05 Design Data

Proportioning Studies; G

SD-06 Test Reports

Batch Plant Manufacturer's Inspection Report; G

Slipform Paver Manufacturer's Inspection Report; G

Sampling and Testing; G

Diamond Grinding of PCC Surfaces; G

Mixer Performance (Uniformity) Testing; G

Repair Recommendations Plan; G

Paving Lot Report; G

Test Section Lot Report; G

SD-07 Certificates

Contractor Quality Control (CQC) Staff; G

Laboratory Accreditation and Validation; G

NRMCA Certificate of Conformance

Petrographer Resume; G

Licensed Surveyor; G

Concrete Batch Plant Operator; G

Profilograph Operator; G

1.4 QUALITY CONTROL

1.4.1 Contractor Quality Control (CQC) Staff

Reference Section 01 45 00 QUALITY CONTROL for general CQC personnel qualification requirements. In addition, submit specific CQC personnel qualification requirements listed below. Submit qualifications and resumes for the Concrete Paving CQC Manager and petrographer. Submit certification for all CQC personnel assigned to concrete construction for their respective position:

a. Identify an individual within the onsite work organization as the Concrete Paving CQC Manager, who is responsible for overall management of concrete paving CQC and has the authority to act in all concrete paving CQC matters including authority to stop concrete paving work which is out of compliance.

   The minimum requirements for the Concrete Paving CQC Manager consist of 8 years airfield concrete paving experience similar to work required under this contract with a minimum of 3 years in a concrete paving CQC role. The Concrete Paving CQC Manager is a separate person, and is in addition to the Quality Control Manager identified in Section 01 45 00 QUALITY CONTROL.

   The minimum requirements for the Concrete Paving CQC Manager consist of 5 years concrete paving experience similar to work required under this contract with a minimum of 2 years in a concrete paving CQC role. The Concrete Paving CQC Manager can also serve as the QUALITY CONTROL and the Concrete Paving CQC Manager experience requirements above.

b. CQC personnel responsible for inspection of concrete paving operations: ACI Concrete Transportation Construction Inspector. The ACI Concrete Transportation Construction Inspector is required to be present at the paving site during all paving operations, with the exception of the initial saw cutting operation. The QC manager is required to be present during initial saw cutting operations.

c. CQC staff is required to oversee all aspects of sawing operations (sawing, flushing, vacuuming, checking for random cracking, lighting).

d. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews: ACI Advanced Concrete Flatwork Finisher.

e. Batch Plant Manufacturer's Inspection Report : A technical representative from the batch plant manufacturer is required to be on-site to inspect and make necessary adjustments prior to uniformity testing and after major component repairs or replacements. The inspection and necessary adjustments of all batch plant components include but are not limited to aggregate bin weighing operations, water metering, cement and fly ash weighing devices. All necessary inspections and adjustments by the manufacturer technical representative are required to be performed prior to uniformity testing. Submit a written Batch Plant Manufacturer's Inspection Report signed by the technical representative noting all inspection items and corrections and stating the batch plant is capable of producing the volume of concrete as required herein.

f. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

g. Slipform Paving Equipment Manufacturer's Representative: A technical representative of the slipform paving equipment manufacturer is required to be on-site during the test section construction to inspect and make corrections to the paving equipment to provide proper operations. Perform a complete and full hydraulic flow test of the vibrator system prior to the test section being placed. Submit a written Slipform Paver Manufacturer's Inspection Report signed by the manufacturer's technical representative noting all inspections, corrections, and flow tests have been performed and the paver is in a condition to perform the required work.

h. Laboratory Testing Technicians: ACI Concrete Strength Testing Technician and ACI Concrete Laboratory Testing Technician, Level 1 or 2.

1.4.2 Other Staff

Submit for approval the qualifications and resumes for the following staff:

a. Petrographer: Bachelor of Science degree in geology or petrography, trained in petrographic examination of concrete aggregate according to ASTM C294 and ASTM C295/C295M and trained in identification of the specific deleterious materials and tests identified in this specification. Detail the education, training and experience related to the project-specific test methods and deleterious materials in the Petrographer Resume and submit at least 20 days before petrographic and deleterious materials examination is to commence.

b. Licensed Surveyor: Perform all survey work under the supervision of a professional land surveyor licensed in the region the work is being performed.

c. Concrete Batch Plant Operator: National Ready Mix Concrete Association (NRMCA) Plant Manager certification.

d. Profilograph Operator: Certification by equipment manufacturer or a state Department of Transportation.

1.4.3 Laboratory Accreditation and Validation

Provide laboratory and testing facilities. Submit accreditation of the commercial laboratory by an independent evaluation authority, indicating conformance to ASTM C1077, including all applicable test procedures identified in this specification. If multiple laboratories are proposed, identify which tests will be conducted by each. Submit accreditation documentation a minimum of 30 days before any specified testing is performed. The laboratories performing the tests are required to be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. Provide current accreditation and include the required and optional test methods, as specified. In addition, all laboratories performing testing require USACE validation by the Material Testing Center (MTC) for both parent laboratory and on-site laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Request MTC laboratory validation at https://mtc.erdc.dren.mil/requestvalidation.aspx for costs and scheduling. Contact the MTC Director at https//mtc.erdc.dren.mil/contact2.aspx with questions or additional information.

1.4.3.1 Aggregate Testing and Mix Proportioning

Aggregate testing and mixture proportioning studies are required to be performed by a commercial laboratory.

A mandatory preparatory phase meeting is required prior to beginning work on aggregate testing and mix proportioning. Meeting to be coordinated with the Contracting Officer.

1.4.3.2 Acceptance Testing

Provide all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the paving site and in the laboratory. Provide steel molds for molding the beam specimens. Provide on-site temperature-controlled concrete curing facilities. Provide and maintain boxes or other facilities suitable for storing and curing the specimens at the paving site while in the mold within the temperature range stipulated by ASTM C31/C31M. Provide flexural loading equipment in accordance with ASTM C78/C78M

1.4.3.3 Pavement Quality Control Plan

Submit the Pavement Quality Control Plan. The Pavement Quality Control Plan is specific to this specification and supplements the overall Quality Control Plan required by Section 01 45 00 QUALITY CONTROL. Do not produce portland cement concrete pavement for payment until the Pavement Quality Control Plan has been approved. In the Pavement Quality Control Plan, address all elements which affect the quality of the pavement including, but not limited to:

a. Condition of underlying course
b. Condition of adjacent pavement and dowels
c. Stockpile management and aggregate grading
d. Mix proportions and batching operations
e. Transportation
f. Placing and consolidation
g. Placing dowels
h. Finishing and texturing
i. Curing
j. Sawcutting Joints
k. CQC Testing and Inspection
l. Inclement / Hot

1.4.3.4 Laboratory Inspection

The Government will inspect all laboratories requiring validation for equipment and test procedures prior to the start of any concreting operations for conformance to ASTM C1077. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory validation is not allowed. The laboratory is to maintain this certification for the duration of the project.

1.4.4 Preconstruction Testing of Materials

All sampling and testing is required to be performed using an approved commercial laboratory or, for cementitious materials and chemical admixtures, a laboratory maintained by the manufacturer of the material. Materials are not allowed to be used until notice of acceptance has been

given. Additional payment or extension of time due to failure of any material to meet project requirements, or for any additional sampling or testing required is not allowed. Additional tests may be performed by the Government; such Government testing does not relieve any required testing responsibilities.

1.4.4.1 Aggregates

Sample aggregates in the presence of a Government Representative. Obtain samples representative of the materials to be used for the project in accordance with ASTM D75/D75M. Perform all aggregate tests no earlier than 6 months prior to test section construction.

1.4.4.2 Chemical Admixtures, Curing Compounds and Epoxies

At least 30 days before the material is used, submit certified copies of test results for the specific lots or batches to be used on the project. Provide test results less than 5 years old prior to use in the work. Retest chemical admixtures that have been in storage for longer than 6 months or that have been subjected to temperatures outside of manufacturer requirements. Reject if test results do not meet the Level 2 proof of compliance requirements of ASTM C494/C494M.

1.4.4.3 Testing of Cementitious Materials

All materials referenced under paragraph CEMENTITIOUS MATERIALS will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports showing that the material in each shipment meets the requirements of the specification under which it is provided. Provide mill test reports no more than 1 month old, prior to use in the work. Do not use cementitious materials until notice of acceptance has been given. Cementitious materials may be subjected to testing by the Government from samples obtained at the mill, at transfer points, or at the project site. If tests prove that a cementitious material that has been delivered is unsatisfactory, promptly remove it from the project site. Retest cementitious material that has not been used within 6 months after testing, and reject if test results do not meet manufacturer requirements.

1.4.5 Testing During Construction

During construction, sample and test aggregates, cementitious materials, and concrete as specified herein. The Government will sample and test concrete and ingredient materials as considered appropriate. Provide facilities and labor necessary for procurement of representative test samples. Testing by the Government does not relieve the specified testing requirements.

1.4.6 Test Section

1.4.6.1 General

a. Prior to test section placement a pavement workshop provided by the NAVFAC Pavement SME will be conducted. Workshop will be provided by the USACE Transportation Systems Center.

b. Schedule the test section after all required submittals and uniformity testing has been reviewed and approved. Perform a preparatory meeting before commencing the test section.

c. Construct a separate test section for each placement method proposed for use. Construct a separate test section for each paver and each batch plant proposed for use.

d. Up to 15 days, but not more than 60 days, prior to construction of the concrete pavement, construct a test section as part of the production paving area at a location as coordinated with the Contracting Officer. Construct the pilot lane and fill-in lane test sections on separate days using the approved mixture proportions. Aggregate proportioning changes may be required due to specification requirements not being met.

e. Construct the test section matching the thickest pavement section and underlying structure required in the work. Use the same equipment, materials, and construction techniques on the test sections as proposed for use in all subsequent work. The underlying layers must be reviewed and approved by the Government prior to paving of the test section.

f. Perform underlying layer preparation, concrete production, placing, consolidating, texturing, curing, construction of joints, and all testing in accordance with applicable provisions of this specification.

g. Use the test sections to develop and demonstrate the proposed techniques of mixing, hauling, placing, consolidating, finishing, texturing, curing, initial saw cutting, start-up procedures, sampling, testing methods, plant operations, and the preparation of the joints for production paving. Report per requirements of paragraph Reports.

1.4.6.2 Pilot Lane

Construct the test section consisting of one continuous paving lane at least 200 feet long and to the same thickness as the thickest portion of pavement shown on the Drawings. The test section may not exceed 180 m 600 feet; all pavement placed for the test section before or after 130 m 400 feet of continuously acceptable placement must be removed. Construct at the same lane width as that required for use in the project. If doweled longitudinal construction joints are required in any of the production pavements, install them full length along one side of the test lane throughout the test section.

1.4.6.3 Fill-In Lane

A fill-in lane is defined as full width concrete placement using two adjacent lanes as forms. Consider the first 400 feet of the initial production fill-in lane as a test section for purposes of testing and evaluation. All requirements for the test section are applicable. Obtain cores from the fill-in lane side of the longitudinal construction joint with the pilot lane. No measurements will be required for longitudinal vertical faces that are against existing or recently placed panels. Straightedge measurements are required across the joint per paragraph Testing Method.

1.4.6.4 Testing and Inspection

a. Provide aggregate, fresh concrete, and hardened concrete sampling and testing in accordance with paragraph Testing and Inspection by Contractor and Table 17. Provide inspection of the hardened concrete

for surface smoothness, plan grade, edge slump and joint face deformation in accordance with the specifications. Acceptable control joint cracking is defined as a full-depth crack occurring at a minimum of one every six consecutive contraction joints within 48 hours after initial sawing or within 48 hours after increased depth sawing as specified in paragraph CONTRACTION JOINTS. Provide a test section report in accordance with paragraph TEST-SECTION PRE-PRODUCTION PAVING REPORT.

b. Provide sampling and testing to determine the loss of air content through the paving equipment. Samples are to be obtained before and after the paving equipment along the vibrator path and in-between the vibrators. Obtain one sample of the fresh concrete before the paving equipment has passed with material in the sublot. Once the paver has passed, obtain two samples of the in-place, plastic concrete to the full depth of the placement avoiding the underlying layer. Provide stationing references for all samples. Report this data in the Test Section Lot Report. This testing is in addition to required testing in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION and only required during the Test Section(s). Adjustments to air contents to meet the specified air content in paragraph Air Content are only to be made based on measured air contents before the paver has passed. Immediately fill voids resulting from sample collection with freshly mixed concrete, strike off, consolidate with an internal vibrator, and refinish.

c. No more than three working days after completion of the test sections, procure, evaluate and measure eight cores with a minimum diameter of 6 inches by full depth cut from points selected in the test sections by the Government on a basis of two cores per sublot. Evaluate cores in accordance with paragraph EVALUATION OF CORES.

1.4.6.5 Test-Section Pre-Production Paving Report

For the test-section paving, submit a report containing test data, organized into 8 sections that correspond to the following content listed in this section:

a. Surface smoothness.

b. Edge slump and joint face deformation.

c. Actual plan grade.

d. Flexural strength.

e. Thickness.

f. Evaluation of cores.

g. Testing and inspection as organized in sub-paragraphs corresponding to each row of Table 6.

h. Assessment of slabs for uncontrolled cracking, unusual contraction joint cracking, and other criteria for rejection.

Prepare a summary sheet as the first page of each section and sub-section. List the following on each summary sheet:

a. Test or subject

b. Test frequency

c. Test method

d. Acceptance criteria or control limit per specification

e. Statement Compliance: Certify testing and test results are in compliance with specification, or

f. Identify non-compliance (if necessary): Describe the discrepancy, significance of the discrepancy, and corrective actions. Indicate how the non-complying results are flagged and marked, and flag/mark the non-compliant results in the compliled test data.

1.4.6.6 Acceptance of Test Section

a. Construct the test sections meeting the specification requirements including plastic and hardened concrete properties, surface texture, thickness, plan grade, smoothness, joint face deformation, edge slump, and plan joint alignment.

b. Do not commence production paving until the results on aggregates and concrete, including evaluation of cores, and all pavement measurements for edge slump, joint face deformation, actual plan grade, surface smoothness, and thickness have been submitted and approved, and the payment calculation has been submitted for information only. Remove test sections which do not meet specification requirements and conduct additional test sections, as required. If an acceptable test section is unable to be constructed by slipform paving, repair or replace the slipform paving equipment, or complete the paving using fixed-forms and equipment as required by the specification. Pavement accepted as a production lot will be evaluated and paid as specified in PART 1 GENERAL.

1.4.7 Acceptability of Work

The materials and the pavement itself will be accepted on the basis of production testing. The Government may make check tests to validate the results of the production testing. If the results of the production testing vary by less than 2.0 percent of the Government's test results, the results of the production testing will be used. If the results of the Government and production tests vary by 2.0 percent, but less than 4.0 percent, the average of the two will be considered the value to be used. If these vary by 4.0 percent or more, carefully evaluate each sampling and testing procedure and obtain another series of Government and production tests on duplicate samples of material. If these vary by 4.0 percent or more, use the results of the tests made by the Government and the Government will continue check testing of this item on a continuous basis until the two sets of tests agree within less than 4.0 percent on a regular basis. Testing performed by the Government does not relieve the specified testing requirements.

1.4.8 Acceptance Requirements

1.4.8.1 Pavement Lots

A lot is that quantity of construction to be evaluated for acceptance with

specification requirements. A lot is equal to production paving not to exceed 1000 cubic yards. In order to evaluate thickness, divide each lot into sublots not to exceed 250 cubic yards. Perform grade determinations on the lot as a whole. Perform surface smoothness determinations on every 0.1 mile segment in each lot. Select sample locations on a random basis in accordance with ASTM D3665. When operational conditions cause a lot to be terminated before the specified four sublots have been completed, use the following procedure to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they constitute a lot. Where one or two sublots have been completed, incorporate them into the next lot (except for the last lot), and the total number of sublots used and acceptance criteria adjusted accordingly.

1.4.8.2 Evaluation

Provide all sampling and testing required for acceptance and payment adjustment, including batch tickets with all required acceptance testing. Individuals performing sampling, testing and inspection duties are required to meet the requirements of paragraph: Contractor Quality Control Staff. The Government reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. Testing in these areas are in addition to the sublot or lot testing, and the requirements for these areas are the same as those for a sublot or lot. Provide facilities, and where directed personnel, to assist in obtaining samples for any Government testing.

1.5 AIRFIELD PCC PAVING WORKSHOP

USACE Transportation Systems Center will conduct a mandatory two day pavement workshop in advance of the concrete paving for the Contractor and his representatives for the minimum amount of time listed below. Additionally, personnel may attend any non-mandatory sessions on a space-available basis. Contractor is to acquire a facility for the workshop in the vicinity of the installation, or other appropriate location, as approved by the Government. Provide a facility that includes at a minimum, parking and seating for forty attendees, audio/visual with standard connections, including TV, projector, screen and any other items as required for display of digital presentations, and access to Wi-Fi. Coordinate schedule with the Government. Attendance requirements apply to each paving crew anticipated to be on the project. At a minimum, the following attendees are required.

a. Project Engineer/Pavement Engineer: 2 days
b. Project Superintendent: 2 days
c. Paving Superintendent or Foreman(s): 2 days
d. ACI Transportation Inspector: 2 days
e. Quality Control Manager & Alternate(s): 2 days
f. Quality Control Testing Lab Technicians: 2 days
g. Paving Machine Operator(s):2 days
h. Batch Plant Manager(s): 1 day
i. Sawing/Sealing/Contractor(s): 1 day.
j. PCC Aggregate Supplier: 1/2 day.
k. MTV Operator(s): 2 days

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Bulk Cementitious Materials

Provide all cementitious materials in bulk at a temperature, as delivered

to storage at the site, not exceeding 150 degrees F. Provide sufficient cementitious materials in storage to sustain continuous operation of the concrete mixing plant while the pavement is being placed. Provide separate facilities to prevent any intermixing during unloading, transporting, storing, and handling of each type of cementitious material.

1.6.2 Aggregate Materials

Store aggregate at the site of the batching and mixing plant avoiding breakage, segregation, intermixing or contamination by foreign materials. Store each size of aggregate from each source separately and allow the fine aggregate and the smallest size coarse aggregate to drain. Provide a minimum 24 inch thick sacrificial layer left undisturbed for each aggregate stored on ground or provide a paved or chemically stabilized surface course beneath the stockpiles. Maintain sufficient aggregate at the site at all times to permit continuous uninterrupted operation of the mixing plant at the time concrete pavement is being placed. Do not allow tracked equipment on coarse aggregate stockpiles.

1.6.3 Other Materials

Store reinforcing bars and accessories above the ground on supports. Store all materials properly to avoid contamination and deterioration.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete pavement. However, where the construction covered herein interfaces with other sections, construct each interface to conform to the requirements of both this section and the other section, including tolerances for both.

2.1.1 Surface Smoothness

Use the profilograph method for all longitudinal testing, except for paving lanes less than 200 feet in length. Use the straightedge method for transverse testing, for longitudinal testing where the length of each pavement lane is less than 200 feet, and at the ends of the paving limits for the project. Smoothness requirements do not apply over crowns, drainage structures, or similar penetrations. Maintain detailed notes of the testing results and provide a copy to the Government after each day's testing.

2.1.1.1 Straightedge Testing

Provide the finished surfaces of the pavements with no sudden change in elevation or abrupt change of 1/4 inch or more from the as-built finished surface or face, and all pavements within the limits specified when checked with an approved 12 foot straightedge. Report measurements to the nearest 1/16 inch. Provide runways and taxiways with a variation from the specified straight edge not greater than 1/8 inch in the longitudinal direction and not greater than 1/4 inch in the transverse direction. Provide all other airfield areas with a variation from a straight edge not greater than 1/4 inch in either the longitudinal or transverse direction.

2.1.1.2 Bumps ("Must Grind" Areas)

Reduce any bumps ("must grind" areas) shown on the profilograph trace or

by straightedge measurements which exceed 0.4 inch in height by diamond grinding in accordance with paragraph DIAMOND GRINDING OF PCC SURFACES below until they do not exceed 0.3 inch when retested. Taper such diamond grinding in all directions to provide smooth transitions to areas not requiring diamond grinding.

2.1.1.3 Testing Method

After the concrete has hardened sufficiently to permit walking thereon, but not later than 48 hours after placement, test the entire surface of the pavement in each lot in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. If any pavement areas are diamond ground, retest these areas immediately after diamond grinding. Test the entire area of the pavement in both a longitudinal and a transverse direction on parallel lines. Perform the transverse lines 15 feet or less apart, as directed. Perform the longitudinal lines at the 1/8th point in from each side of the lane and at the centerline of each paving lane shown on the drawings, regardless of whether multiple lanes are allowed to be paved at the same time. Also test other areas having obvious deviations. Perform longitudinal testing lines continuous across all joints. Perform transverse testing lines for pilot lanes carried to construction joint lines and for fill-in lanes carried 24 inches across construction joints, and the readings in this area applied to the fill-in lane. Perform straightedge testing of the longitudinal edges of slipformed pilot lanes before paving fill-in lanes as specified below.

2.1.1.3.1 Straightedge Testing

Hold the straightedge in contact with the surface and move ahead one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and measuring the maximum gap between the straightedge and the pavement surface. Determine measurements along the entire length of the straight edge.

2.1.2 Edge Slump and Joint Face Deformation

2.1.2.1 Edge Slump

Provide a maximum of 15.0 percent of each free edge of each pavement panel with a maximum edge slump of 1/4 inch and none of the free edge of the pavement lot with an edge slump exceeding 3/8 inch. (A pavement panel is defined as a lane width by the length between two adjacent transverse contraction joints. The free edge of the pavement is the linear measurement of pavement panel edge originally constructed as non-adjacent to any existing pavement; for example, 100 feet of pilot lane originally constructed as a separate lane, would have 100 feet of free edge on each side; 100 feet of fill-in lane would have no free edge.) The area affected by the downward movement of the concrete along the pavement edge is a maximum of 18 inches back from the edge.

2.1.2.2 Joint Face Deformation

Provide a vertical joint face with a surface within the maximum limits shown in Table 5. Provide the offset measurements from all five Joint Face Deformation Limits from Table 5 at the specified testing frequency. Properly reference all recorded measurements in accordance with paving lane identification and stationing, and submit a report within 10 days after measurement is made. Identify areas requiring replacement within

the report.

TABLE 5

JOINT FACE DEFORMATION LIMITS

Offset from Straightedge Applied Longitudinally to Pavement Surface (a)	Offset from Straightedge Applied Longitudinally to Vertical Face (b)	Offset from Straightedge Applied Top to Bottom Against the Joint Face (c)	Abrupt Offset in Any Direction (d)	Offset of Joint Face from True Vertical (e)
Airfield Pavement				
1/8 inch	1/4 inch	3/8 inch	1/4 inch	1 inch per 12 inches
All Other Pavement				
1/4 inch	All other items same as airfield pavement			

(a) Measurement is taken by placing the straightedge longitudinally on the pavement surface 1 inch from the free edge. Record the longitudinal joint face deformation of the joint on a continuous line 1 inch back from the joint line using the 12 foot straightedge advanced one-half its length for each reading.

(b) Measurement is taken by applying the straightedge longitudinally along the center of the vertical joint face. Record the longitudinal joint face deformation using the 12 foot straightedge advanced one-half its length for each reading.

(c) Measurement places a 3/8 inch spacer attached to a straightedge and spaced approximately equal to the thickness of the concrete being measured. The offset from straightedge with spacers is measured by placing the spacers against the top and bottom of the vertical concrete face. Record measurements at 5 foot spacings.

(d) Check for abrupt offsets at any location that an abrupt change in the joint face plane appears to be present through use of a 12 foot straightedge.

(e) Measurement of the offset from the joint face to a level in the true vertical position against the joint face. Record measurements at 5 foot spacings.

2.1.2.3 Edge Slump Determination

Test the pavement surface to determine edge slump immediately after the concrete has hardened sufficiently to permit walking thereon. Perform testing with a minimum 12 foot straightedge to reveal irregularities exceeding the edge slump tolerance specified above. Determine the vertical edge slump at each free edge of each slipformed paving lane constructed. Place the straightedge transverse to the direction of paving and the end of the straightedge located at the edge of the paving lane.

Record measurements at 5 to 10 foot spacings, as directed, commencing at the header where paving was started. Initially record measurements at 5 foot intervals in each lane. When no deficiencies are present after 5 measurements, the interval may be increased. The maximum interval is 10 feet. When any deficiencies exist, return the interval to 5 feet. Perform other tests of the exposed joint face to produce a uniform, true vertical joint face. Properly reference all recorded measurements in accordance with paving lane identification and stationing, and submit a report within 10 days after measurement is made. Identify areas requiring replacement within the report.

2.1.2.4 Excessive Edge Slump or Joint Face Deformation

When edge slump or joint face deformation exceeding the limits specified above is encountered on either side of the paving lane, record additional straightedge measurements to define the linear limits of the excessive slump or joint face deformation. Remove and replace concrete slabs having excessive edge slump or joint deformation to the next transverse joint in conformance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS. Discontinue use of slip-form paving equipment and procedures that fail to consistently provide edges within the specified tolerances on edge slump and joint face deformation and construct by means of standard paving procedures using fixed forms.

2.1.3 Plan Grade

Within 5 working days after completion of a particular lot, survey the surface of the pavement area for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals corresponding to every longitudinal and transverse joint to determine the elevation at each joint intersection. Resurvey any areas corrected after initial survey.

TABLE 6

Plan Grade Tolerances

Airfield Pavements	**Finished Surface Measurements at Joint Intersections** (after allowable corrections)	
	0-0.04 foot from designed Plan Grade	Acceptable, no Payment Adjustment considered on grade measurements at these Joint Intersections
	0.041-0.06 foot from designed Plan Grade	Calculate Plan Grade Pay Adjustment Factor per paragraph PAYMENT ADJUSTMENT FOR PLAN GRADE
	Greater than 0.06 foot from designed Plan Grade	Remove and Replace affected Panel(s)

TABLE 6		
Heavy-Duty Pavements other than Airfield Pavements	0-0.06 foot from designed Plan Grade	Acceptable, no Payment Adjustment considered on grade measurements at these Joint Intersections
	0.041 foot-0.09 foot from designed Plan Grade	Calculate Plan Grade Pay Adjustment Factor per paragraph PAYMENT ADJUSTMENT FOR PLAN GRADE
	Greater than 0.09 foot from designed Plan Grade	Remove and Replace affected Panel(s)

The above deviations from the approved grade line and elevation are not permitted in areas where closer conformance with the planned grade and elevation is required for the proper functioning of appurtenant structures. Provide finished surfaces of new abutting pavements that coincide at their juncture. Corrections within the tolerances of paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS are allowed to improve the payment adjustment or to improve an unacceptable surface to allow for a payment adjustment. Provide horizontal control of the finished surfaces of all airfield pavements that vary not more than 1/2 inch from the plan joint alignment indicated.

2.1.3.1 Joint Alignment

Provide survey points for the joint intersections. Provide horizontal control of the finished surfaces of all airfield pavements.

TABLE 7		
Joint Alignment Tolerances		
All Airfield Pavements	**Horizontal Measurements of Joint Intersections (both transverse and longitudinal joints)**	
	0-1/2 inch from designed Jointing Plan	Acceptable
	Greater than 1/2 inch from the designed Jointing Plan	Remove and Replace affected Panel(s)

2.1.4 Flexural Strength

Each lot of pavement will be evaluated for acceptance for flexural strength in accordance with paragraph Sampling and Testing and paragraph

Computations.

2.1.4.1 Sampling and Testing

For acceptance, obtain one composite sample of concrete from each sublot in accordance with ASTM C172/C172M from one batch or truckload.Fabricate and cure test beams 6 x 6 inches in accordance with ASTM C31/C31M; and test at 14 days in accordance with ASTM C78/C78M. Test two beams per sublot (8 per lot).

2.1.4.2 Computations

Average the eight 14-day strength tests for the lot. Use the average strength in accordance with paragraph Concrete Strength For Final Acceptance.

2.1.5 Thickness

Each lot of pavement will be evaluated for acceptance and payment adjustment in accordance with the following procedure. Drill two cores, between 4 and 6 inches in diameter, from the pavement, per sublot (8 per lot). Drill the cores within 3 days after lot placement, fill the core holes with an approved concrete patching mixture, and respray the cored areas with curing compound. Prevent the core hole from drying or damage until backfilled. Complete backfillng of core hole during the subsequent production placement or within 5 calendar days, whichever occurs first. Record eight measurements of thickness around the circumference of each core and one in the center, in accordance with ASTM C174/C174M. Provide the results with the thickness measurement data. Average the pavement thickness from the 8 cores for the lot and evaluate as described in paragraph Payment Adjustment For Thickness above.

2.1.6 Evaluation of Cores

Record and submit testing, inspection, and evaluation of each core for mortar-rich surface, uniformity of aggregate distribution, segregation, voids, cracks, and depth of reinforcement or dowels (if present). Moisten the core with water to visibly expose the aggregate and take a minimum of three photographs of the sides of the core's entire length, rotating the core approximately 120 degrees between photographs. Provide photographs with the clarity and quality to identify the defects identified above. Each core is to be identified on the top with the core number referenced to paving lot plan view. Photograph the core against a contrasting background, in profile, and with an extended tape measure parallel and to the right of the core with incremental measurements clearly visible. Provide plan view of location for each core. Store the cores and make available to the Government when requested, until otherwise directed.

2.1.7 Diamond Grinding of PCC Surfaces

Those performing diamond grinding are required to have a minimum of three years experience in diamond grinding of airfield pavements. In areas not meeting the specified limits for surface smoothness and plan grade, reduce high areas to attain the required smoothness and grade, except as depth and surface area is limited below. Reduce high areas by diamond grinding the hardened concrete with approved equipment after the concrete is at a minimum age of 14 days. Provide
diamond grinding equipment capable of cutting a path a minimum of 3 feet wide. Equip the cutting head with saw blades that are 3 mm 1/8-inch

wide with sufficient number of blades to create grooves between 0.090-inches and 0.130-inches wide and peaks and ridges approximately 1/32-inch higher than the bottom of the grinding cut. Diamond grinding equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints is not permitted. The maximum area corrected by diamond grinding the surface of the hardened concrete is 10 percent of the total area of any sublot. The maximum depth of diamond grinding is 1/4 inch. Provide diamond grinding equipment capable of flushing and vacuuming the pavement surface. Dispose of all debris from diamond grinding operations off Government property, leaving the surface of the pavement in a clean condition. Prior to diamond grinding, submit a Diamond Grinding Plan for review and approval. At a minimum, include the daily reports for the deficient areas, the location and extent of deficiencies, corrective actions, and equipment. Remove and replace all pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above in conformance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS. Repair aggregate popouts using the core and patch method of paragraph REPAIRING SPALLS ALONG JOINTS. All areas in which diamond grinding has been performed are subject to the thickness tolerances specified in paragraph Thickness, above.

Prior to production diamond grinding operations, perform a test section at the approved location. Perform a test section that consists of a minimum of two adjacent passes with a minimum length of 40 feet to allow evaluation of the finish, transition between adjacent passes, and the results of crossing a transverse joint. Production diamond grinding operations are not to be performed prior to approval.

2.2 CEMENTITIOUS MATERIALS

Provide cementitious materials consisting of portland cement, or portland cement in combination with supplementary cementitious materials (SCM), that conform to appropriate specifications listed below. New submittals are required when the cementitious materials sources or types change.

2.2.1 Portland Cement

Provide portland cement conforming to ASTM C150/C150M, Type I.

2.2.2 Blended Cements

Provide blended cement conforming to ASTM C595/C595M, Type IP, IS, or IL. Provide pozzolan added to the Type IP blend consisting of ASTM C618 Class F or Class N and that is interground with the cement clinker. Include a written statement from the manufacturer that the amount of pozzolan in the finished cement does not vary more than plus or minus 5 mass percent of the finished cement from lot to lot or within a lot. Provide limestone added to the Type IL blend that is interground with the cement clinker. Include a written statement from the manufacturer that the amount of limestone in the finished cement does not vary more than plus or minus 2.5 mass percent of the finished cement from lot to lot or within a lot. Limit the percent of slag, pozzolan, or limestone to a maximum of IS(50), IP(35) or IL(15). The percentage and type of mineral admixture used in the blend is not allowed to change from that submitted for the aggregate evaluation and mixture proportioning.

2.2.3 Pozzolan

2.2.3.1 Fly Ash

Provide fly ash that conforms to ASTM C618, Class F, including the optional requirement for uniformity with a loss on ignition not exceeding 6 percent. Provide Class F fly ash for use in mitigating Alkali-Silica Reactivity with a total equivalent alkali content less than 4 percent.

2.2.3.2 Raw or Calcined Natural Pozzolan

Provide natural pozzolan that is raw or calcined and conforms to ASTM C618, Class N, including the optional requirement for uniformity with a loss on ignition not exceeding 3 percent. Provide Class N pozzolan for use in mitigating Alkali-Silica Reactivity with a total equivalent alkali content less than 4 percent.

2.2.3.3 Ultra Fine Fly Ash and Ultra Fine Pozzolan

Provide Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) that conforms to ASTM C618, Class F or N, and the following additional requirements:

a. The strength activity index at 28 days of age of at least 95 percent of the control specimens.

b. The average particle size is a maximum of 6 microns.

2.2.4 Supplementary Cementitious Materials (SCM) Content

Provide a concrete mix that contain one of the SCMs listed in Table 6 within the range specified therein, whether or not the aggregates are found to be reactive in accordance with paragraph ALKALI SILICA REACTIVITY.

TABLE 8

SUPPLEMENTARY CEMENTITIOUS MATERIALS CONTENT

Supplementary Cementitious Material	Minimum Content (percent)	Maximum Content (percent)
Class N Pozzolan and Class F Fly Ash		
$SiO_2 + Al_2O_3 + Fe_2O_3 > 70$ percent	25	35
$SiO_2 + A1_2O_3 + Fe_2O_3 > 80$ percent	20	35
$SiO_2 + A1_2O_3 + Fe_2O_3 > 90$ percent	15	35
UFFA and UFP	7	16
Slag Cement	40	50

2.3 AGGREGATES

Provide aggregates meeting the requirements of this specification. If aggregate sources in the project area do not meet the requirements of this specification, provide aggregates from sources outside the project area.

2.3.1 Aggregate Sources

2.3.1.1 Durability of Coarse Aggregate

Evaluate and test all fine and coarse aggregates to be used in all concrete for durability in accordance with ASTM C88. Provide fine and coarse aggregates with a maximum of 18 percent loss when subjected to 5 cycles using Magnesium Sulfate or a maximum of 12 percent loss when subjected to 5 cycles if Sodium Sulfate is used.

2.3.1.2 Alkali-Silica Reactivity

Evaluate and test fine and coarse aggregates to be used in all concrete for alkali-aggregate reactivity. Test all size groups and sources proposed for use individually.

a. Evaluate the aggregate size groups and sources separately using ASTM C1260. Reject individual aggregates with test results that indicate an expansion of greater than 0.08 percent after 28 days of immersion in 1N NaOH solution, or perform additional testing as follows: utilize the proposed portland cement, blended cement, and SCM, or Lithium Nitrate in combination with each individual aggregate. If only SCMs are being evaluated, test in accordance with ASTM C1567. If Lithium Nitrate is being evaluated, with or without SCMs, test in accordance with COE CRD-C 662. Determine the quantity that meets all the requirements of these specifications and that lowers the expansion equal to or less than 0.08 percent after 28 days of immersion in a 1N NaOH solution. Base the mixture proportioning on the highest percentage of SCM required to mitigate ASR-reactivity.

b. If any of the above options does not lower the expansion to less than 0.08 percent after 28 days of immersion in a 1N NaOH solution, reject the aggregate(s) and submit new aggregate sources for retesting. Submit the results of testing for evaluation and acceptance.

2.3.1.3 Combined Aggregate Gradation

In addition to the grading requirements specified for coarse aggregate and for fine aggregate, provide the combined aggregate grading meeting the following requirements:

a. Provide materials selected and the proportions used such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in d. below, the point and its associated production tolerance thus determined falls within the parallelogram described therein. Refer to TSPWG M 3-250-04.97-05 for combined aggregate plot locations for the intended placement technique(s).

b. Determine the Coarseness Factor (CF) from the following equation:

$$CF = \frac{\text{(cumulative percent retained on the 3/8 inch sieve)(100)}}{\text{(cumulative percent retained on the No. 8 sieve)}}$$

c. The Workability Factor (WF) is defined as the percent passing the No. 8 sieve based on the combined aggregate gradation. Adjust the WF, prorated upwards only, by 2.5 percentage points for each 94 pounds per cubic yard of cementitious material greater than 564 pounds per cubic yard.

d. Plot a diagram using a rectangular scale with WF on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram, plot a parallelogram with corners at the following coordinates (CF-75, WF-28), (CF-75, WF-40), (CF-45, WF-32.5), and (CF-45, WF-44.5). If the point determined by the intersection of the computed CF and WF does not fall within the above parallelogram, revise the grading of each size of aggregate used and the proportions selected as necessary.

e. Plot the associated production tolerance limits, identified in Table 17, around the CF and adjusted WF point.

2.3.2 Coarse Aggregate

2.3.2.1 Coarse Aggregate Composition

Provide coarse aggregate consisting of crushed or uncrushed gravel, crushed stone, or a combination thereof. Provide aggregates, as delivered to the mixers, consisting of clean, hard, uncoated particles meeting the requirements of ASTM C33/C33M except as specified herein. Provide coarse aggregate with no more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C131/C131M. Provide coarse aggregates with a maximum sodium sulfate soundness loss of 12 percent, or with a magnesium sulfate soundness loss of 18 percent after five cycles when tested in accordance with ASTM C88.

2.3.2.2 Particle Shape Characteristics

Provide particles of the coarse aggregate that are generally spherical or cubical in shape. The quantity of flat particles and elongated particles in any size group coarser than the 3/8 inch sieve are not allowed to exceed 20 percent by weight as determined by the Flat Particle Test and the Elongated Particle Test of ASTM D4791, Method A. A flat particle is defined as one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

2.3.2.3 Size and Grading

Provide coarse aggregate with a nominal maximum size (as defined in ASTM C125) of 1.5 inches with a minimum of 10 percent retained on the 1.0 inch sieve of the proposed combined aggregate gradation that meets the criteria of paragraph COMBINED AGGREGATE GRADATION.

Mix designs that include a minimum of three coarse aggregate size groups can use grading limits not defined by ASTM C33/C33M provided all other requirements are met. Provide upper and lower grading limits of historic gradations and for all proposed coarse aggregates not defined by ASTM C33/C33M but intended for use in the mix design.

2.3.2.4 Deleterious Materials - Airfield Pavements

The amount of deleterious material in each individual size group and source of coarse aggregate is not allowed to exceed the limits shown in Table 7A below, determined in accordance with the test methods shown.

TABLE 9A

LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE FOR AIRFIELD PAVEMENTS

Percentage by Mass

Materials (h)	Severe Weather	Moderate Weather
Clay lumps and friable particles (ASTM C142/C142M)	0.2	0.2
Shale (a) (ASTM C295/C295M)	0.1	0.2
Material finer than No. 200 sieve (b) (ASTM C117)	0.5	0.5
Lightweight particles (c) (ASTM C123/C123M)	0.2	0.2
Clay ironstone (d) (ASTM C295/C295M)	0.1	0.5
Chert, cherty stone, and other aggregates (less than 2.40 Sp. Gr.) (e) (ASTM C123/C123M and ASTM C295/C295M)	0.1	0.5
Claystone, mudstone, and siltstone (f) (ASTM C295/C295M)	0.1	0.1
Shaly and argillaceous limestone (g) (ASTM C295/C295M)	0.2	0.2
Other soft particles (COE CRD-C 130)	1.0	1.0
Total of all deleterious substances exclusive of material finer than No. 200 sieve	1.0	2.0

(a) Shale is defined as a fine-grained, thinly laminated or fissile sedimentary rock. It is commonly composed of clay or silt or both. It has been indurated by compaction or by cementation, but not so much as to have become slate.

(b) Limit for material finer than No. 200 sieve is allowed to be increased to 1.5 percent for crushed aggregates if the fine material consists of crusher dust that is essentially free from clay or shale. Use XRD or other appropriate techniques as determined by petrographer to quantify amount and justify increase.

(c) Test with a separation medium with a density of Sp. Gr. of 2.0. This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.

(d) Clay ironstone is defined as an impure variety of iron carbonate, iron oxide, hydrous iron oxide, or combinations thereof, commonly mixed with clay, silt, or sand. It commonly occurs as dull, earthy particles, homogeneous concretionary masses, or hard-shell particles with soft interiors. Other names commonly used for clay ironstone are "chocolate bars" and limonite concretions.

TABLE 9A

LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE FOR AIRFIELD PAVEMENTS

Percentage by Mass

Materials (h)	Severe Weather	Moderate Weather
(e) Chert is defined as a rock composed of quartz, chalcedony or opal, or any mixture of these forms of silica. It is variable in color. The texture is so fine that the individual mineral grains are too small to be distinguished by the unaided eye. Its hardness is such that it scratches glass but is not scratched by a knife blade. It may contain impurities such as clay, carbonates, iron oxides, and other minerals. Cherty stone is defined as any type of rock (generally limestone) that contains chert as lenses and nodules, or irregular masses partially or completely replacing the original stone. Other aggregates consist of obsidian, ash tuff, and palygorskite.		
(f) Claystone, mudstone, or siltstone, is defined as a massive fine-grained sedimentary rock that consists predominantly of indurated clay or silt without laminations or fissility. It may be indurated either by compaction or by cementation.		
(g) Shaly limestone is defined as limestone in which shale occurs as one or more thin beds or laminae. These laminae may be regular or very irregular and may be spaced from a few inches down to minute fractions of an inch. Argillaceous limestone is defined as a limestone in which clay minerals occur disseminated in the stone in the amount of 10 to 50 percent by weight of the rock; when these make up from 50 to 90 percent, the rock is known as calcareous (or dolomitic) shale (or claystone, mudstone, or siltstone).		
(h) Perform testing in accordance with the referenced test methods, except use the minimum sample size specified below.		

2.3.2.5 Testing Sequence for Deleterious Materials in Coarse Aggregate - Airfields Only

No extension of time or additional payment due to any delays caused by the testing, evaluation, or personnel requirements is allowed. The minimum test sample size of the coarse aggregate is 200 pounds for the 3/4 inch and larger maximum size and 25 pounds for the No. 4 to 3/4 inch coarse aggregate. Provide facilities for the ready procurement of representative test samples. The testing procedure on each sample of coarse aggregate for compliance with limits on deleterious materials is as follows:

Step 1: Wash each full sample of coarse aggregate for material finer than the No. 200 sieve. Discard material finer than the No. 200 sieve.

Step 2: Test remaining full sample for clay lumps and friable particles and remove.

Step 3. Test remaining full sample for chert and cherty stone with SSD density of less than 2.40 specific gravity. Remove lightweight

chert and cherty stone. Retain other materials less than 2.40 specific gravity for Step 4.

Step 4: Test the materials less than 2.40 specific gravity from Step 3 for lightweight particles (Sp. GR. 2.0) and remove. Restore other materials less than 2.40 specific gravity to the sample.

Step 5: Test remaining sample for clay-ironstone, shale, claystone, mudstone, siltstone, shaly and argillaceous limestone, and remove.

Step 6: Test a minimum of one-fifth of remaining full sample for other soft particles.

2.3.2.6 Deleterious Material - Heavy Duty Pavements

The amount of deleterious material in each size group of coarse aggregate is not to exceed the limits in Table 7B when tested as indicated.

TABLE 9B

LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE FOR HEAVY DUTY PAVEMENTS

	Percentage by Mass
Clay lumps and friable particles (ASTM C142/C142M)	2.0
Material finer than No. 200 sieve (ASTM C117)	1.0
Lightweight particles (ASTM C123/C123M)	1.0
Other soft particles (COE CRD-C 130)	2.0
Total of all deleterious substances, exclusive of material finer than No. 200 sieve	5.0

The limit for material finer than the No. 200 sieve is allowed to be increased to 1.5 percent for crushed aggregates consisting of crusher dust that is essentially free from clay or shale. Use a separation medium for lightweight particles with a density of 2.0 specific gravity. This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.

2.3.3 Fine Aggregate

2.3.3.1 Fine Aggregate Composition

Provide fine aggregate consisting of natural sand, manufactured sand, or a combination of the two, each composed of clean, hard, durable particles meeting the requirements of ASTM C33/C33M. Stockpile and batch each type of fine aggregate separately. Provide fine aggregate with particles that are generally spherical or cubical in shape. For fine aggregate provided as a combination of sources, test each source individually.

2.3.3.2 Grading

Provide fine aggregate, as delivered to the mixer, with a grading that conforms to the requirements of ASTM C33/C33M and having a fineness

modulus of not less than 2.50 nor more than 3.40. For fine aggregate supplied as a combination of sources, determine the fineness modulus on a composite sample.

2.3.3.3 Deleterious Material

The minimum test sample size for fine aggregate proposed for use in airfield paving is 10 pounds. The amount of deleterious material in the fine aggregate is not to exceed the limits listed in Table 8 when performed on the full sample:

TABLE 9

LIMITS OF DELETERIOUS MATERIALS IN FINE AGGREGATE

Material	Percentage by Mass
Clay lumps and friable particles ASTM C142/C142M	1.0
Material finer than No. 200 sieve ASTM C117	3.0
Lightweight particles ASTM C123/C123M using a medium with a density of Sp. Gr. of 2.0	0.5
Total of all above	3.0

2.3.3.4 Testing Sequence for Deleterious Materials in Fine Aggregate - Airfields Only

The testing procedure on each sample of fine aggregate for compliance with limits on deleterious materials is as follows:

Step 1: Wash each full sample of fine aggregate for material finer than the No. 200 sieve. Discard material finer than the No. 200 sieve.

Step 2: Test remaining full sample for clay lumps and friable particles and remove.

Step 3. Test remaining full sample for lightweight particles (Sp. GR. 2.0).

2.4 CHEMICAL ADMIXTURES

2.4.1 General Requirements

Only use chemical admixtures when the specific admixture type and manufacturer is the same material used in the mixture proportioning studies. Provide all chemical admixtures from the same manufacturer. Provide air-entraining admixture conforming to ASTM C260/C260M. Use an accelerating admixture conforming to ASTM C494/C494M, Type C or Type E, when specified in paragraph MIXTURE PROPORTIONS below provided it is not used to reduce the amount of cementitious material. Calcium chloride and admixtures containing calcium chloride are not allowed. Provide retarding or water-reducing admixture that meet the requirements of ASTM C494/C494M, Type A, B, or D, except that the 6-month and 1-year compressive strength tests are waived. ASTM C494/C494M, Type F and G high range water reducing

admixtures and Type S specific performance admixtures are not allowed. ASTM C1017/C1017M flowable admixtures are not allowed.

2.4.2 Lithium Nitrate

Provide lithium admixture consisting of a nominal 30 percent aqueous solution of Lithium Nitrate, with a density of 10 pounds per gallon, with the approximate chemical form as shown below:

TABLE 10

LITHIUM NITRATE COMPOSITION

Constituent	Limit (Percent by Mass)
$LiNo_3$ (Lithium Nitrate)	30 plus or minus 0.5
SO_4^{-2} (Sulfate Ion)	0.1 (max)
Cl^- (Chloride Ion)	0.2 (max)
Na^+ (Sodium Ion)	0.1 (max)
K^+ (Potassium Ion)	0.1 (max)

Provide the services of a manufacturer's technical representative experienced in dispensing, mixing, proportioning, placement procedures and curing of concrete containing lithium nitrate, at no expense to the Government. This representative is required to be present on the project prior to and during at least the first two days of placement using lithium nitrate.

2.5 MEMBRANE FORMING CURING COMPOUND

Provide membrane forming curing compound that conforms to COE CRD-C 300 and is white pigmented.

2.6 WATER

Provide water for mixing and curing that is fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water, or water from concrete production operations, can be used if it meets the requirements of ASTM C1602/C1602M.

2.7 JOINT MATERIALS

2.7.1 Expansion Joint Material

Provide preformed expansion joint filler material conforming to ASTM D1752 Type II. Provide expansion joint filler that is 3/4 inch thick, unless otherwise indicated, and provided in a single full depth piece.

2.7.2 Slip Joint Material

Provide slip joint material that is 1/4 inch thick expansion joint filler, unless otherwise indicated, conforming to paragraph EXPANSION JOINT MATERIAL.

2.8 REINFORCING

Provide reinforcement that is free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties is not allowed to be used.

2.8.1 Reinforcing Bars and Bar Mats

Provide reinforcing bars conforming to ASTM A615/A615M, billet-steel, Grade 60. Provide bar mats conforming to ASTM A184/A184M. The bar members may be billet rail or axle steel.

2.8.2 Welded Wire Reinforcement

Provide welded wire reinforcement that is deformed or smooth, conforming to ASTM A1064/A1064M, and provided in flat sheets.

2.9 DOWELS

2.9.1 Dowels

Provide dowels in single piece bars fabricated or cut to length at the shop or mill before delivery to the site. Dowels are to be free of loose, flaky rust and loose scale and be clean and straight. Dowels may be sheared to length provided that the deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and does not extend more than 0.04 inch from the end of the dowel. Dowels are required to be smooth steel bars conforming to ASTM A615/A615M, Grade 40 or 60; ASTM A996/A996M, Grade 50 or 60. Epoxy coat dowels in conformance with Type 1 coating requirements of ASTM A1078/A1078M, to include the ends. Provide grout retention rings that are fully circular metal or plastic devices capable of supporting the dowel until the epoxy hardens. Dowel sleeves or inserts are not permitted.

2.9.2 Dowel Bar Assemblies

Provide dowel bar assemblies that consist of a framework of metal bars or wires arranged to provide rigid support for the dowels throughout the paving operation, with a minimum of four continuous bars or wires extending along the joint line. Provide dowels that are welded to the assembly or held firmly by mechanical locking arrangements that prevent them from rising, sliding out, or becoming distorted during paving operations.

2.10 EPOXY RESIN

Provide epoxy-resin materials that consist of two-component materials conforming to the requirements of ASTM C881/C881M, Class as appropriate for each application temperature to be encountered, except that in addition, the materials meet the following requirements:

a. Type IV, Grade 3 for use for embedding dowels and anchor bolts.

b. Type III, Grade as required for use as patching materials for complete filling of spalls, saw-cut runouts, and other voids and for use in

preparing epoxy resin mortar.

c. Type IV, Grade 1 for use for injecting cracks.

d. Type V, Grade as required for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete.

2.11 EQUIPMENT

Maintain all plant, equipment, tools, and machines used in the work in satisfactory working conditions at all times. Submit the following:

a. Details and data on the batching and mixing plant prior to plant assembly including manufacturer's literature showing that the equipment meets all requirements specified herein.

b. Obtain National Ready Mixed Concrete Association (NRMCA) certification of the concrete plant, at no expense to the Government. Provide inspection report of the concrete plant by an engineer approved by the NRMCA. The NRMCA certified engineer cannot be employed by the primary contractor or a subcontractor. A list of NRMCA approved engineers is available on the NRMCA website at http://www.nrmca.org. Submit a copy of the NRMCA QC Manual Section 3 Concrete Plant Certification Checklist, NRMCA Certificate of Conformance, and Calibration documentation on all measuring and weighing devices prior to uniformity testing.

c. A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the paving equipment.

d. A description of the equipment proposed for the machine and hand placing, consolidating and curing of the concrete mixture. Manufacturer's literature on the paver and finisher, together with the manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the concrete pavement. The literature is required to show that the equipment meets all details of these specifications. Include detailed information on automatic laser controlled systems if proposed for use.

2.11.1 Batching and Mixing Plant

2.11.1.1 Location

Locate the batching and mixing plant on project site as indicated on the drawings. Water and electrical power are available on the project site. Provide operable telephonic or radio communication between the plant and the placing site at all times concreting is taking place.

2.11.1.2 Type and Capacity

Provide a batching and mixing plant consisting of a stationary-type central mix plant, including permanent installations and portable or relocatable plants installed on stable foundations. Provide a plant designed and operated to produce concrete within the specified tolerances, with a minimum capacity of 250 cubic yards per hour, that conforms to the requirements of NRMCA QC 3 including provisions addressing:

1. Material Storage and Handling

2. Batching Equipment
3. Central Mixer
4. Ticketing System
5. Delivery System

2.11.1.3 Tolerances

TABLE 11

BATCH PLANT MIXING TOLERANCES

Materials	Percentage of Required Mass
Cementitious Materials	plus or minus 1
Aggregate	plus or minus 2
Water	plus or minus 1
Admixture	plus or minus 3

For volumetric batching equipment for water and admixtures, the above numeric tolerances apply to the required volume of material being batched. Dilute concentrated admixtures uniformly, if necessary, to provide sufficient volume per batch so that the batchers operate consistently within the above tolerance.

2.11.1.4 Moisture Control

Provide a plant capable of ready adjustment to compensate for the varying moisture contents of the aggregates and to change the quantities of the materials being batched. Provide an electric moisture meter complying with the provisions of COE CRD-C 143 for measuring of moisture in the fine aggregate. Provide a sensing element arranged so that measurement is made near the batcher charging gate of the fine aggregate bin or in the fine aggregate batcher.

2.11.2 Concrete Mixers

Use the project's approved mixture proportions for uniformity testing. Provide stationary or truck mixers that are capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. Do not charge the mixers in excess of the capacity recommended by the manufacturer. Operate the mixers at the drum or mixing blade speed designated by the manufacturer. Maintain the mixers in satisfactory operating condition, with the mixer drums kept free of hardened concrete. Replace mixer blades or paddles when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades or paddles.

2.11.2.1 Stationary Mixers

Stationary mixers are required to be drum or pan mixers. Provide mixers with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. Perform mixer performance (uniformity) testing in accordance with COE CRD-C 55 and with paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION in PART 3.

2.11.2.1.1 Mixing Time and Uniformity for Stationary Mixers

For stationary mixers, before uniformity data are available, the minimum mixing time for each batch after all solid materials are in the mixer, provided that all of the mixing water is introduced before one-fourth of the mixing time has elapsed, is 1 minute for mixers having a capacity of 1 cubic yard. For mixers of greater capacity, increase this minimum time by 20 seconds for each additional 1.33 cubic yard or fraction thereof. Provide uniformity test results meeting the properties required by this specification in addition to meeting the requirements of Table 11. After results of uniformity tests are available, the mixing time may be reduced to the minimum time required to meet uniformity requirements; but if uniformity requirements are not being met, increase the mixing time as directed. Perform mixer uniformity tests at new mixing times immediately after any change in mixing time or volume. Any changes to the mix constituents or sequence of charging the mixer after a batch requires an additional three consecutive passing batches. For regular testing perform all six tests on three consecutive batches of concrete. The range for regular testing is the average of the ranges of the three consecutive batches. Conduct the Regular Test sequence for initial determination of the mixing time or as directed. When regular testing is performed, the concrete is required to meet the limits of any five of the six uniformity requirements listed in Table 11 below.

2.11.2.1.2 Abbreviated Uniformity Test

Conduct the Abbreviated Test sequence for production concrete verification at the frequency specified in Table 17. Provide uniformity test results meeting the fresh and hardened concrete properties required by this specification in addition to meeting the requirements of Table 11. When abbreviated testing is performed, the concrete is required to meet only those requirements listed for abbreviated testing. Abbreviated testing is performed on a single batch of concrete. The range for abbreviated testing is the range for one batch. If more than one mixer is used and all are identical in terms of make, type, capacity, condition, speed of rotation, the results of tests on one of the mixers apply to the others, subject to Government approval.

TABLE 12

UNIFORMITY REQUIREMENTS--STATIONARY MIXERS

Parameter	Regular Tests Allowable Maximum Range for 3 Consecutive Batches	Abbreviated Tests Allowable Maximum Range for 1 Batch
Unit weight of air-free mortar	2.0 pounds per cubic foot	2.0 pounds per cubic foot
Air content	1.0 percent	Not Applicable
Slump	1.0 inch	1.0 inch
Coarse aggregate	6.0 percent	6.0 percent
Compressive strength at 7	10.0 percent	10.0 percent
Water content	1.5 percent	Not Applicable

2.11.2.2 Truck Mixers

Truck mixers are not allowed for mixing or transporting slipformed paving

concrete. Provide only truck mixers designed for mixing or transporting paving concrete with extra large blading and rear opening specifically for low-slump paving concrete. Provide truck mixers, the mixing of concrete therein, and concrete uniformity and testing thereof that conform to the requirements of ASTM C94/C94M. Any changes to the mix constituents or sequence of charging the truck mixer requires an additional three consecutive passing batches. Determine the number of revolutions between 70 to 100 for truck-mixed concrete and the number of revolutions for shrink-mixed concrete by uniformity tests as specified in ASTM C94/C94M and in requirements for mixer performance stated in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION in PART 3. If requirements for the uniformity of concrete are not met with 100 revolutions of mixing after all ingredients including water are in the truck mixer drum, discontinue use of the mixer until the condition is corrected. Water is not allowed to be added after the initial introduction of mixing water except, when on arrival at the job site, the slump is less than specified and the water-cement ratio is less than that given as a maximum in the approved mixture. Additional water may be added to bring the slump within the specified range provided the approved water-cement ratio is not exceeded. Inject water into the head of the mixer (end opposite the discharge opening) drum under pressure, and turn the drum or blades a minimum of 30 additional revolutions at mixing speed. The addition of water to the batch at any later time is not allowed.

2.11.3 Transporting Equipment

Provide non-agitating equipment conforming to ASTM C94/C94M or approved open top agitators for slipformed paving concrete transportation. Provide non-agitating equipment or approved truck mixers conforming to ASTM C94/C94M for fixed form and hand placement paving concrete transportation. Truck mixers are not allowed for mixing or transporting slipformed paving concrete. All truck mixers are to bedesigned with extra large blading and rear opening specifically for low slump concrete. Provide transporting equipment designed and operated to deliver and discharge the required concrete mixture completely without segregation.

2.11.4 Transfer and Spreading Equipment

Provide a Material Transfer Vehicle (MTV) capable of moving between the hauling equipment and the paver and equipped with a swing conveyor that delivers material to the paver from outside the paving lane without making contact with the paver while allowing the paver to operate at a constant speed.

2.11.5 Paver-Finisher

Provide paver-finisher consisting of a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement, with a minimum weight of 2200 pounds per foot of lane width, and powered by an engine having a minimum 6.0 horsepower per foot of lane width. The paver-finisher is required to spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The mechanisms for forming the pavement are required to be easily adjustable in width and thickness. In addition to other spreaders required by paragraph above, equip the paver-finisher with a full width knock-down auger or plow mechanism, capable of operating in both directions, which evenly spreads the fresh concrete in front of the screed or extrusion plate.

2.11.5.1 Vibrators

Provide gang mounted immersion vibrators at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete, as required. Provide vibrators that are automatically controlled to immediately stop as forward motion of the paver ceases. Equip the paver-finisher with an electronic vibrator monitoring device displaying the operating frequency of each individual internal vibrator with a readout display visible to the paver operator that operates continuously while paving, and displays all vibrator frequencies with manual or automatic sequencing among all individual vibrators. Discontinue paving if the vibrator monitoring system fails to operate properly during the paving operation. Provide the spacing of the immersion vibrators across the paving lane as necessary to properly consolidate the concrete, with a maximum clear distance between vibrators of 30 inches and outside vibrators a maximum of 12 inches from the lane edge. Determine vibrator frequency and amplitude per COE CRD-C 521.

2.11.5.2 Screed or Extrusion Plate

Equip the paver-finisher with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface and finish the surface that no significant amount of hand finishing, except use of cutting straightedges, is required. Provide adjustment for variation in lane width or thickness and to prevent more than 8 inches of the screed or extrusion plate extending over previously placed concrete on either side when paving fill-in lanes. Repair or replace machines that cause displacement of properly installed forms or cause ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures.

2.11.5.3 Longitudinal Mechanical Float

A longitudinal mechanical float may be used. If used, provide a float that is specially designed and manufactured to smooth and finish the pavement surface without working excess paste to the surface and is rigidly attached to the rear of the paver-finisher or to a separate self-propelled frame spanning the paving lane. Provide float plate at least 5 feet long by 8 inches wide that automatically oscillates in the longitudinal direction while slowly moving from edge to edge of the paving lane, with the float plate in contact with the surface at all times.

2.11.5.4 Other Types of Finishing Equipment

Clary screeds (triple drum roller screeds), other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to approval. Only use vibrating screeds or pans for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

2.11.5.5 Fixed Forms

Provide paver-finisher equipped with wheels designed to ride the forms, keep it aligned with the forms, and spread the load so as to prevent deformation of the forms. When traveling on new or existing concrete to remain, provide paver-finishers traveling on guide rails located outside of the paving lane that are equipped with wheels that will not cause

damage or spalling to concrete joint edges to remain. Alternatively, a modified slipform paver that straddles the forms may be used. Provide a modified slipform paver which has the side conforming plates removed or rendered ineffective and travels over or along pre-placed fixed forms.

2.11.5.6 Slipform

Provide an automatically controlled slipform paver-finisher that is crawler mounted with padded tracks so as to be completely stable under all operating conditions and provide a finish to the surface and edges so that no edge slump beyond allowable tolerance occurs. Provide suitable moving side forms that are adjustable and produce smooth, even edges, perpendicular to the top surface and meeting specification requirements for alignment, edge slump, and joint face deformation.

2.11.6 Curing Equipment

Provide equipment for applying membrane-forming curing compound mounted on a self-propelled frame that spans the paving lane. Constantly agitate the curing compound reservoir mechanically (not air) during operation and provide a means for completely draining the reservoir. Provide a spraying system that consists of a mechanically powered pump which maintains constant pressure during operation, an operable pressure gauge, and either a series of spray nozzles evenly spaced across the lane to provide uniformly overlapping coverage or a single spray nozzle which is mounted on a carriage which automatically traverses the lane width at a speed correlated with the forward movement of the overall frame. Protect all spray nozzles with wind screens. Calibrate the spraying system in accordance with ASTM D2995, Method A, for the rate of application required in paragraph MEMBRANE CURING. Provide hand-operated sprayers allowed by that paragraph with compressed air supplied by a mechanical air compressor. Immediately replace curing equipment if it fails to apply an even coating of compound at the specified rate.

2.11.7 Texturing Equipment

Provide texturing equipment as specified below. Before use, demonstrate the texturing equipment on the test section, and modify the equipment as necessary to produce the texture directed.

2.11.7.1 Burlap Drag

Securely attach a burlap drag to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. Provide length of the material between 24 to 36 inches dragging flat on the pavement surface and with a width at least equal to the width of the slab. Provide clean, reasonably new burlap material, completely saturated with water before attachment to the frame, moistened before start of use, and kept clean and maintained moist during use. Provide burlap conforming to AASHTO M 182, Class 3 or 4. Burlap drag is not to include any impervious layers, such as a polyethylene layer.

2.11.8 Sawing Equipment

Provide equipment for sawing joints and for other similar sawing of concrete consisting of standard diamond-type concrete saws mounted on a wheeled chassis which can be easily guided to follow the required alignment. Provide diamond tipped blades. If demonstrated to operate properly, abrasive blades may be used. Provide spares as required to

maintain the required sawing rate. Provide saws capable of sawing to the full depth required. Early-entry saws may be used, subject to demonstration and approval. No change to the initial sawcut depth is permitted.

2.11.9 Straightedge

Provide and maintain at the job site, in good condition, a minimum 12 foot straightedge for each paving train for testing the hardened portland cement concrete surfaces. Provide straightedges constructed of aluminum or magnesium alloy and blades of box or box-girder cross section with flat bottom, adequately reinforced to maintain rigidity and accuracy. Provide straightedges with handles for operation on the pavement.

2.11.10 Work Bridge

Provide a self-propelled work bridge capable of spanning the required paving lane width where workmen can efficiently and adequately reach the pavement surface.

2.11.11 Hand Finishing Tools

Provide hand finishing equipment in accordance with the provisions of this specification. Use the hand method only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Keep supplemental hand finishing for machine finished pavement to an absolute minimum. Do not seal the paving surface with steel trowels.

2.12 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

2.12.1 Specified Flexural Strength

Specified flexural strength, R, for concrete is 650 psi at 90 days, as determined by tests made in accordance with ASTM C78/C78M of beams fabricated and cured in accordance with ASTM C192/C192M.

2.12.2 Allowable Water-Cementitious Materials Ratio

The allowable water-cementitious material ratio is 0.38 to 0.45. The water-cementitious material ratio is the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus SCM by the mass equivalency method described in ACI 211.1.

2.12.3 Air Content

Provide concrete that is air-entrained with a total air content of 4.0 plus or minus 1.5 percentage points, at the point of placement. Determine air content in accordance with ASTM C231/C231M.

2.12.4 Slump

The maximum allowable slump of the concrete at the point of placement is listed in Table 12.

TABLE 13	
MAXIMUM ALLOWABLE SLUMP	
Placement Method	Maximum Slump
Slipform	As required to meet edge slump and joint face deformation limits
Fixed Form	2 inches
Hand Placement utilizing Other Types of Finishing Equipment	3 inches

The selected slump is applicable to both pilot and fill-in lanes. Perform separate trial mixture studies for each placement method, as specified in paragraph Trial Mixture Studies.

2.12.5 Concrete Temperature

The temperature of the concrete as delivered is required to conform to the requirements of paragraphs Paving In Hot Weather and Paving In Cold Weather. Determine the temperature of concrete in accordance with ASTM C1064/C1064M.

2.12.6 Concrete Strength for Final Acceptance

The strength of the concrete will be considered acceptable when the average equivalent 90-day flexural strengths for each lot are above the 'Specified Flexural Strength' as determined by correlation with 14-day compressive strength tests specified in paragraph Mixture Proportioning For Flexural Strength below, and no individual set (2 specimens per sublot) in the lot are 25 psi or more below the equivalent 'Specified Flexural Strength'. If any lot or sublot, respectively, fails to meet the above criteria, remove and replace the lot or sublot at no additional cost to the Government. This is in addition to and does not replace the average strength required for day-to-day CQC operations as specified in paragraph Average Cqc Flexural Strength Required For Mixtures, below.

2.13 MIXTURE PROPORTIONS

2.13.1 Mixture Proportions Composition

Provide concrete composed of cementitious material, water, fine and coarse aggregates, and admixtures. Include supplementary Cementitious Materials (SCM) choice and usage in accordance with paragraph Supplementary Cementitious Materials (SCM) Content. Provide a minimum total cementitious materials content of 517 pounds per cubic yard. Limit the total alkali loading contributed by the portland cement or the portland cement portion of a blended cement to a maximum of 3.0 lb per cubic yard. Calculate the alkali loading as the product of the portland cement content of the concrete multiplied by the alkali content of the portland cement or the portland cement portion of the blended cement, divided by 100. Determine the alkali content in accordance with ASTM C114. Acceptable admixtures consist of air entraining admixture and may also include, as approved, water-reducing and retarding admixtures.

2.13.2 Proportioning Studies

Perform trial design batches, mixture proportioning studies, and testing, at no expense to the Government. Submit for approval the Preliminary Proposed Proportioning to include items a., b., and i. below a minimum of 21 days prior to beginning a mixture proportioning study. Submit the results of the mixture proportioning studies signed and stamped by the registered professional engineer having technical responsibility for the mix design study, and submitted at least 30 days prior to commencing concrete placing operations. Include a statement summarizing the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard basis. Base aggregate quantities on the mass in a saturated surface dry condition. Provide test results demonstrating that the proposed mixture proportions produce concrete of the qualities indicated. Base methodology for trial mixtures having proportions, slumps, and air content suitable for the work as described in ACI 211.1, modified as necessary to accommodate flexural strength. ACI 211.1 can be supplemented with ACI 325.14R. Submit test results including:

a. Individual coarse and fine aggregate gradations and plots that meet ASTM C33. Include historic gradation averages and standard deviations on individual sieves for each aggregate size group produced within the past 12 months. Historical gradation averages are not to be utilized for the Proportioning Studies.
b. Combined aggregate gradation and coarseness vs. workability plots.
c. Coarse aggregate quality test results. Report the Aggregate Correction Factor (ACF).
d. Fine aggregate quality test results.
e. Mill certificates for cement and supplementary cementitious materials.
f. Certified test results for air entraining, water reducing, retarding, non-chloride accelerating admixtures.
g. Specified flexural strength, slump, and air content.
h. Documentation of required average CQC flexural strength, Ra.
i. Recommended proportions and volumes for each proposed mixture for each proposed placement method (slipform, fixed form, and hand placement) if different. Include three trial water-cementitious materials ratios for each proposed placement method (slipform, fixed form, and hand placement).
j. Individual beam breaks.
k. Flexural strength summaries and plots.
l. Correlation ratios for acceptance testing and CQC testing.
m. Historical record of ACI 214R strength test results, documenting production standard deviation (if available).
n. Narrative discussing methodology on how the mix design was developed in accordance with ACI 211.1 and ACI 325.14R.
o. Alternative aggregate blending to be used during the test section if necessary to meet the required surface and consolidation requirements.

2.13.2.1 Water-Cementitious Materials Ratio

Perform at least three different water-cementitious materials ratios, within the limits specified in paragraph Allowable Water-Cementitious Materials Ratio, which produce a range of strength encompassing that required on the project. The minimum and maximum water-cementitious materials ratios of the approved mix design become the minimnum and maximum water-cementitious materials ratio for the project during production.

2.13.2.2 Trial Mixture Studies

Perform separate sets of trial mixture studies made for each combination of cementitious materials and each combination of admixtures proposed for use. No combinations are to be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerating or retarding admixture can be used without separate trial mixture study. Perform separate trial mixture studies for each placing method (slip form, fixed form, or hand placement) proposed. Report the temperature of concrete in each trial batch. Design each mixture to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding. Proportion laboratory trial mixtures for maximum slump and air content, as permitted by the placement method being utilized.

2.13.2.3 Mixture Proportioning for Flexural Strength

Follow the step by step procedure below:

a. Fabricate all beams for each mixture from the same batch or blend of batches. Fabricate and cure all beams in accordance with ASTM C192/C192M, using 6 x 6 inches steel beam molds.

b. Cure test beams from each mixture for 3, 7, 14, and 90-day flexural tests; 6 beams to be tested per age.

c. Test beams in accordance with ASTM C78/C78M.

d. Using the average strength for each w/c at each age, plot all results from each of the three mixtures on separate graphs for w/c versus:
    3-day flexural strength
    7-day flexural strength
    14-day flexural strength
    90-day flexural strength

e. From these graphs select a w/c that produces a mixture giving a 90-day flexural strength equal to the required strength determined in accordance with paragraph Average CQC Flexural Strength Required for Mixtures.

f. Using the above selected w/c, select from the graphs the expected 3, 7 and 14-day flexural strengths.

g. From the above expected strengths for the selected mixture, determine the Ratio of the 7-day flexural strength of the selected mixture to the 90-day flexural strength of the mixture (for CQC control).

h. From the above expected strengths for the selected mixture, determine the Ratio of the 14-day flexural strength of the selected mixture to the 90-day flexural strength of the mixture (for acceptance).

i. If there is a change in materials, perform additional mixture design studies using the new materials and determine new Correlation Ratios.

j. No concrete pavement placement is allowed until the mixture proportions are approved. The approved water-cementitious materials ratio is restricted to the minimum and maximum values specified in paragraph Water-Cementitious Materials Ratio and is not to be increased without written approval.

2.13.3 Average CQC Flexural Strength Required for Mixtures

a. In order to meet the strength requirements specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES during production, the mixture proportions selected during mixture proportioning studies and used during construction require an average CQC flexural strength, Ra, exceeding the specified flexural strength, R, by the amount indicated below.

b. The required average CQC flexural strength, Ra, is used only for proportioning studies and CQC operations as specified in paragraph Concrete Strength Testing for CQC.

c. Acceptance of production flexural strength results is based on the specified flexural strength R specified in paragraph: Specified Flexural Strength.

2.13.3.1 From Previous Test Records

Where a concrete production facility has previous test records current to within 18 months, establish a standard deviation in accordance with the applicable provisions of ACI 214R. Include test records from which a standard deviation is calculated that represent materials, quality control procedures, and conditions similar to those expected, that represent concrete produced to meet a specified flexural strength or strengths within 150 psi of the 90-day flexural strength specified for the proposed work, and that consist of at least 30 consecutive tests. Perform verification testing to document the current strength. A strength test is the average of the strengths of two specimens made from the same sample of concrete and tested at 90 days. Required average CQC flexural strength, Ra, used as the basis for selection of concrete proportions is the value from the equation that follows, using the standard deviation as determined above:

$$Ra = R + 1.34S$$

Where: S = standard deviation
R = specified flexural strength
Ra = required average CQC flexural strength

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, establish a standard deviation as the product of the calculated standard deviation and a modification factor from Table 13:

TABLE 14

MODIFICATION FACTOR FOR STANDARD DEVIATION

NUMBER OF TESTS	MODIFICATION FACTOR
20	1.08
25	1.03
30 or more	1.00

2.13.3.2 Without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, determine the required average CQC flexural strength, Ra, by adding 15 percent to the specified flexural strength, R.

PART 3 EXECUTION

3.1 PREPARATION FOR PAVING

Before commencing paving, perform the following actions to prepare for paving operations. If used, place cleaned, coated, and adequately supported forms. Have any reinforcing steel needed at the paving site; all transporting and transfer equipment ready for use, clean, and free of hardened concrete and foreign material; equipment for spreading, consolidating, screeding, finishing, and texturing concrete at the paving site, clean and in proper working order; and all equipment and material for curing and for protecting concrete from weather or mechanical damage at the paving site, in proper working condition, and in sufficient amount for the entire placement.

3.1.1 Weather Precaution

When windy conditions during paving appear probable, have equipment and material at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete. During these conditions, record and report the evaporation rate hourly.

3.1.2 Proposed Techniques

Submit placing and protection methods; paving sequence; jointing pattern; data on curing equipment and profilographs; repair in accordance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS, demolition of existing pavements, as specified; pavement diamond grinding equipment and procedures. Submit for approval the following items:

a. Pavement demolition work plan, presenting the proposed methods and equipment to remove existing pavement and protect pavement to remain in place.

b. A description of the placing and protection methods proposed when concrete is to be placed in or exposed to hot, cold, or inclement weather conditions

c. A detailed paving sequence plan and proposed paving pattern showing all planned construction joints; transverse and longitudinal dowel bar spacing; and identifying pilot lanes, fill-in lanes, and hand placement areas. Include stationing for reference to all sampling and testing performed. Deviations from the jointing pattern shown on the drawings are not allowed without written approval of the design engineer.

d. Plan and equipment proposed to control alignment of sawn joints within the specified tolerances.

e. Data on the curing equipment, media and methods to be used.

f. Data on profilograph and methods to measure pavement smoothness.

g. A description of the equipment and methods to be used for grinding and repairs.

3.2 CONDITIONING OF UNDERLYING MATERIAL

3.2.1 General Procedures

Confirm the underlying material upon which concrete is to be placed is clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, confirm the underlying material is well drained and has been satisfactorily graded and uniformly compacted in accordance with the applicable contract documents. Test the surface of the underlying material to crown, elevation, and density in advance of setting forms or of concrete placement using slip-form techniques. Trim high areas to proper elevation. Fill and compact low areas to a condition similar to that of surrounding grade, or fill with concrete monolithically with the pavement. Low areas filled with concrete are not to be cored for thickness to avoid biasing the average thickness used for evaluation and payment adjustment. Rework and compact any underlying material disturbed by construction operations to specified density immediately in front of the paver. If a slipform paver is used, continue the same underlying material beyond the edge of the lane a sufficient distance to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane.

3.2.2 Traffic on Underlying Material

After the underlying material has been prepared for concrete placement, equipment is not permitted thereon with exception of the paver. Subject to specific approval, crossing of the prepared underlying material at specified intervals for construction purposes may be permitted, provided rutting or indentations do not occur. Rework and repair the surface before concrete is placed. Transporting equipment is not to be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher.

3.3 WEATHER LIMITATIONS

3.3.1 Placement and Protection During Inclement Weather

Do not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain. Immediately cover and protect all unhardened concrete from rain or other damaging weather. Suspend placement of concrete whenever rain, high winds, or other weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete.

Remove and replace any slab damaged by rain or other weather, as defined in paragraph Weak Surfaces, full depth, by full slab width, to the nearest original joint as specified in paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS, at no expense to the Government.

3.3.2 Paving in Hot Weather

Prepare for hot weather paving in accordance with ACI 305R. When the ambient temperature during paving is expected to exceed 90 degrees F, properly place and finish the concrete in accordance with procedures previously submitted, approved, and as specified herein. Provide concrete that does not exceed the temperature shown in Table 14 below when measured in accordance with ASTM C1064/C1064M at the time of delivery. Cool the mixing water or aggregates or place in the cooler part of the day to obtain an adequate placing temperature. Cool steel forms and reinforcing as needed to maintain steel temperatures below 120 degrees F. Cool or protect transporting and placing equipment if necessary to maintain proper concrete placing temperature. Keep the finished surfaces of the newly laid pavement damp by applying a fog spray (mist) with approved spraying equipment until the pavement is covered by the curing medium.

TABLE 15

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature in Degrees F
Greater than 60	90
55-60	85
Less than 55	75

3.3.3 Prevention of Plastic Shrinkage Cracking

During weather with low humidity, and particularly with high temperature and appreciable wind, develop and institute measures to prevent plastic shrinkage cracks from developing. If plastic shrinkage cracking occurs, halt further placement of concrete until protective measures are in place to prevent further cracking. Periods of high potential for plastic shrinkage cracking can be anticipated by use of ACI 305R. In addition to the protective measures specified in the previous paragraph, further protect the concrete placement by erecting shades and windbreaks and by applying fog sprays of water, the addition of monomolecular films, or wet covering. If monomolecular films are used, apply only after finishing is complete, do not use in the finishing process, and follow manufacturer recommendations. Immediately commence curing procedures when such water treatment is stopped. Repair plastic shrinkage cracks in accordance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS. Never trowel over or fill plastic shrinkage cracks with slurry.

3.4 CONCRETE PRODUCTION

Maintain a continuous, uniform forward movement of the paver of not less than 2.5 feet per minute. Provide batching, mixing, and transporting equipment with a capacity sufficient to meet this production rate. Deposit concrete transported in non-agitating equipment in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 90 degrees F, the time is reduced to 30 minutes. Deposit concrete transported in truck mixers in front of the paver within 90 minutes from the time cement has been charged into the mixer drum of the plant or truck mixer. Truck mixers

are not allowed for mixing or transporting slipformed paving concrete. If the ambient temperature is above 90 degrees F, the time is reduced to 60 minutes. Accompany every load of concrete delivered to the paving site with a batch ticket from the operator of the batching plant. Provide batch ticket information required by ASTM C94/C94M on approved forms. In addition provide design quantities in mass or volume for all materials, batching tolerances of all materials, mixture batching time, and design and actual water cementitious materials ratio on each batch delivered, and the time of day on all batch tickets. Provide batch tickets for each truck delivered as part of the lot acceptance package to the placing foreman to maintain on file and deliver them to the Government weekly.

3.4.1 Batching and Mixing Concrete

Remove any equipment which fails to perform as specified immediately from use until properly repaired and adjusted or replaced.

3.4.2 Transporting and Transfer - Spreading Operations

Operate non-agitating equipment only on smooth roads and for haul time less than 30 minutes. Deposit concrete as close as possible to its final position in the paving lane. Operate all equipment to discharge and transfer concrete without segregation. Dumping of concrete in discrete piles is not permitted. No transfer or spreading operation which requires the use of front-end loaders, dozers, or similar equipment to distribute the concrete is permitted. No equipment is permitted to operate on the grade in front of the paver.

3.5 PAVING

3.5.1 General Requirements

Construct pavement with paving and finishing equipment utilizing rigid fixed forms or by use of slipform paving equipment. Provide paving and finishing equipment and procedures resulting in paving lanes of the required width at a rate of at least 2.5 feet of paving lane per minute on a routine basis. Control paving equipment and its operation, and coordinate with all other operations, such that the paver-finisher has a continuous forward movement at a reasonably uniform speed from beginning to end of each paving lane, except for inadvertent equipment breakdown. Backing the paver and refinishing a lane is not permitted. Remove and replace concrete refinished in this manner. Failure to achieve a continuous forward motion requires halting operations, and modifying procedures, equipment, or mix proportions to achieve this requirement. Personnel are not permitted to walk or operate in the plastic concrete at any time. Select paving equipment and procedures which operate properly on the underlying material without causing displacement or other damage.

3.5.2 Consolidation

Consolidate concrete with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. Insert vibrators into the concrete to a depth that provides the best full-depth consolidation but not closer to the underlying material than 2 inches. Excessive vibration is not permitted. If vibrators cause visible tracking in the paving lane, discontinue paving operations until equipment and operations have been modified to prevent it. Consolidate concrete in small, odd-shaped slabs or in isolated

locations inaccessible to the gang-mounted vibration equipment with an approved hand-operated immersion vibrator operated from a bridge spanning the area. Do not use vibrators to transport or spread the concrete. Do not operate hand-operated vibrators in the concrete at one location for more than 20 seconds. Insert hand-operated vibrators between 6 to 15 inches on centers. For each paving train, provide at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) requires the immediate stopping of the paving operation and approved adjustment of the equipment or procedures.

3.5.3 Operation

When the paver approaches a header at the end of a paving lane, maintain a sufficient amount of concrete ahead of the paver to provide a roll of concrete which spills over the header. Provide a sufficient amount of extra concrete to prevent any grout that is formed and carried along ahead of the paver from being deposited adjacent to the header. Maintain the spud vibrators in front of the paver at the desired depth as close to the header as possible before they are lifted. Provide additional consolidation adjacent to the headers by hand-manipulated vibrators. When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provide provisions to prevent damage to the adjacent pavement. Electronically control screeds or extrusion plates so as to prevent them from applying pressure to the existing pavement and to prevent abrasion of the pavement surface. Maintain the overlapping area of existing pavement surface completely free of any loose or bonded foreign material as the paver-finisher operates across it. Pavers using transversely oscillating screeds are not allowed to form fill-in lanes that have widths less than a full width for which the paver was designed or adjusted.

3.5.4 Required Results

Adjust and coordinate the paver-finisher, its gang-mounted vibrators, and operating procedures with the concrete mixture being used, to produce a thoroughly consolidated slab throughout that is true to line and grade within specified tolerances. Provide a paver-finishing operation that produces a surface finish with a minimum, isolated amount of irregularities, tears, voids of any kind, and any other discontinuities in a single pass across the pavement; multiple passes are not permitted. Provide equipment and its operation that produce a finished surface requiring no hand finishing other than the use of cutting straightedges, except in very infrequent instances. Stop paving if any equipment or operation fails to produce the above results. Prior to recommencing paving, properly adjust or replace the equipment, modify the operation, or modify the mixture proportions, in order to produce the required results. No water, other than fog sprays (mist) as specified in paragraph Prevention Of Plastic Shrinkage Cracking above, is allowed to be applied to the concrete or the concrete surface during paving and finishing.

3.5.5 Fixed Form Paving

Provide paving equipment for fixed-form paving and operation that conforms to the requirements of paragraph EQUIPMENT, and all requirements specified herein.

3.5.5.1 Forms for Fixed-Form Paving

a. Provide straight forms made of steel and in sections not less than 10 feet in length that are clean and free of rust or other contaminants. Seal any holes or perforations in forms prior to paving unless otherwise permitted. Maintain forms in place and passable by all equipment necessary to complete the entire paving operation without need to remove horizontal form supports. Provide flexible or curved forms of proper radius for curves of 100-foot radius or less. Provide wood forms for curves and fillets made of well-seasoned, surfaced plank or plywood, straight, and free from warp or bend that have adequate strength and are rigidly braced. Provide forms with a depth equal to the pavement thickness at the edge. Where the project requires several different slab thicknesses, build up forms by bolting or welding a tubular metal section or by bolting wood planks to the bottom of the form to completely cover the underside of the base of the form and provide an increase in depth of not more than 25 percent. Provide forms with the base width of the one-piece or built-up form not less than eight-tenths of the vertical height of the form, except provide forms 8 inches or less in vertical height with a base width not less than the vertical height of the form. Provide forms with maximum vertical deviation of top of any side form, including joints, not varying from a true plane more than 1/8 inch in 10 feet, and the upstanding leg not varying more than 1/4 inch.

b. Provide form sections that are tightly locked and free from play or movement in any direction. Provide forms with adequate devices for secure settings so that when in place they withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment.

c. Set forms for full bearing on foundation for entire length and width and in alignment with edge of finished pavement. Support forms during entire operation of placing, consolidation, and finishing so that forms do not deviate vertically more than 0.01 foot from required grade and elevations indicated. Check conformity to the alignment and grade elevations shown on the drawings and make necessary corrections immediately prior to placing the concrete. Clean and oil the forms each time before concrete is placed. Concrete placement is not allowed until setting of forms has been checked and approved by the CQC team.

d. Do not anchor guide rails for fixed form pavers into new concrete or existing concrete to remain.

3.5.5.2 Form Removal

Keep forms in place at least 12 hours after the concrete has been placed. When conditions are such that the early strength gain of the concrete is delayed, leave the forms in place for a longer time. Remove forms by procedures that do not damage the concrete. Do not use bars or heavy metal tools directly against the concrete in removing the forms. Promptly repair any concrete found to be defective after form removal, using procedures specified or as directed.

3.5.6 Slipform Paving

3.5.6.1 General

Provide paving equipment for slipform paving and the operation thereof that conforms to the requirement of paragraph EQUIPMENT, and all requirements specified herein. Provide a slipform paver capable of shaping the concrete in one pass to the specified and indicated cross section, meeting all tolerances, with a surface finish and edges that require only a very minimum isolated amount of hand finishing. If the paving operation does not meet the above requirements and the specified tolerances, immediately stop the operation and modify any equipment, paving procedures, or the concrete mix in order to resolve the problem. Provide a slipform paver that is automatically electronically controlled from a taut guideline for horizontal alignment and on both sides from a taut guideline for vertical alignment, except that electronic control from a ski operating on a previously constructed adjoining lane is required where applicable for either or both sides. Automatic, electronic controls are required for vertical alignment on both sides of the lane. Control from a slope-adjustment control or control operating from the underlying material is not allowed. Properly adjust side forms on slipform pavers so that the finished edge of the paving lane meets all specified tolerances. Install dowels in longitudinal construction joints as specified below. The installation of these dowels by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete is not permitted.

3.5.6.2 Guideline for Slipform Paving

Accurately and securely install guidelines well in advance of concrete placement. Provide supports at necessary intervals to eliminate all sag in the guideline when properly tightened. Provide guideline consisting of high strength material designed for use as a paving guideline with sufficient tension to remove all sag between supports. Provide supports that are securely staked to the underlying material or make other provisions to keep the supports from displacing when the guideline is tightened or when the guideline or supports are accidentally touched by workmen or equipment during construction. Provide appliances for attaching the guideline to the supports that are capable of easy adjustment in both the horizontal and vertical directions. When it is necessary to leave gaps in the guideline to permit equipment to use or cross underlying material, provide provisions for quickly and accurately replacing the guideline without any delay to the forward progress of the paver. Provide supports on either side of the gap that are secured in such a manner as to avoid disturbing the remainder of the guideline when the portion across the gap is positioned and tightened. Check the guideline across the gap and adjacent to the gap for a distance of 200 feet for horizontal and vertical alignment after the guideline across the gap is tightened. Provide vertical and horizontal positioning of the guideline such that the finished pavement conforms to the alignment and grade elevations shown on the drawings within the specified tolerances for grade and smoothness. The specified tolerances are intended to cover only the normal deviations in the finished pavement that occur under good supervision and do not apply to setting of the guideline. Set the guideline true to line and grade.

3.5.6.3 Stringless Technology

If the use of any type of stringless technology is proposed, submit a

detailed description of the system and perform a trial field demonstration at least one week prior to start of paving. Approval of the control system will be based on the results of the demonstration and on continuing satisfactory operation during paving.

3.5.7 Placing Reinforcing Steel

Provide the type and amount of steel reinforcement indicated. Regardless of placement procedure, provide reinforcing steel free from coatings which could impair bond between the steel and concrete, with reinforcement laps as indicated. Regardless of the equipment or procedures used for installing reinforcement, adequately consolidate the entire depth of concrete. Install steel reinforcement at the required elevation within a tolerance of plus of minus 1/2 inch.

3.5.7.1 Pavement Thickness Greater Than 12 inches

For pavement thickness of 12 inches or more, place an initial lift of concrete on the underlying material to the required elevation of the steel reinforcement, consolidate the initial lift of concrete, place the steel reinforcement upon the surface of the initial lift, place a second lift of concrete to final grade, consolidate, and finish in the required manner. When placement of the second lift causes the steel reinforcement to be displaced horizontally from its original position, provide provisions for increasing the thickness of the initial lift and depressing the steel reinforcement into the unhardened concrete to the required elevation. Limit the increase in thickness only as necessary to permit correct horizontal alignment to be maintained. Remove and replace any portions of the initial lift of concrete that have been placed more than 30 minutes without being covered with the second lift with newly mixed concrete without additional cost to the Government.

3.5.7.2 Pavement Thickness Less Than 12 Inches

For pavements less than 12 inches thick, position the reinforcement on suitable chairs or continuous mesh support devices securely fastened to the subgrade prior to concrete placement. Consolidate concrete after the steel has been placed.

3.5.8 Placing Dowels

Provide a method to install and hold dowels in position that meets the tolerances for location, alignment, and spacing of Table 15. Do not place longitudinal dowels closer than 0.6 times the dowel bar length to the planned joint line. If the last regularly spaced longitudinal dowel is closer than that dimension, move it away from the joint to a location 0.6 times the dowel bar length, but not closer than 6 inches to its nearest neighbor. Resolve dowel interference at a transverse joint-longitudinal joint intersection by deleting the closest transverse dowel. Do not position the end of a transverse dowel closer than 12 inches from the end of the nearest longitudinal dowel. Install dowels as specified in the following subparagraphs.

TABLE 16	
DOWEL ALIGNMENT TOLERANCES	
Dowel Measurement	Tolerance
Horizontal alignment (a)	Maximum of 1/8 inch per foot after the pavement has been completed
Vertical alignment (b)	Maximum of 1/8 inch per foot after the pavement has been completed
Horizontal spacing	plus or minus 5/8 inch, except as otherwise specified above
Vertical location on the face of the slab	plus or minus 1/2 inch
(a) Check horizontal alignment perpendicular to the joint edge with a framing square.	
(b) Measure the vertical alignment of the dowels parallel to the designated top surface of the pavement, except for those across the crown or other grade change joints. Measure dowels across crowns and other joints at grade changes to a level surface.	

3.5.8.1 Contraction Joints

Securely hold dowels in longitudinal and transverse contraction joints within the paving lane in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. Securely hold the basket assemblies in the proper location by means of suitable pins or anchors. Do not cut or crimp the dowel basket tie wires.

3.5.8.2 Construction Joints-Fixed Form Paving

Install dowels by the bonded-in-place method or the drill-and-dowel method. Installation by removing and replacing in preformed holes is not permitted. Prepare and place dowels across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. Provide the spacing of dowels in construction joints as indicated, except that, where the planned spacing cannot be maintained because of form length or interference with form braces, provide closer spacing with additional dowels.

3.5.8.3 Dowels Installed in Hardened Concrete

Install dowels in hardened concrete by bonding the dowels into holes drilled into the hardened concrete. Before drilling commences, cure the concrete for 7 days or until it has reached a minimum field cured flexural strength of 450 psi. Drill holes 1/8 inch greater in diameter than the dowels into the hardened concrete using rotary-core drills. Rotary-percussion drills are permitted, provided that excessive spalling does not occur at the concrete joint face. Excessive spalling is defined

as spalling deeper than 1/4 inch from the joint face or 1/2 inch radially from the outside of the drilled hole. Continuing damage requires modification of the equipment and operation. Drill depth of dowel hole within a tolerance of plus or minus 1/2 inch of the half length of the embedded dowel. Upon completion of the drilling operation, blow out the dowel hole with oil-free, compressed air. Bond dowels in the drilled holes using epoxy resin. Inject epoxy resin at the back of the hole before installing the dowel and extrude to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel is not permitted. Hold the dowels in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic grout retention ring fitted around the dowel. Provide dowels required between new and existing concrete in holes drilled in the existing concrete, all as specified above.

3.5.8.4 Lubricating Dowel Bars

Wipe clean the portion of each dowel intended to move within the concrete and coat with a thin, even film of lubricating oil or light grease before the concrete is placed. Form oil is not acceptable.

3.6 FINISHING

Provide finishing operations as a continuing part of placing operations starting immediately behind the paver. Provide finishing by the machine method. Hand finishing requirements are specifed in paragraph HAND FINISHING. Provide the sequence of operations consisting of transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Provide a work bridge as necessary for consolidation and hand finishing operations. Use the hand method only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Keep supplemental hand finishing for machine finished pavement to an absolute minimum. Immediately stop any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing. Prior to recommencing machine finishing, properly adjust or replace the equipment. Immediately halt any operations which produce more than 1/8 inch of mortar-rich surface (defined in paragraph Weak Surfaces) and modify the equipment, mixture, or procedures as necessary. Compensate for surging behind the screeds or extrusion plate and settlement during hardening and adjust the paving and finishing machines so that the finished surface of the concrete (not just the cutting edges of the screeds) is at the required line and grade. Maintain finishing equipment and tools clean and in an approved condition. Water is not allowed to be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

3.6.1 Machine Finishing With Fixed Forms

Replace machines that cause displacement of the forms. Only one pass of the fixed form finishing machine is allowed over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, immediately stop the operation and adjust the equipment, mixture, and procedures as necessary.

3.6.2 Machine Finishing with Slipform Pavers

Operate the slipform paver so that only a very minimum of additional

finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Immediately modify or replace any equipment or procedure that fails to meet these specified requirements as necessary. A non-rotating pipe float can be used while the concrete is still plastic, to remove minor irregularities and score marks. Only one pass of the pipe float is allowed. If there is concrete slurry or fluid paste on the surface that runs over the edge of the pavement, immediately stop the paving operation and modify the equipment, mixture, or operation to prevent formation of such slurry. Immediately remove any slurry which runs down the vertical edges by hand, using stiff brushes or scrapers. Slurry, concrete or concrete mortar is not allowed to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

3.6.3 Surface Correction and Testing

After all other finishing is completed but while the concrete is still plastic, eliminate minor irregularities and score marks in the pavement surface by means of cutting straightedges. Provide cutting straightedges with a minimum length of 12 feet that are operated from the sides of the pavement or from bridges. Provide cutting straightedges operated from the side of the pavement equipped with a handle 3 feet longer than one-half the width of the pavement. Test the surface for trueness with a straightedge held in successive positions parallel and at right angles to the center line of the pavement, and cover the whole area to detect variations. Advance the straightedge along the pavement in successive stages of not more than one-half the length of the straightedge. Immediately fill depressions with freshly mixed concrete, strike off, consolidate with an internal vibrator, and refinish. Strike off projections above the required elevation and refinish. Continue the straightedge testing and finishing until the entire surface of the concrete is free from observable departure from the straightedge and conforms to the surface requirements specified in paragraph SURFACE SMOOTHNESS. This straightedging is not allowed to be used as a replacement for the straightedge testing of paragraph SURFACE SMOOTHNESS. Use long-handled, flat bull floats very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, stop the paving operation and adjust the equipment, mixture or procedures to eliminate the surface defects. Keep finishing with hand floats and trowels to the absolute minimum necessary. Take extreme care to prevent overfinishing joints and edges. Produce the surface finish of the pavement essentially by the finishing machine and not by subsequent hand finishing operations. All hand finishing operations are subject to approval.

3.6.4 Hand Finishing

Use hand finishing operations only as specified below. Provide a work bridge to be used as necessary for consolidation and placement operations to avoid standing in concrete.

3.6.4.1 Equipment and Template

In addition to approved mechanical internal vibrators for consolidating the concrete, provide a strike-off and tamping template and a longitudinal float for hand finishing. Provide a template at least 1 foot longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, that is constructed of metal or other suitable material shod with metal. Provide a longitudinal float at

least 10 feet long, of approved design, that is rigid and substantially braced to maintain a plane surface on the bottom. Grate tampers (jitterbugs) are not allowed.

3.6.4.2 Finishing and Floating

As soon as the plastic concrete is placed and consolidated, strike off the concrete and screed to the cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement is at the required elevation. Immediately following the final tamping of the surface, float the pavement longitudinally from bridges resting on the side forms and spanning but not touching the concrete. Do not advance the floating operation more than half the length of the float and continue over the new and previously floated surfaces.

3.6.5 Texturing

Before the surface sheen has disappeared and before the concrete hardens or curing compound is applied, texture the surface of the pavement as described herein. After the curing period is complete, thoroughly power broom all textured surfaces to remove all debris.

3.6.5.1 Burlap Drag Surface

Apply surface texture by dragging the surface of the pavement, in the direction of the concrete placement, with an approved burlap drag. Operate the drag with the fabric moist, and maintain the fabric clean. Change as required to keep clean. Perform the dragging so as to produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.6.6 Pavement Penetrations

Construct recesses for the tie-down anchors, lighting fixtures, and other outlets in the pavement to conform to the details and dimensions shown. Carefully finish the concrete in these areas to provide a surface of the same texture as the surrounding area that is within the requirements for plan grade and surface smoothness.

3.7 CURING

3.7.1 Protection of Concrete

Continuously protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Have all equipment needed for adequate curing and protection of the concrete on hand and ready for use before actual concrete placement begins. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove or replace the damaged pavement, and provide another method of curing as directed. Accomplish curing by one of the following methods.

3.7.2 Membrane Curing

Apply a uniform coating of white-pigmented, membrane-forming, curing compound to the entire exposed surface of the concrete as soon as the free water has disappeared from the surface after finishing. Apply immediately along the formed edge faces after the forms are removed. Do not allow the concrete to dry before the application of the membrane. If any drying has

occurred, moisten the surface of the concrete with a fine spray of water, and apply the curing compound as soon as the free water disappears. Apply the curing compound to the finished surfaces by means of an approved automatic spraying machine. Apply the curing compound with an overlapping coverage that provides a two-coat application at a coverage of 400 square feet per gallon, plus or minus 5.0 percent for each coat. A one-coat application is allowed provided it is applied in a uniform application and coverage of 200 square feet per gallon, plus or minus 5.0 percent is obtained. The application of curing compound by hand-operated, mechanical powered pressure sprayers is permitted only on odd widths or shapes of slabs and on concrete surfaces exposed by the removal of forms. When the application is made by hand-operated sprayers, apply a second coat in a direction approximately at right angles to the direction of the first coat. If pinholes, abrasions, or other discontinuities exist, apply an additional coat to the affected areas within 30 minutes. Respray curing compound to concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied. Within the curing period, immediately respray areas where the curing compound is damaged by subsequent construction operations. During the entire curing period, adequately protect membrane-cured concrete surfaces from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.8 JOINTS

3.8.1 General Requirements for Joints

Construct joints that conform to the locations and details indicated and are perpendicular to the finished grade of the pavement. Provide joints that are straight and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch. Where any joint fails to meet these tolerances, remove and replace the slabs adjacent to the joint at no additional cost to the Government. Changes from the jointing pattern shown on the drawings are not allowed without written approval. Seal joints immediately following curing of the concrete or as soon thereafter as weather conditions permit as specified in Section 32 13 73.19 COMPRESSION CONCRETE PAVING JOINT SEALANT.

3.8.2 Longitudinal Construction Joints

Install dowels in the longitudinal construction joints, or thicken the edges as indicated. Install dowelsas specified above. After the end of the curing period, saw longitudinal construction joints to provide a reservoir at the top for sealant conforming to the details and dimensions indicated.

3.8.3 Transverse Construction Joints

Install transverse construction joints at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. Provide transverse construction joints by utilizing headers or by paving through the joint, then full-depth sawcutting the excess concrete. Construct pavement with the paver as close to the header as possible, with the paver run out completely past the header. Provide transverse construction joints at a planned transverse joint constructed as shown or, if not shown otherwise, dowelled in accordance with paragraph DOWELS INSTALLED IN HARDENED CONCRETE, or paragraph FIXED FORM PAVING above.

3.8.4 Expansion Joints

Provide expansion joints where indicated, and about any structures and features that project through or into the pavement, using joint filler of the type, thickness, and width indicated, and installed to form a complete, uniform separation between the structure and the pavement or between two pavements. Attach the filler to the original concrete placement with adhesive and mechanical fasteners and extending to the full slab depth. Tightly fit adjacent sections of filler together, with the filler extending across the full width of the paving lane or other complete distance in order to prevent entrance of concrete into the expansion space. Finish edges of the concrete at the joint face with an edger with a radius of 1/8 inch. After placement and curing of the adjacent slab, sawcut the sealant reservoir depth from the filler.

3.8.5 Slip Joints

The contractor may propose utilization of a slip form pause. Attach preformed joint filler material to the face of the original concrete placement with adhesive and mechanical fasteners. Sawcut a 3/4 inch deep reservoir for joint sealant at the top of the joint. Finish edges of the joint face with an edger with a radius of 1/8 inch.

3.8.6 Contraction Joints

Construct transverse and longitudinal contraction joints by an initial sawcut in the concrete with a 1/8 inch blade to the indicated depth. During sawing of joints, and again 24 hours later, inspect all exposed lane edges for development of cracks below the saw cut, and immediately report results. If there are more than six consecutive uncracked joints after 48 hours, saw succeeding joints 25 percent deeper than originally indicated at no additional cost to the Government. Vary the time of initial sawing depending on existing and anticipated weather conditions to prevent uncontrolled cracking of the pavement. Commence sawing of the joints as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. Inspect the sawed faces of joints for undercutting or washing of the concrete due to the early sawing, and delay sawing if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. Continue the sawing operation as required during both day and night regardless of weather conditions. Saw the joints in the sequence of the concrete placement. Provide adequate lighting for night work. Illumination using vehicle headlights is not permitted. Provide a chalk line or other suitable guide to mark the alignment of the joint. Before sawing a joint, examine the concrete closely for cracks, and do not saw the joint if a crack has occurred near the planned joint location. Discontinue sawing if a crack develops ahead of the saw cut. Immediately after the joint is sawed, thoroughly flush the saw cut and adjacent concrete surface with water and vacuum until all waste from sawing is removed from the joint and adjacent concrete surface. Properly protect the concrete from damage and cure at sawed joints. Tightly seal the top of the joint opening and the joint groove at exposed edges with cord backer rod before the concrete in the region of the joint is resprayed with curing compound, and maintain until removed immediately before sawing the joint sealant reservoir. Respray the surface with curing compound as soon as free water disappears. Seal the exposed saw cuts on the vertical faces of pilot lanes with bituminous mastic or masking tape. After expiration of the curing period, widen the upper portion of the groove by sawing with ganged

diamond saw blades to the width and depth indicated for the joint sealer. Center the reservoir over the initial sawcut.

3.8.7 Thickened Edge Joints

Construct thickened edge joints as indicated on the drawings. Grade the underlying material in the transition area as shown and meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.9 REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS

3.9.1 General Criteria

Repair or remove and replace new pavement slabs as specified at no cost to the Government. Removal of partial slabs is not permitted. Prior to any repairs, submit a Repair Recommendations Plan detailing areas exceeding the specified limits as well as repair recommendations required to bring these areas within specified tolerances.

3.9.2 Repair of Free Edge Lane Vertical Faces

Repair excessive edge slump and joint face deformation while concrete is in a plastic state by approved methods using forms in accordance with paragraph Forms for Fixed-Form Paving.

3.9.3 Slabs with Cracks

The Government may require cores to be taken over cracks to determine depth of cracking. Drill cores with a minimum diameter of 6 inches, and backfill with an approved concrete mixture. Perform drilling of cores and filling of holes at no expense to the Government. Clean cracks that do not exceed 2 inches in depth; then pressure inject full depth with epoxy resin, Type IV, Grade 1. In lieu of injectable epoxy the following may be used:

a. For cracks of a width less than or equal to 0.015 inch: A High Molecular Weight Methyl Methacrylate (HMWMMA) with a neat monomer viscosity of less than or equal to 50 centipoise and greater than 5 centipoise as measured using ASTM D2196. If measuring the viscosity of a catalyzed or polymerization initiated HMWMMA the viscosity as measured using ASTM D2196 must be less than or equal to 60 centipoise and greater than 5 centipoise.

b. For crack widths greater than 0.015 inch: A HMWMMA with a neat monomer viscosity of less than 300 centipoise as measured using ASTM D2196. The cured surface of the MMA must be flush with the surface of the surrounding PCC Plus or minus 1/16 inch.

c. Do not apply HMWMMA to surfaces larger than 25 square feet prior to 70 days of curing of the PCC. Perform a test section with the HMWMMA product manufacturer's representative present before production application in the presence of the government.

Remove and replace slabs containing cracks deeper than 2 inches.

3.9.4 Removal and Replacement of Full Slabs

Remove new or existing slabs damaged during construction that contain more

than 15.0 percent of each longitudinal or transverse joint edge spalled. Where it is necessary to remove full slabs, remove in accordance with paragraph Removal Of Existing Pavement Slab below. Remove and replace full depth, by full width of the slab, and extend to each original joint. Compact and shape the underlying material as specified in the appropriate section of these specifications, clean the surfaces of all four joint faces of all loose material and contaminants, and coat with a double application of membrane forming curing compound as a bond breaker and to protect concrete that has not been cured for at least 7 days. Install dowels of the size and spacing as specified for other joints in similar pavement by epoxy grouting them into holes drilled into the existing concrete using procedures as specified in paragraph PLACING DOWELS, above. Provide dowels for all four edges of the new slab. Cut off original damaged dowels flush with the joint face. Lightly oil or grease protruding portions of new dowels. Place concrete as specified for original construction. Take care to prevent any curing compound from contacting dowels. Prepare and seal the resulting joints around the new slab as specified for original construction.

3.9.5 Repairing Spalls Along Joints

Repair spalls along joints to be sealed to a depth to restore the full joint-face support prior to placing adjacent pavement. Where directed, repair spalls along joints of new slabs, along edges of adjacent existing concrete, and along parallel cracks by first making a vertical saw cut at least 3 inches outside the spalled area and to a depth of at least 2 inches. Provide saw cuts consisting of straight lines forming rectangular areas without sawing beyond the intersecting saw cut. Chip out the concrete between the saw cut and the joint, or crack, to remove all unsound concrete and into at least 1/2 inch of visually sound concrete. Thoroughly clean the cavity thus formed with high pressure water jets supplemented with oil-free compressed air to remove all loose material. Immediately before filling the cavity, apply a prime coat to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. Apply the prime coat in a thin coating and scrub into the surface with a stiff-bristle brush. Provide prime coat for portland cement repairs consisting of a neat cement grout and for epoxy resin repairs consisting of epoxy resin, Type III, Grade 1. Fill the prepared cavity with material identified in Table 16 based on the cavity volume.

TABLE 17

SPALL REPAIRS

Volume of Prepared Cavity After Removal Operations	Material
less than 0.03 cubic foot	epoxy resin mortar or epoxy resin or latex modified mortar
0.03 cubic foot and 1/3 cubic foot	portland cement mortar
more than 1/3 cubic foot	portland cement concrete or latex modified mortar

Provide portland cement concretes and mortars that consist of very low slump mixtures, 1/2 inch slump or less, proportioned, mixed, placed, consolidated by tamping, and cured, all as directed. Provide epoxy resin

mortars made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved. Proprietary patching materials may be used, subject to Government approval. Place the epoxy resin materials in the cavity in layers with a maximum thickness of 2 inches. Provide adequate time between placement of additional layers such that the temperature of the epoxy resin material does not exceed 140 degrees F at any time during hardening. Provide mechanical vibrators and hand tampers to consolidate the concrete or mortar. Remove any repair material on the surrounding surfaces of the existing concrete before it hardens. Where the spalled area abuts a joint, provide an insert or other bond-breaking medium to prevent bond at the joint face. For existing joints, seal the bottom contraction crack with backer rod to prevent instrusion of primer or mortar. Saw a reservoir for the joint sealant to the dimensions required for other joints. Thoroughly clean the reservoir and then seal with the sealer specified for the joints. In lieu of sawing, spalls and popouts, less than 6 inches in maximum dimension and not adjacent to a joint, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. Repair the core hole as specified above for other spalls.

3.9.6 Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Rain damaged pavement is pavement with coarse aggregate exposed at the surface. Cores evaluated by a qualified petrographer to contain carbonation to a depth greater than 1/8 inch or Mohs hardness of less than 2, when tested in accordance with ASTM C1895, are also considered rain damaged. A mortar-rich surface is defined as pavement deficient in plus 4.75 mm U.S. No. 4 sieve size aggregate. Diamond grind slabs containing weak surfaces less than 1/4 inch thick to remove the weak surface. Diamond grind in accordance with paragraph Diamond Grinding Of PCC Surfaces. All diamond ground areas are required to meet the thickness, smoothness and plan grade criteria specified in PART 1 GENERAL. Remove and replace slabs containing weak surfaces greater than 1/4 inch thick.

3.9.7 Repair of Pilot Lane Vertical Faces

Repair excessive edge slump and joint face deformation while concrete is in a plastic state by approved methods.

3.10 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Demolition of existing operational pavement is not allowed prior to approval of the Proportioning Studies. Remove existing concrete pavement at locations indicated on the drawings. Prior to commencing pavement removal operations, inventory the pavement distresses (cracks, spalls, and corner breaks) along the pavement edge to remain. After pavement removal, survey the remaining edge again to quantify any damage caused by removal operations. Perform both surveys in the presence of the Government. Perform repairs as indicated and as specified herein. Carefully control all operations to prevent damage to the concrete pavement and to the underlying material to remain in place. Perform all saw cuts perpendicular to the slab surface, forming rectangular areas. Perform all existing concrete pavement repairs prior to paving adjacent lanes.

3.10.1 Removal of Existing Pavement Slab

When existing concrete pavement is to be removed and adjacent concrete is to be left in place, perform the first full depth saw cut on the joint between the removal area and adjoining pavement to stay in place with a standard diamond-type concrete saw. Next, perform a full depth saw cut parallel to the joint that is at least 24 inches from the joint and at least 6 inches from the end of any dowels with a wheel saw as specified in paragraph SAWING EQUIPMENT. Remove all pavement beyond this last saw cut in accordance with the approved demolition work plan. Remove all pavement between this last saw cut and the joint line by carefully pulling pieces and blocks away from the joint face with suitable equipment and then picking them up for removal. In lieu of this method, this strip of concrete may be carefully broken up and removed using hand-held jackhammers, 30 lb or less, or other approved light-duty equipment which does not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. In lieu of the above specified removal method, the slab may be sawcut full depth to divide it into several pieces and each piece lifted out and removed. Use suitable equipment to provide a truly vertical lift, and safe lifting devices used for attachment to the slab.

3.10.2 Edge Repair

Protect the edge of existing concrete pavement against which new pavement abuts from damage at all times. Remove and replace slabs which are damaged during construction as directed at no cost to the Government. Repair of previously existing damaged areas is considered a subsidiary part of concrete pavement construction. Saw off all exposed keys and keyways full depth.

3.10.2.1 Spall Repair

Repair spalls caused by construction activities if less than 15.0 percent of any slab's edge. Provide repair materials and procedures as previously specified in paragraph, Repairing Spalls Along Joints. Remove and replace full slabs if spalls exceed 15.0 percent of any slab's edge as specified in paragraph, Removal and Replacement of Full Slabs.

3.10.2.2 Underbreak and Underlying Material

Repair all underbreak by removal and replacement of the damaged slabs in accordance with paragraph REMOVAL AND REPLACEMENT OF FULL SLABS above. Protect the underlying material adjacent to the edge of and under the existing pavement which is to remain from damage or disturbance during removal operations and until placement of new concrete, and shape as directed. Maintain sufficient underlying material in place outside the joint line to completely prevent disturbance of material under the pavement which is to remain in place. Remove and replace any slab with underlying material that is disturbed or loses its compaction.

3.11 PAVEMENT PROTECTION

Exclude traffic from the new pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment is permitted on the new pavement after the pavement has been cured for 7 days, the joints have been sealed or

otherwise protected, the concrete has attained a minimum field cured flexural beam strength of 550 psi and approved means are provided to prevent damage to the slab edge. Fabricate and field cure specimens in accordance with ASTM C31/C31M. Continuously maintain all new and existing pavement carrying construction traffic or equipment completely clean, and clean up spillage of concrete or other materials immediately upon occurrence. Take special care in areas where traffic uses or crosses active airfield pavement. Power broom other existing pavements at least daily when traffic operates. For fill-in lanes, provide equipment that does not damage or spall the edges or joints of the previously constructed pavement. Protect the pavement against all damage prior to final acceptance of the work by the Government. Placement of aggregates, rubble, or other similar construction materials on airfield pavements is not allowed.

3.12 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION

3.12.1 Testing and Inspection by Contractor

During construction, perform sampling and testing of aggregates, cementitious materials (cement and pozzolan), and concrete to determine compliance with the specifications. Provide facilities and labor for procurement of representative test samples. Furnish sampling platforms and belt templates to obtain representative samples of aggregates from charging belts at the concrete plant. Obtain samples of concrete at the point of delivery to the paver. Testing by the Government in no way relieves the specified testing requirements. Perform the inspection and tests described below, and based upon the results of these inspections and tests, take the action required and submit reports as required. Perform this testing regardless of any other testing performed by the Government, either for pay adjustment purposes or for any other reason. Include stationing for all sampling and testing.

3.12.2 Testing and Inspection Requirements

Perform CQC sampling, testing, inspection and reporting in accordance with the following Table. Retest aggregate sources and stockpiles in accordance with Table 17 if not used within the previous 3 months.

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
Fine Aggregate Gradation and Fineness Modulus			
2 per lot	ASTM C136/C136M sample at belt	9 of 10 tests vary less than 0.15 from average	Retest, resolve, retest
		Outside limits on any sieve	Retest
		2nd gradation failure	Stop, resolve, retest
1 per 10 gradations	ASTM C117	Outside limits on any sieve	Retest
		2nd gradation failure	Stop, repair, retest
Coarse Aggregate Gradation (each aggregate size)			

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
2 per lot	ASTM C136/C136M sample at belt	Outside limits on any sieve	Retest
		2nd gradation failure	report to COR, correct
		2 consecutive averages of 5 tests outside limits	report to COR, stop ops, repair, retest
1 per 10 gradations	ASTM C117	Outside limits on any sieve	Retest
		2nd gradation failure	report to COR, correct
		2 consecutive averages of 5 tests outside limits	report to COR, stop ops, repair, reverify all operations
Workability Factor and Coarseness Factor Computation			
Same as C.A. and F.A.	see paragraph AGGREGATES	Use individual C.A. and F.A. gradations. Combine using batch ticket percentages (average of aggregate percentages from 3 before and 3 after sampling). Tolerances: plus or minus 3 points on WF; plus or minus 5 points on CF from approved adjusted mix design values; only the portion of the tolerance box within the parallelogram is available for use	Check batching tolerances, recalibrate scales
		2 consecutive averages of 5 tests outside limits	Stop production paving, report to COR, and revise materials and operations to be in compliance prior to restarting production paving
Aggregate Deleterious, Quality, and ASR Tests			
Every 30 days of concrete production	see paragraph AGGREGATES		Stop production, retest, replace aggregate. Increase testing interval to 90 days if previous 2 tests pass
Plant - Scales, Weighing Accuracy			

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
Monthly	NRMCA QC 3		Stop plant ops, repair, recalibrate
Plant - Batching and Recording Accuracy			
Weekly	Record/Report	Record required/recorded/actual batch mass	Stop plant ops, repair, recalibrate
Plant - Batch Plant Control			
Every lot	Record/Report		Record type and amount of each material per lot
Plant - Mixer Uniformity - Stationary Mixers			
Before test section and Every 4 months during paving or Every 6 months when not generating production paving	COE CRD-C 55	After initial approval, use abbreviated method	Increase mixing time, change batching sequence, reduce batch size to bring into compliance. Retest
Plant - Mixer Uniformity - Truck Mixers			
Every 4 months during paving	ASTM C94/C94M	Random selection of truck.	Increase mixing time, change batching sequence, reduce batch size to bring into compliance. Retest
Concrete Mixture - Air Content			
When test specimens prepared plus 2 random per lot	ASTM C231/C231M sample at point of discharge within the paving lane	Individual test control chart: Warning plus or minus 1.0	Adjust AEA, retest
		Individual test control chart: Action plus or minus 1.5	Halt operations, repair, retest
		Range between 2 consecutive tests: Warning plus 2.0	Recalibrate AEA dispenser
		Range between 2 consecutive tests: Action plus 3.0	Halt operations, repair, retest
Concrete Mixture - Unit Weight and Yield			

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
Same as Air Content	ASTM C138/C138M sample at point of discharge within the paving lane	Individual test basis: Warning Yield minus 0 or plus 1 percent	Check batching tolerances
		Individual test basis: Action Yield minus 0 or plus 5 percent	Halt operations
Concrete Mixture - Slump			
When test specimens prepared plus 4 random per lot	ASTM C143/C143M sample at point of discharge within the paving lane	Individual test control chart: Upper Warning slipform minus 1/2 inch below max fixed form 1.5 inches hand placement 2.5 inches	Adjust batch masses within max W/C ratio
		Individual test control chart: Upper Action at maximum allowable slump	Stop operations, adjust, retest
		Range between each consecutive test: 1-1/2 inches	Stop operations, repair, retest
Concrete Mixture - Temperature			
When test specimens prepared	ASTM C1064/C1064M sample at point of discharge within the paving lane	See paragraph WEATHER LIMITATIONS	
Concrete Mixture - Strength			
8 per lot	ASTM C31/C31M sample at point of discharge within the paving lane	See paragraph CONCRETE STRENGTH TESTING for CQC Perform fabrication of strength specimens and initial cure outside the paving lane and within 1,000 feet of the sampling point.	
Paving - Inspection Before Paving			
Prior to each paving operation	Report	Inspect underlying materials, construction joint faces, forms, reinforcing, dowels, and embedded items	
Paving - Inspection During Paving			

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
During paving operation		Monitor and control paving operation, including placement, consolidation, finishing, texturing, curing, and joint sawing.	
Paving - Vibrators			
Weekly during paving	COE CRD-C 521	Test frequency (in concrete), and amplitude (in air), average measurement at tip and head.	Repair or replace defective vibrators.
Moist Curing			
2 per lot, min 4 per	Visual		Repair defects, extend curing by 1 day
Membrane Compound Curing			
Daily	Visual	Calculate coverage based on quantity/area	Respray areas where coverage defective. Recalibrate equipment
Cold Weather Protection			
Once per day	Visual		Repair defects, report conditions to COR

3.12.3 Control Charts

Maintain linear control charts for fine and coarse aggregate gradation, combined gradation coarseness factor/workability factor, slump, air content, unit weight, yeld, and 7 and 14 day flexural strengths.

Post the control charts as directed and maintain current at all times. Identify the following on the control charts: the project number, the test parameter being plotted, the individual sample numbers, the Warning and Action Limits listed in Table 17 applicable to the test parameter being plotted, and the test results. Use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Make decisions concerning mix modifications based on analysis of the results provided in the control charts.

3.12.4 Concrete Strength Testing for CQC

Perform Contractor Quality Control operations for concrete strength consisting of the following steps:

a. Take samples for strength tests at the paving site. Fabricate and cure test beams in accordance with ASTM C31/C31M; test them in accordance with ASTM C78/C78M.

b. Fabricate and cure 2 test beams per sublot from the same batch or truckload and at the same time acceptance beams are fabricated and test them for flexural strength at 7-day age.

c. Average all 8 flexural tests per lot. Convert this average 7-day flexural strength per lot to equivalent 90-day flexural strength using the Correlation Ratio determined during mixture proportioning studies.

d. Compare the equivalent 90-day flexural strength from the conversion to the required average CQC flexural strength, Ra.

e. If the equivalent average 90-day strength for the lot is below the required average CQC flexural strength, Ra, by 69 psi flexural strength or more, at any time, adjust the mixture to increase the strength, as approved.

f. Maintain up-to-date control charts for strength, showing the 7-day CQC flexural strength, the Ratio of the 14-day flexural strength to the 90 -day flexural strength (from acceptance tests), and the 90-day flexural strength (from acceptance tests) of each of these for each lot.

3.12.5 Reports

Report all results of tests or inspections conducted as they are completed and in writing daily. Post updated control charts and identify accepted paving lots on the detailed paving sequence paving plan covering the entire period from the start of paving through the current week. These requirements do not relieve the obligation to report failures immediately as required in preceding paragraphs and Section 01 45 00 QUALITY CONTROL. Confirm reports of failures and the corrective action taken in writing in the daily Quality Control reports and within each respective Paving Lot Report. Compile, reduce, analyze and compute pay adjustment factors for all associated test data collected on each paving lot.

Submit complete and comprehensive Paving Lot Reports for the test section and production paving within 16days after the completion of the placement. Do not place an adjacent or contiguous lane/lot prior to providing required pavement data identified in items a.-y. conforming to the acceptance criteria. Payment will not be made until all required data identified in items a.-y. has been submitted and reviewed by the government. Organize each Paving Lot Report by the following specific items. The list below is not all inclusive. Add tests and inspections as appropriate for each specific paving lot constructed.

Table Summary of payment adjustment factors and pass/fail factors Detailed Placement Plan, labeling lots/sublots with stationing. Identify core locations, and testing locations.

Provide narrative addressing the following at a minimum:

a. Protective Measures: Rain, Cold, Hot and/or windy on-site conditions including evaporation rates, high/low ambient temperature. Post-Production protection and traffic control.
b. Success, failures, and issues encountered during all operations associated with the placement to include, but not limited to, batching, transporting, paving, texturing and curing.Include any process control changes that were necessary to meet specified tolerances.
c. Stockpile Management before and during placement.
d. Initial saw cutting operation to include start and finish times (early entry or wet diamond, flushing and vacuuming, backer rod installation and reapplication of curing compound).
e. Finishing operations (cutting straight-edge, automatic longitudinal float, edging tool, minimal hand work and excess paste).
f. Texturing operations to include start and finish times.
g. Curing operations to include start and finish times.
h. Environmental conditions of initial cure facility to include location and temperatures.
i. Planned correction(s) or correction(s) completed
j. Dowel installation

Provide required inspection documentation for the following at a minimum:

k. Batch Plant, Equipment, and Curing Equipment Verification
l. Dowel Baskets, forms, reinforcing, embeds and block-outs
m. Summary of recent underlying material test results showing compliance. Include information such as submittal numbers or date of daily report(s) where the detailed testing data is located.

Quality Control Testing

n. PCC Plastic Mixture Properties (temperature, air content, slump, unit weight)
o. Aggregate gradation test results and CF-WF plot
p. Control Charts
q. Joint Crack Tracking and Record

Acceptance Testing (before and after corrections)

r. Surface Smoothness test results (straightedge and profilograph) in both longitudinal and transverse directions.
s. Edge Slump test results(identify excessive, lost and rebuilt edge(s)).
t. Joint Face Deformation test results.
u. Plan Grade: table providing x, y, and elevation values versus design values signed by licensed surveyor.
v. Strength: beam/cylinder strength results (with updated correlation ratios and control chart).
w. Cores: Locations/Stationing of cores shown on Placement Plan, thickness measurements, photos and evaluation of cores.
x. Dowel holes, and dowel alignment
y. Legible copies of batch tickets. Tickets should include all required data, time received, and time discharge completed.

-- End of Section --

SECTION 32 13 73.19

COMPRESSION CONCRETE PAVING JOINT SEALANT
11/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D412	(2016; R 2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D2628	(1991; R 2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D2835	(1989; R 2017) Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 548	(1988) Standard Specification for Jet-Fuel and Heat-Resistant Preformed Polychloroprene Elastomeric Joint Seals for Rigid Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment

Manufacturer's Instructions

SD-04, Samples

Compression Seals; G

SD-06 Test Reports

Test Requirements; G

1.3 QUALITY ASSURANCE

1.3.1 Trial Joint Seal and Lubricant/Adhesive Installation

Prior to the cleaning and sealing of the joints for the entire project, prepare a test section at least 200 ft long at a designated location in the project pavement, using the specified materials and the approved equipment to demonstrate the proposed joint preparation and sealing of the joints in the project. Following the completion of the trial length and before another joint is sealed, the Government will inspect the trial joints to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements, remove the materials, and reclean and reseal the joints at no cost to the Government. Do not seal other joints until the test installation has been approved. If the trial section is approved, permit the section to be incorporated into the permanent work. Seal other joints in the manner approved for sealing the trial joint.

1.4 SAFETY

Do not place compression joint seals within 25 ft of liquid oxygen (LOX) equipment, LOX storage, or LOX piping.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the jobsite for defects. Unload and store materials with a minimum of handling to avoid damage. Provide storage facilities that protect materials from weather and maintain materials within temperatures recommended by the manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

Install materials only when the ambient temperature and the pavement temperature within the joint wall is at least 35 degrees F and rising. Do not permit sealant installation if moisture or foreign material is observed in the joint.

PART 2 PRODUCTS

2.1 SYSTEM EQUIPMENT

Provide machines, tools, and equipment, for use in the performance of the work required by this section, approved before the work is started, and maintained in satisfactory condition. Submit list of proposed machines, tools, and equipment to be used in the performance of joint sealing, including descriptive data, 30 days prior to use on the project.

2.1.1 Joint Cleaning Equipment

2.1.1.1 Concrete Saw

Provide a self-propelled power saw with water-cooled diamond saw blades for cutting joints to the depths and widths specified and for removing filler, existing old joint seal, or other material embedded in the joints or adhered to the joint faces.

2.1.1.2 Waterblasting Equipment

Include with the waterblasting equipment a trailer-mounted water tank,

pumps, high-pressure hose, a wand with safety release cutoff controls, nozzle, and auxiliary water resupply equipment. Use a water tank and auxiliary water resupply equipment of sufficient capacity to permit continuous operations. Use pumps, hoses, wand, and nozzle of sufficient capacity to permit the cleaning of both walls of the joint and the pavement surface for a width of at least 1/2 in on either side of the joint. Use a pressure gauge mounted at the pump that shows the pressure in psi at which the equipment is operating.

2.1.2 Sealing Equipment

Install the compression seal by placing the compression seal to the prescribed depths and within the specified tolerances without cutting, nicking, twisting, or otherwise damaging the seal. Use equipment capable of placing the seal with not more than two percent longitudinal stretch or compression of the seal during installation. Use a machine that is an automatic self-propelled joint seal application equipment and engine powered. Use a machine that includes a reservoir for the lubricant/adhesive, a device for conveying the lubricant/adhesive in the proper quantities to the sides of the compression seal or the sidewalls of the joints, a reel capable of holding one full spool of compression seal, and a power-driven apparatus for feeding the joint seal through a compression device and inserting the seal into the joint. Include a guide with the equipment to maintain the proper course along the joint being sealed. Operate the machine by an experienced operator.

2.1.3 Test Requirements

Submit certified copies of test results, 30 days prior to use of material on the project. Sample, identify and test each lot of compression joint seal and lubricant/adhesive for conformance with the material specification.

a. A lot of compression seal consists of 1 day's production or 20,000 linear ft for each cross section, whichever is less. A lot of lubricant/adhesive consists of 1 day's production.

b. Testing of the compression joint seal and lubricant/adhesive material is the responsibility of the Contractor. Perform testing in an approved, independent laboratory, and submit certified copies of the test reports for approval 30 days prior to the use of the materials at the jobsite.

c. Submit samples of each lot of material to be retained by the Government for possible future testing if the materials appear defective during or after application. Provide additional samples of materials, in sufficient quantity to be tested, upon request. Base final acceptance on conformance to the specified test requirements and the performance of the in-place materials with respect to slipping down the joint or material coming out of the joint.

2.2 COMPRESSION SEALS

Regardless of testing responsibility, submit 9 ft long samples of the materials, 60 days prior to use on the project. Provide printed directions from the manufacturer on recommended installation criteria with the samples plus the manufacturer's certification that the selected seal is recommended for the installation on this project. Use compression joint seal materials that are vulcanized elastomeric compound using

polychloroprene as the only base polymer. Use material and manufactured seal in accordance with ASTM D2628 and COE CRD-C 548 where jet fuel and/or heat blast resistance is required as tested by ASTM D412. Use a labryinth seal for the joint seal. The uncompressed depth of the face of the compression seal (that is to be bonded to the joint wall) is greater than the uncompressed width of the seal, except that for seals 1 in or greater in width, the depth need be only 1 in or greater. The actual width of the uncompressed seal for construction and contraction joints is 0.75 or 1 in and for expansion joints is 1.25 in. The tolerance on the seal is plus 1/8 in or minus 1/16 in.

2.3 LUBRICANT/ADHESIVE

Use a lubricant/adhesive for the compression elastomeric joint seal that is a one-component compound conforming to ASTM D2835.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before installation of the compression joint seal, clean the joints to remove laitance, filler, existing sealer, foreign material and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed. Clean by waterblasting and extend along pavement surfaces at least 1/2 in on either side of the joint. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave free of debris and water. Demonstrate that the selected cleaning operation meets the cleanliness requirements resulting in joint sidewalls that are clean and dry and exhibit newly exposed concrete. Correct irregularities in the joint face which would prevent uniform contact between the joint seal and the joint face prior to the installation of the joint seal.

3.1.1 Sawing

Clean and open joints to the specified width and depth by sawing. Immediately following the sawing operation, clean the joint faces and opening using a water jet to remove saw cuttings or debris remaining on the faces or in the joint opening. Install compression seal within 3 calendar days of the time the joint cavity is sawed. Provide a depth of the joint cavity in accordance with manufacturer's instructions. Where installation procedures are required in accordance with the manufacturer's recommendations, submit printed copies of manufacturers' instructions, 30 days prior to use on the project. Center the saw cut for the joint seal cavity over the joint line. Provide the nominal width of the sawed joint seal cavity as follows:

a. If a nominal 13/16 in wide compression seal is provided, the nominal width of the saw cut is 8/16 in when the pavement temperature at the time of sawing is between 30 and 110 degrees F. If the pavement temperature at the time of sawing is above this range, decrease the nominal width of the saw cut 1/16 in. If the pavement temperature at the time of sawing is below this range, increase the nominal width of the saw cut 1/16 in.

b. If a nominal 1 in wide compression seal is provided, the nominal width of the saw cut is 9/16 ins when the pavement temperature at the time of sawing is between 30 and 170 degrees F. If the pavement temperature at the time of sawing is above this range, decrease the

nominal width of the saw cut 1/16 in. If the pavement temperature at the time of sawing is below this range, increase the nominal width of the saw cut 1/16 in.

c. Measure the pavement temperature in the presence of the Contracting Officer. Make measurement each day before commencing sawing and when the temperature appears to be varying from the allowable sawing range.

Use a tolerance of plus or minus 1/16 in for the actual width.

3.1.2 Waterblast Cleaning

Use a multiple pass waterblast technique until the surfaces are free of dust, dirt, curing compound, or residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave completely free of debris and water.

3.1.3 Rate of Progress

Limit waterblasting of joint faces to the length of joint that can be sealed during the same workday.

3.2 INSTALLATION OF THE COMPRESSION SEAL

Confirm a representative of the joint seal manufacturer is present at the trial joint installation to correct installation issues prior to full installation.

3.2.1 Time of Installation

Seal joints immediately within 3 calendar days of sawing the joint seal cavity and following concrete cure and the final cleaning of the joint walls. Provide open joints, ready for sealing that cannot be sealed under the specified conditions, with an approved temporary seal to prevent infiltration of foreign material. When rain interrupts the sealing operations, wash, clean with air pressure, and allow joints to dry prior to installing the lubricant/adhesive and compression seal.

3.2.2 Sequence of Installation

Seal longitudinal joints first, followed by transverse joints. Install seals in longitudinal joints so that transverse joint seals are intact from edge to edge of the pavement. Make intersections monolithic by use of joint seal adhesive and care in fitting the intersection parts together. Do not permit extender pieces of seal at intersections. Remove and replace seals falling short at the intersection with new seals at no additional cost to the Government. Require a poured sealant at the intersection where seals are required to change direction by more than 20 degrees. Provide poured sealant in accordance with compression seal manufacturer's instructions.

3.3 SEALING OF JOINTS

Cover the sides of the joint seal or the sides of the joint with a coating of lubricant/adhesive and the seal installed as specified. Coat butt joints and seal intersections with liberal applications of lubricant/adhesive. Immediately removed lubricat/adhesive spilled on the

pavement to prevent setting on the pavement.

Provide the in-place joint seal will be in an upright position and free from twisting, distortion, and cuts. Adjustments will be made to the installation equipment and procedure, if the stretch exceeds 1 percent. Remove and replace seals exceeding 2 percent stretch. Place the joint seal at a uniform depth within the tolerances specified. Remove and replace in-place joint seals which fail to meet the specified requirements with new joint seal at no cost to the Government.

Place the compression joint seal to a depth of 1/4 in, plus or minus 1/8 in, below the pavement surface except when the joint is beveled or has a radius at the surface, or unless otherwise directed. For beveled joints or joints with a radius at the surface, install the compression joint seal at a depth of 1/8 in, plus or minus 1/8 in, below the bottom of the edge of the bevel or radius. Do not permit the seal to project above the surface of the pavement or above the edge of the bevel or radius.

Install the seal in the longest practicable lengths in longitudinal joints and cut at the joint intersections to provide continuous installation of the seal in the transverse joints. Permit the lubricant/adhesive in the longitudinal joints to set for 1 hour prior to cutting at the joint intersections to reduce the possibility of shrinkage. For transverse joints, the minimum length of the compression joint seal is the pavement width from edge to edge.

3.4 CLEAN-UP

Upon completion of the project, remove unused materials from the site, remove lubricant/adhesive on the pavement surface, and leave the pavement in clean condition.

3.5 QUALITY CONTROL PROVISIONS

3.5.1 Application Equipment

Inspect the application equipment to assure uniform application of lubricant/adhesive to the sides of the compression joint seal or the walls of the joint. If equipment causes cutting, twisting, nicking, excessive stretching or compressing of the seal, or improper application of the lubricant/adhesive, suspend the operation until causes of the deficiencies are determined and corrected.

3.5.2 Procedures

3.5.2.1 Quality Control Inspection

Provide quality control provisions during the joint cleaning process to prevent or correct improper equipment and cleaning techniques that damage the concrete. Cleaned joints will be approved by the Government prior to installation of the lubricant/adhesive and compression joint seal.

3.5.2.2 Conformance to Stretching and Compression Limitations

Determine conformance to stretching and compression limitations. Mark the top surface of the compression seal at 1 ft intervals in a manner clear and durable to enable length determinations of the seal. After installation, measure the distance between the marks on the seal. If the stretching or compression exceeds 2 percent, remove the seal and replace

it with new joint at no additional cost to the Government. Remove the seal up to the last correct measurement. Inspect the seal a minimum of once per 100 ft of seal for compliance to the shrinkage or compression requirements. Make measurements at the same interval to determine conformance with depth and width of installation requirements. Remove and replace compression seal that is not in conformance with specification requirements with new joint seal at no additional cost to the Government.

3.5.2.3 Pavement Temperature

Determine the pavement temperature by placing a thermometer in the initial saw cut for the joint and record the reading. Pemrit the thermometer to remain in the joint for an adequate time to provide a stable control reading.

3.5.3 Acceptance

Inspect the joint sealing system (compression seal and lubricant/adhesive) for proper rate of cure and bonding to the concrete, cuts, twists, nicks and other deficiencies. Remove, waste and replace seals exhibiting defects prior to final acceptance of the project from the joint.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 16 19

SIDEWALKS
05/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2024) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2024) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2025a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2024a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2024) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(2019) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C920	(2018; R 2024) Standard Specification for Elastomeric Joint Sealants
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete

Paving and Structural Construction

ASTM D5893/D5893M (2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (2017) Standard And Commentary Accessible and Usable Buildings and Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete

Biodegradable Form Release Agent

SD-06 Test Reports

Field Quality Control

1.3 EQUIPMENT, TOOLS, AND MACHINES

1.3.1 General Requirements

Plant, equipment, machines, and tools used in the work will be subject to approval and must be maintained in a satisfactory working condition at all times. Use equipment capable of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Discontinue using equipment that produces unsatisfactory results. Allow the Contracting Officer access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.4 ENVIRONMENTAL REQUIREMENTS

1.4.1 Placing During Warm Weather

The temperature of the concrete as placed must not exceed 85 degrees F except where an approved retarder is used. Cool the mixing water and aggregates as necessary to maintain a satisfactory placing temperature. The placing temperature must not exceed 95 degrees F at any time.

PART 2 PRODUCTS

2.1 CONCRETE

Provide concrete conforming to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete must have a minimum compressive strength of 3500 psi at 28 days. Size of aggregate must not exceed 1-1/2 inches. Submit copies of certified

delivery tickets for all concrete used in the construction.

2.1.1 Air Content

Use concrete mixtures that have an air content by volume of concrete of 4.5 plus or minus 1.5, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

Use concrete with a slump of 3 inches plus or minus 1 inch for hand placed concrete or 1 inch plus or minus 1/2 inch for slipformed concrete as determined in accordance with ASTM C143/C143M.

2.1.3 Reinforcement Steel

Use reinforcement bars conforming to ASTM A615/A615M. Use wire mesh reinforcement conforming to ASTM A1064/A1064M.

2.2 CONCRETE CURING MATERIALS

2.2.1 White Pigmented Membrane-Forming Curing Compound

Use white pigmented membrane-forming curing compound conforming to ASTM C309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Use concrete protection materials consisting of a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Contraction Joint Filler for Curb and Gutter

Use hard-pressed fiberboard contraction joint filler for curb and gutter.

2.4.2 Expansion Joint Filler, Premolded

Onless otherwise indicated, use 1/2 inch thick premolded expansion joint filler conforming to ASTM D1751 or ASTM D1752.

2.5 JOINT SEALANTS

Use cold-applied joint sealant conforming to ASTM C920 or ASTM D5893/D5893M.

2.6 FORM WORK

Design and construct form work to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Use wood or steel forms that are straight and of sufficient strength to resist springing during depositing and consolidating concrete.

2.6.1 Wood Forms

Use forms that are surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Use forms with a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness.

2.6.2 Steel Forms

Use channel-formed sections with a flat top surface and welded braces at each end and at not less than two intermediate points. Use forms with interlocking and self-aligning ends. Provide flexible forms for radius forming, corner forms, form spreaders, and fillers as needed. Use forms with a nominal length of 10 feet and that have a minimum of 3 welded stake pockets per form. Use stake pins consisting of solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.3 Sidewalk Forms

Use sidewalk forms that are of a height equal to the full depth of the finished sidewalk.

2.6.4 Biodegradable Form Release Agent

Use form release agent that is colorless and biodegradableand that is composed of at least 87 percent biobased material. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide form release agent that does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

Construct subgrade to the specified grade and cross section prior to concrete placement.

3.1.1 Sidewalk Subgrade

Place and compact the subgrade in accordance with Section 31 00 00 EARTHWORK. Test the subgrade for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Maintenance of Subgrade

Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade must be in a moist condition when concrete is placed. Prepare and protect subgrade so that it is free from frost when the concrete is deposited.

3.2 FORM SETTING

Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms. Remove forms in a

manner that will not injure the concrete. Do not use bars or heavy tools against the concrete when removing the forms. Promptly and satisfactorily repair concrete found to be defective after form removal. Clean forms and coat with form oil or biodegradable form release agent each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Set forms for sidewalks with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment must be checked with a 10 foot straightedge. Sidewalks must have a transverse slope as indicated. Do not remove side forms less than 12 hours after finishing has been completed.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Place concrete in the forms in one layer. When consolidated and finished, the sidewalks must be of the thickness indicated. Use a strike-off guided by side forms after concrete has been placed in the forms to bring the surface to proper section to be compacted. Consolidate concrete by tamping and spading or with an approved vibrator. Finish the surface to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

Finish all slab edges, including those at formed joints, with an edger having a radius of 1/8 inch. Edge transverse joints before brooming. Eliminate the flat surface left by the surface face of the edger with brooming. Clean and solidly fill corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing with a properly proportioned mortar mixture and then finish.

3.3.4 Surface and Thickness Tolerances

Finished surfaces must not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Concrete Finishing

Float and finish exposed surfaces with a smooth wood float until true to grade and section and uniform in texture. Brush floated surfaces with a fine-hair brush using longitudinal strokes. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1-1/2 inch.

Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the front curb surface, while still wet, in the same manner as the gutter and curb top. Finish the top surface of gutter to grade with a wood float.

3.4.2 Joint Finishing

Finish curb edges at formed joints as indicated.

3.4.3 Surface and Thickness Tolerances

Finished surfaces must not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.5 SIDEWALK JOINTS

Construct sidewalk joints to divide the surface into rectangular areas. Space transverse contraction joints at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and continuous across the slab. Construct longitudinal contraction joints along the centerline of all sidewalks 10 feet or more in width. Construct transverse expansion joints at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, install transverse expansion joints as indicated. Form expansion joints around structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.

3.5.1 Sidewalk Contraction Joints

Form contraction joints in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness. Unless otherwise approved or indicated, either use a jointer to cut the groove or saw a groove in the hardened concrete with a power-driven saw. Construct sawed joints by sawing a groove in the concrete with a 1/8 inch blade. Provide an ample supply of saw blades on the jobsite before concrete placement is started. Provide at least one standby sawing unit in good working order at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

Form expansion joints using 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D1752 or building paper. Hold joint filler in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, round joint edges using an edging tool having a radius of 1/8 inch. Remove any concrete over the joint filler. At the end of the curing period, clean the top of expansion joints and fill with cold-applied joint sealant. Use joint sealant that is gray or stone in color. Thoroughly clean the joint opening before the sealing material is placed. Do not spill sealing material on exposed surfaces of the concrete. Apply joint sealing material only when the concrete at the joint is surface dry and atmospheric and concrete temperatures are above 50 degrees F. Immediately

remove any excess material on exposed surfaces of the concrete and clean the concrete surfaces.

3.5.3 Reinforcement Steel Placement

Accurately and securely fasten reinforcement steel in place with suitable supports and ties before the concrete is placed.

3.6 CURING AND PROTECTION

3.6.1 General Requirements

Protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete must be on hand and ready for use before actual concrete placement begins. Protect concrete as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.6.1.1 Membrane Curing Method

Apply a uniform coating of white-pigmented membrane-curing compound to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Coat formed surfaces immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Do not allow concrete surface to dry before application of the membrane. If drying has occurred, moisten the surface of the concrete with a fine spray of water and apply the curing compound as soon as the free water disappears. Apply curing compound in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet/gallon for the total of both coats. Apply the second coat in a direction approximately at right angles to the direction of application of the first coat. The compound must form a uniform, continuous, coherent film that will not check, crack, or peel and must be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, apply an additional coat to the affected areas within 30 minutes. Respray concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied by the method and at the coverage specified above. Respray areas where the curing compound is damaged by subsequent construction operations within the curing period. Take precautions necessary to ensure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. Tightly seal the top of the joint opening and the joint groove at exposed edges before the concrete in the region of the joint is resprayed with curing compound. Use a method used for sealing the joint groove that prevents loss of moisture from the joint during the entire specified curing period. Provide approved standby facilities for curing concrete pavement at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Adequately protect concrete surfaces to which membrane-curing compounds have been applied during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from other possible damage to the continuity of the membrane.

3.6.2 Backfilling

After curing, remove debris and backfill, grade, and compact the area adjoining the concrete to conform to the surrounding area in accordance with lines and grades indicated.

3.6.3 Protection

Protect completed concrete from damage until accepted. Repair damaged concrete and clean concrete discolored during construction. Remove and reconstruct concrete that is damaged for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Dispose of removed material as directed.

3.7 FIELD QUALITY CONTROL

Submit copies of all test reports within 24 hours of completion of the test.

3.7.1 General Requirements

Perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, take the action and submit reports as required below, and additional tests to ensure that the requirements of these specifications are met.

3.7.2 Concrete Testing

3.7.2.1 Strength Testing

Take concrete samples in accordance with ASTM C172/C172M not less than once a day nor less than once for every 250 cubic yards of concrete placed. Mold cylinders in accordance with ASTM C31/C31M for strength testing by an approved laboratory. Each strength test result must be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.7.2.2 Air Content

Determine air content in accordance with ASTM C173/C173M or ASTM C231/C231M. Use ASTM C231/C231M with concretes and mortars made with relatively dense natural aggregates. Make two tests for air content on randomly selected batches of each class of concrete placed during each shift. Make additional tests when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. Notify the placing foreman if results are out of tolerance. The placing foreman must take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.7.2.3 Slump Test

Perform two slump tests on randomly selected batches of each class of

concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Perform additional tests when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.7.3 Thickness Evaluation

Determine the anticipated thickness of the concrete prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, construct the subgrade true to grade prior to concrete placement. The thickness will be determined by measuring each edge of the completed slab.

3.7.4 Surface Evaluation

Provide finished surfaces for each category of the completed work that are uniform in color and free of blemishes and form or tool marks.

3.8 SURFACE DEFICIENCIES AND CORRECTIONS

3.8.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.8.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, reduce high areas either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete must not exceed 5 percent of the area of any integral slab, and the depth of grinding must not exceed 1/4 inch. Remove and replace pavement areas requiring grade or surface smoothness corrections in excess of the limits specified.

3.8.3 Appearance

Exposed surfaces of the finished work will be inspected by the Contracting Officer and deficiencies in appearance will be identified. Remove and replace areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work.

3.9 DETECTABLE WARNING SYSTEM

Install Detectable Warning Systems required by Contract plans in accordance with ICC A117.1, Section 705, and by manufacturers' installation instructions.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 17 23.16

ROAD AND PARKING LOT PAVEMENT MARKINGS
11/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 247	(2013) Standard Specification for Glass Beads Used in Pavement Markings

ASTM INTERNATIONAL (ASTM)

ASTM D4414	(1995; R 2020) Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM E1710	(2011) Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer

MASTER PAINTERS INSTITUTE (MPI)

MPI 97	(2012) Traffic Marking Paint, Latex

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2023) Manual on Uniform Traffic Control Devices

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325	(Rev D; Notice 1; Notice 2 2017) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(2015; Rev F; Notice 1) Paint, Traffic and Airfield Markings, Waterborne

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G

Qualifications; G

Safety Data Sheets For Each Paint Type; G

Surface Preparation Equipment List; G

Marking Applications Equipment List; G

Detour Plans; G

SD-03 Product Data

Manufacturer Data Sheets for all Marking Materials; G

Manufacturer Data Sheets for all Reflective Media; G

SD-04 Samples

Samples of Marking Materials; G

Samples of each Reflective Media; G

SD-06 Test Reports

Marking Application Wet Film Thickness Test; G

Reflective Media Reflectivity Test; G

SD-07 Certificates

Manufacturer Certificate of Compliance for Marking Materials; G

Manufacturer Certificate of Compliance for Reflective Materials; G

Manufacturer Certificate of Conformance for Volatile Organic Compliance; G

SD-08 Manufacturer's Instructions

Marking Materials Storage and Application; G

Reflective Media Storage and Application; G

Chemicals Used in Surface Preparation; G

1.3 QUALITY CONTROL

1.3.1 Quality Control Plan

Within 10 calendar days of project award, submit a quality control plan. The plan must state the means, methods, equipment, and materials to be employed for the performance of the surface preparation, existing markings removal, application of reflective and non-reflective marking, and marking layout. At a minimum, provide descriptive criteria for each of the

following activities for review and approval by the Contracting Officer:

a. Describe the means and methods used to layout marking geometry and the location of marking elements.

b. Describe the protocol for determination of the operating pressure and speed of the equipment for surface preparation.

c. Describe the protocol for surface preparation when not using water.

d. Describe the protocol for existing markings removal.

e. Define the protocol for the performance of test stripes for each line width, color, and paint type.

f. Provide equipment details to include speed, pressures and application rate for the minimum wet film thickness and the application rate of reflective media to provide the specified glass bead anchoring and reflectivity.

g. Provide and discuss safety directives for maintaining traffic on roads and parking lots.

h. Define communications procedures when operating on roads and parking lots.

1.3.2 Qualifications

Submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of applicable chemicals. The documentation should include experience on five projects of similar size and scope with references for all personnel.

1.3.3 Qualifications For Roads and Parking Marking Personnel

Submit documentation of qualifications in resume format a minimum of 30 days before pavement marking work is to be performed showing personnel who will be performing the work have experience working on airfields, operating mobile self-powered marking, cleaning, and paint removal equipment and performing these tasks. Include with their resume a list of references complete with points of contact and telephone numbers. Provide certification for pavement marking machine operator and Foreman demonstrating experience successfully completing a minimum of two airfield pavement marking projects of similar size and scope. Provide documentation demonstrating personnel have a minimum of two years of experience operating similar equipment and performing the same or similar work in similar environments, similar in size and scope of the planned project. The Contracting Officer reserves the right to require additional proof of competency or to reject proposed personnel.

1.4 DELIVERY, STORAGE, AND HANDLING

Provide a conditioned storage and staging area located off the installation for all materials intended to be used on the project. Ensure all materials delivered to the storage location are in the original container and clearly marked with the product name, compliance information, batch number, color, manufactured date, instructions for storage, instructions for application, and the name of the manufacturer. All materials are to be stored in conformance with the manufacturer instructions. Provide

manufacturer instructions for; marking materials storage and application, reflective media storage and application, and the chemicals used in surface preparation.

1.5 PROJECT/SITE SPECIAL CONDITIONS

1.5.1 Environmental Requirements

Pavement surface must be free of snow, ice, or slush; with a surface temperature of at least 40 degrees F and rising at the beginning of operations, except those involving shot blasting or grinding. Cease operation during thunderstorms, or during rainfall, except for water blasting and removal of previously applied chemicals. Cease water blasting where surface water accumulation alters the effectiveness of material removal.

1.5.1.1 Weather Limitations for Marking Application

Apply pavement markings to clean, dry surfaces and only when the ambient temperature is at least 5 degrees F above the dew point and the pavement surface temperatures are within the limits recommended by the manufacturer of the material being used unless otherwise noted. Allow the pavement surface to dry after the water has been used for surface preparation or after a precipitation event. Do not perform marking applications when the wind carries overspray onto locations adjacent to the marking. Provide wind screens to shroud application equipment.

1.5.1.2 Testing Dry Surfaces

Do not commence marking until the pavement surface is dry. Use the plastic wrap method as described in paragraph PRE-APPLICATION TESTING to test the pavement surface for moisture. Do not proceed with marking until the Contracting Officer has observed the moisture test and has accepted the area prepared for marking.

1.5.1.3 Volatile Organic Compounds Compliance

Submit a manufacturer certificate stating that the proposed pavement marking paint meets the Volatile Organic Compound (VOC) regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located. Submit manufacturer certificate of conformance for volatile organic compliance.

1.5.2 Traffic Control for Roads and Parking Lots

Place approved signs conforming to MUTCD near the beginning of the worksite and well ahead of the worksite to alert approaching traffic from both directions. Place markers along newly painted lines to control traffic and prevent damage to newly painted surfaces . Mark painting equipment with warning signs that can be read from a distance of 100 feet, indicating slow-moving painting equipment in operation. Provide all lighting and equipment necessary to light the work area during night operations effectively.

When traffic is rerouted or controlled to accomplish the work, provide necessary warning signs, flag persons, and related equipment for the safe passage of vehicles. Submit detour plans to the Contracting Officer for approval before doing the work.

1.6 APPLICATION EQUIPMENT CALIBRATION

Before performing any marking application, calibrate the paint and glass bead application equipment at the necessary speed to execute the application. Calibration and application will be performed using paint that is not diluted or thinned. Paint will be used as formulated by the manufacturer. Calibrate paint and bead guns for each line width and color intended to be applied. Use metal coupons placed in the path of the equipment to capture a test line without glass beads. Use a wet film gauge in accordance with ASTM D4414, to determine if the wet film thickness is the same at each edge and at the center of the marking. Adjust each paint gun to provide a line of uniform thickness.

Collect a sample of glass beads directly from the glass bead dispenser along a measured distance. Weigh the glass beads captured and determine the coverage by dividing the weight by the area of the line placed during the calibration. Adjust the glass bead dispenser to provide an application rate necessary to meet or exceed the reflectivity specified. After determining the application rate, apply a reflective marking using the wet film thickness to be used for the color and marking element. Using a magnifying glass, examine the distribution and embedment of the glass beads. Beads are to be distributed uniformly for the width of the marking. Adjust the wet film thickness if the beads are submerged or predominantly on the surface of the marking.

PART 2 PRODUCTS

2.1 EQUIPMENT

Submit a surface preparation equipment list by serial number, type, model, and manufacturer. Include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation. Mobile equipment must allow for removal of markings without damaging the pavement surface or joint sealant. Maintain machines, tools, and equipment used in the performance of the work in satisfactory operating condition.

2.1.1 Surface Preparation and Paint Removal for Roads and Parking Lots

2.1.1.1 Water Blasting Equipment

Use mobile water blasting equipment capable of producing a pressurized stream of water that effectively removes paint from the pavement surface without significantly damaging the pavement. Provide equipment, tools, and machinery which are safe and in good working order.

2.1.1.2 Shot Blasting Equipment

Use mobile self-propelled shot blasting equipment capable of producing an adjustable depth of paint removal and propelling abrasive particles at high velocities on the paint for effective removal. Ensure each unit is self-cleaning and self-contained. Use equipment able to confine the abrasive, any dust that is produced, and removed paint and is capable of recycling the abrasive for reuse.

2.1.1.3 Grinding or Scarifying Equipment

Use equipment capable of removing surface contaminates, paint build-up, or extraneous markings from the pavement surface without leaving any

residue. Clean the surface by a hydro blast to remove surface contaminants, and ash after a weed torch is used to remove paint.

2.1.2 Markings Application Equipment

Submit a marking applications equipment list of equipment appropriate for the material(s) to be used. Include the manufacturer's descriptive data and certification for the planned use that indicates the area of coverage per pass, pressure adjustment range, tank and flow capacities, and all safety precautions required for operating and maintaining the equipment. Provide and maintain machines, tools, and equipment used in the performance of the work in satisfactory operating condition, or remove equipment that is not providing satisfactory performance from the work site. Provide mobile and maneuverable application equipment to the extent that straight lines can be followed and normal curves can be made in a true arc.

2.1.2.1 Airless or Atomizing Equipment

Provide mobile airless or pneumatic air-atomized application equipment that is maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. Mount equipment on trucks, skids or tractors. Use equipment suitable for application of the marking material specified. Airless systems are used to apply waterborne and epoxy coatings. Pneumatic systems are used only to apply waterborne and solvent based coatings.

Provide equipment capable of applying a marking from 4 inches to 12 inches wide in a single pass and also capable of applying two single solid or intermittent lines using a minimum of two colors. Provide equipment with tanks or reservoirs equipped with mechanical agitators, pressure regulators, and gages in full view of the equipment operator. Use paint strainers suitable to screen paint flowing in all supply lines.

2.1.2.2 Hand-Operated Machines

Provide a hand-operated push-type applicator machine commonly used for the application of water-based paint or two-component, chemically curing paint, thermoplastic, or preformed tape to pavement surfaces for small marking projects, such as legends and cross-walks, parking lots, or surface painted signs. Provide an applicator machine with the necessary tanks and spraying nozzles capable of applying paint uniformly at specified wet film thickness. Provide spray guns for hand application of paint in areas where push-type machines cannot be used.

2.1.2.3 Reflective Media Dispenser

Mount glass bead dispensers that are automatically triggered when paint guns are activated. The dispensers may be pressurized or gravity-drop systems. Pressurized systems require moisture control.

2.1.3 Reflective Thermoplastic Striping Material (Hot Applied) Application Equipment

Apply thermoplastic material with equipment capable of providing continuous uniformity for the dimensional and reflectivity requirements of the marking.

2.1.3.1 Hand-Operated Machines

Provide portable hand-operated equipment, specifically designed for placing special markings such as crosswalks, stop bars, legends, arrows, and short lengths of the lane, edge, and centerlines; and apply thermoplastic pavement markings by the extrusion method. Equip the hand-operated applicator with all the necessary components, including a materials storage reservoir, bead dispenser, extrusion shoe, and heating accessories.

2.1.3.2 Reflective Media Dispenser

Attach the dispenser for applying the reflective media to the dispenser that is designed to operate automatically and simultaneously with the applicator through the same control mechanism. Provide a bead applicator capable of adjustment and designed to provide a uniform flow of reflective media over the full length and width of the marking.

2.1.4 Preformed Retroreflective Pavement Marking Tape Application Equipment

Provide mechanical application equipment specifically designed for the placement of preformed marking tape. The equipment is specifically designed to apply pressure-sensitive pavement marking tape of varying widths. Equip the applicator with rollers, or other suitable compaction devices to provide initial adhesion of the material with the pavement surface. Use additional tools and devices for properly seating the applied material, as the manufacturer recommends.

2.2 ROAD AND PARKING LOT MATERIALS

Submit safety data sheets for each paint type as well as manufacturer data sheets for all marking materials; include with the submittal a manufacturer certificate of compliance for marking materials and a manufacturer certificate of compliance for reflective materials.

2.2.1 Marking Colors

Provide markings for pavements that conform to SAE AMS-STD-595A color numbers as listed in Table I.

Table I - SAE AMS-STD-595A Color Numbers

Paint Color	SAE AMS-STD-595A Color Number
White	37925
Yellow	33538
Black	37038
Green	34108
Red	33411

2.2.2 Waterborne Paint

Use MPI 97 paint.

2.2.3 Reflective Media for Roads and Parking Lots

Provide AASHTO M 247 reflective media. Paint and glass bead types used with markings are designated on the drawings.

Provide glass beads with those coatings to promote adhesion, limit flotation, and absorb moisture to preclude bundling and dual coatings for waterborne materials. Submit manufacturer data sheets for all reflective media used.

PART 3 EXECUTION

3.1 TEST SECTIONS

Before the performance of any marking application, demonstrate to the Government, using the equipment, materials, and personnel identified in the approved quality control plan, that the requirements for acceptance of the final product(s) are attainable. The minimum length of the test section is 50 feet of marking for each line width, color, and wet film thickness. Perform demonstrations in a location designated by the Contracting Officer within the project scope of work. Do not perform the test section(s) until the Contracting Officer is present to observe the test. Table III identifies minimum and maximum wet film thickness based on glass bead type. Each test section's result is the standard of performance for the color, width, wet film thickness, and glass bead application rate for each marking element. Submit the color, line width, wet film thickness, and measured reflectivity.

3.1.1 Wet Film Thickness Test Section

Adjust the marking application rate for equipment speed, operating pressure, and line width, to provide a minimum wet film thickness, full coverage, and reflective media anchoring. Minimum and maximum wet film thickness is identified in Table III. Measure the wet film thickness using a wet film gauge at three points along the test section. Wet film thickness is determined using ASTM D4414 as the performance standard. When the average of the three readings is less than the minimum specified in Table III, repeat the test section. Submit the results of the marking application wet film thickness test to the Contracting Officer

3.1.2 Reflective Value Test Section

Measure the reflectivity at three points, along the length of the marking placed for wet film thickness. After the application is cured, measure the retro-reflective value using a Retro-Reflectometer with a direct readout in millicandelas per square meter per lux (mcd/m2/lx) using ASTM E1710. Take three readings on each test section. When the average of the three readings is less than the minimum specified in Table V repeat the test section. Document the application rate of the reflective media required to meet the specified minimum reflectivity. Submit the results of the reflective media reflectivity test to the Contracting Officer before proceeding with work on the project.

3.2 SURFACE PREPARATION

Clean surfaces before the application of marking materials. Remove all dust, dirt, scaling or loose paint, algae, oils, and grease and mineral deposits such as iron stains by use of water blasting or chemical removal. Follow the cleaning with sweeping, blowing or using water

rinse. Do not begin painting in any location prepared for marking until surfaces are dry and clean.

Scrub areas with oil or grease present with applications of trisodium phosphate solution or other approved detergent or degreaser. Rinse thoroughly after each application to prevent staining of the new marking. After cleaning oil-soaked areas, seal with shellac or primer as the manufacturer recommends to prevent bleeding through the new paint.

3.3 PRE-APPLICATION TESTING

Test the pavement surface for moisture before beginning pavement marking after each period of rainfall, fog, high humidity, or cleaning or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the Contracting Officer has approved the pavement condition.

Employ the plastic wrap method, described as follows, to test the pavement for moisture:

a. Cover the pavement with a 12 inch by 12 inch section of clear plastic wrap and seal the edges with tape.

b. After 15 minutes, examine the plastic wrap for any visible moisture accumulation. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap.

c. Re-test surfaces when work has been stopped due to a precipitation event.

3.4 MARKINGS APPLICATION

3.4.1 Marking Materials for Roads and Parking Lots Pavement

3.4.1.1 Waterborne Paint

The dilution or thinning of paint prior to application is not allowed.

Provide FS TT-P-1952 waterborne paint and FS TT-B-1325 glass beads. Apply reflective and non-reflective markings in accordance with Table III. Use the paint type as shown on the drawings.

The paint wet film thickness and glass bead application rate is provided in Table III. Perform the marking and bead application test section beginning at the minimum value and adjust the application rate up or down until the requirements of WET FILM THICKNESS TEST SECTION and REFLECTIVE TEST SECTION are satisfied. The values of wet film thickness and bead application rate established by the test section will be the standard of performance for the respective marking type and color.

Table III. Paint Wet Film Thickness and Bead Application Rate

Paint Type	Non-Reflectorized Marking Wet Film Thickness (mil)	Reflectorized Marking			
		Wet Film Thickness (mil) based on Glass Bead Type		Minimum Bead Application Rate	
		Type I Gradation A	Type IV Gradation B	Type I Gradation A	Type IV Gradation B
Type I	14-16	14-16	--	7 lb/gal	--
Type II	14-16	14-16	--	7 lb/gal	--
Type III	16-20	--	25-30	--	8 lb/gal

3.5 FIELD QUALITY CONTROL AND ACCEPTANCE

3.5.1 Material Inspection

The Contractor is responsible for examining all materials accepted for delivery for compliance with the certificate of compliance.

3.5.2 Sampling and Testing

As soon as the marking materials are available for sampling, obtain materials by random selection directly from equipment already calibrated. Four quarts of paint are to be collected; two quarts for the Contractor and two quarts for the Government. Samples of marking materials and samples of each reflective media are to be collected by the Contractor in the presence of the Contracting Officer. Identify samples by project name and number, manufacture date, batch number, and the square yards of markings represented by the sample.

The Government will retain samples for the warranty period under storage conditions recommended by the manufacturer. If there is an issue with a material defect during the period of the warranty the Contractor will incur the cost for an accredited independent laboratory to test the material(s) for conformance with the certifications and the contract specifications. The Government reserves the right to test the samples for verification of materials.

3.5.3 Dimensional Tolerance

The Contractor applies layout markings. All layout markings are placed before the marking material application. The edges of a line must not vary from a straight line drawn between the beginning and end of the line more than 1/2-inch to 50 feet. Marking dimensions and spacing must be within the tolerances provided in Table IV.

TABLE IV - Dimensional Tolerance for Marking Elements	
Dimension and Spacing	Tolerance
12 inch or less	+/- 1/2 inch
Greater than 36 inch to 6 feet	+/- 1 inch
Greater than 6 feet to 60 feet	+/- 2 inch
Greater than 60 feet	+/- 3 inch

3.5.4 Coating and Reflective Media Application Reporting

3.5.4.1 Reporting Wet Film Thickness and Reflectivity

Submit documentation on the wet film thickness and reflectivity for each marking element. Provide a reading at the rate of one reading per 1000 linear feet of line marking. A reading is the average of 10 measurements at random locations within the marking element area. Submit the results of the marking application wet film thickness test and Reflective Media Reflectivity Test to the Contracting Officer before proceeding with work on the project.

3.5.4.2 Wet Film Thickness

Conduct a marking application wet film thickness test. Provide a wet film thickness gauge to measure the wet film thickness using ASTM D4414 at the edge(s) and one interior location of the marking. When more than 3 in 10 consecutive measurements of wet film thickness are outside of the tolerances in Table III, remove and replace areas not meeting the wet film thickness requirement.

3.5.4.3 Reflectivity

Provide documentation that records the readings for white, yellow and red reflective markings. Conduct a Reflective Media Reflectivity Test. Measure the reflectivity using a Retro-Reflectometer using ASTM E1710. The minimum reading for white, yellow, and red markings is provided in Table V in millicandelas per square meter per lux (mcd/m2/lx) at the time of marking. When more than 3 in 10 consecutive measurements of reflectivity are outside of the minimum in Table V, remove and replace the areas not meeting the minimum reflectivity requirements.

TABLE VI - Minimum Reflectivity (millicandelas per square meter per lux)		
Bead Type	Minimum Reflectivity at Time of Marking	
Type I	White - 300	Yellow - 175
Type IV	White - 300	Yellow - 200

3.6 CLEANUP AND WASTE DISPOSAL

The worksite and the material staging area must be free of debris, dirt,

and items that will blow away during periods of elevated wind speeds. Dispose of all materials at a site approved by the Contracting Officer. Dispose of waste from cleaning the marking equipment at a facility that is permitted to accept the material.

3.6.1 Cleanup Requirements

Provide a vacuum sweeper after each work area when markings are cured. Vacuum sweep the entire pavement surface to provide a clean pavement without fugitive glass beads and debris.

-- End of Section --

SECTION 32 17 23.19

AIRFIELD PAVEMENT MARKINGS
11/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 247	(2013) Standard Specification for Glass Beads Used in Pavement Markings

ASTM INTERNATIONAL (ASTM)

ASTM D4414	(1995; R 2020) Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM E1710	(2011) Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer

MASTER PAINTERS INSTITUTE (MPI)

MPI 97	(2012) Traffic Marking Paint, Latex

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325	(Rev D; Notice 1; Notice 2 2017) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(2015; Rev F; Notice 1) Paint, Traffic and Airfield Markings, Waterborne

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G

Qualifications; G

Safety Data Sheets For Each Paint Type; G

Marking Applications Equipment List; G

SD-03 Product Data

Manufacturer Data Sheets for all Marking Materials; G

Manufacturer Data Sheets for all Reflective Materials; G

SD-04 Samples

Samples Of Marking Materials; G

Samples Of Each Reflective Media; G

SD-06 Test Reports

Marking Application Wet Film Thickness; G

Reflective Media Reflectivity Test; G

SD-07 Certificates

Manufacturer Certificate of Compliance for Marking Materials; G

Manufacturer Certificate of Compliance for Reflective Materials; G

Manufacturer Certificate Of Conformance For Volatile Organic Compliance; G

SD-08 Manufacturer's Instructions

Marking Materials Storage and Application; G

Reflective Media Storage and Application; G

Chemicals Used in Surface Preparation; G

1.3 QUALITY CONTROL

1.3.1 Quality Control Plan

Within 10 calendar days of project award, submit a quality control plan. The plan must state the means, methods, equipment and materials to be employed for performance of the marking layout, surface preparation, and application of reflective and non-reflective markings. At a minimum, provide descriptive criteria for each of the following activities for review and approval by the Contracting Officer:

a. Describe the means and methods used to layout marking geometry and the location of marking elements.

b. Describe the protocol for determination of the operating pressure and speed of the equipment for surface preparation.

c. Describe the protocol for surface preparation when not using water.

d. Define the protocol for the performance of test sections for each line width, color, and paint type.

e. Provide equipment details to include speed, pressures and application rate for the minimum wet film thickness and the application rate of reflective media to provide the specified glass bead anchoring and reflectivity. The information will be presented in a table format for each type of marking, width and color.

f. Provide and discuss safety directives for vehicle operations on the airfield.

g. Define communications procedures when operating on the airfield.

1.3.2 Personnel Qualifications for Airfield Pavement Marking

Submit documentation, within 30 calendar days of project award, that describes the training and experience of each person performing work on the project.

1.3.2.1 Qualifications of Airfield Marking Personnel

Submit documentation of qualifications for personnel performing work on the airfield and operating mobile self-powered or drawn marking equipment, hand-operated equipment, hand application equipment and surface preparation equipment. The minimum experience is operating similar equipment in a similar environment, size and scope of work as the project. Two years of experience are required for operators of equipment used for centerline or edge markings with a demonstrated proficiency in meeting dimensional tolerance of markings. The Contracting Officer reserves the right to require additional proof of competency or to reject proposed personnel.

1.4 DELIVERY, STORAGE AND HANDLING

Provide a conditioned storage and staging area located off the installation for all materials intended to be used on the project. Ensure all materials delivered to the storage location are in the original container and clearly marked with the product name, compliance information, batch number, color, manufactured date, instructions for storage, instructions for application, and the name of the manufacturer. All materials are to be stored in conformance with the manufacturer instructions. Provide manufacturer instructions for; marking materials storage and application, reflective media storage and application, and the chemicals used in surface preparation.

1.5 PROJECT SPECIAL CONDITIONS

1.5.1 Environmental Requirements

1.5.1.1 Weather Limitations for Markings Application

Apply pavement markings to clean, dry surfaces only when the ambient temperature is at least 5 degrees F above the dew point and the pavement surface temperatures are within limits recommended by the manufacturer unless otherwise noted. Allow the pavement surfaces to dry after the water has been used for surface preparation or after a precipitation event.

Do not perform marking applications when the wind carries overspray onto locations adjacent to the marking. Provide wind screens to shroud application equipment.

1.5.1.2 Testing Dry Surfaces

Do not commence marking until the pavement surface is dry. Use the plastic wrap method in accordance with paragraph PRE-APPLICATION TESTING to test the pavement surface for moisture. Do not proceed with marking until the Contracting Officer has observed the moisture test and has accepted the area prepared for marking.

1.5.1.3 Volatile Organic Compounds Compliance

Submit a manufacturer certificate stating that the proposed pavement marking paint meets the Volatile Organic Compound (VOC) regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located. Submit manufacturer certificate of conformance for volatile organic compliance.

1.5.2 Traffic Control for Airfields

Coordinate performance of all work in the controlled zones of the airfield with the Contracting Officer and with the Airfield Manager. Neither equipment nor personnel can use any portion of the airfield without permission of the Airfield Manager unless the feature is closed.

1.5.2.1 Radio Communications

No entry of equipment or personnel is allowed into controlled zones of the airfield until radio contact is established with the Air Traffic Control Tower and the Air Traffic Control Tower has granted permission. Radio contact with the Air Traffic Control Tower is to be maintained whenever the Contractor is on the active airfield outside of the established free zone. Notify the Air Traffic Control Tower when work is completed and all equipment, materials, and personnel are clear of the aircraft operating surface(s).

This project utilizes a free zone for construction, communication with the Air Traffic Control Tower should only take place during the establishment and relocation / removal of the free zone and marking operations outside of the free zone.

1.5.2.2 Night Operations

Provide all lighting and equipment necessary to light the work area during night operations effectively. Direct or shade lighting to prevent interference with aircraft, the Air Traffic Control Tower, and other base operations. Coordinate night work with the Contracting Officer and Airfield Manager. The Government reserves the right to accept or reject material applications during night work on the day following night activities.

1.6 APPLICATION EQUIPMENT CALIBRATION

Before performing any marking application, calibrate the paint and glass bead application equipment at the necessary speed to execute the application. Calibration and application will be performed using paint that is not diluted or thinned. Paint will be used as formulated by the

manufacturer. Calibrate paint and bead guns for each line width and color intended to be applied. Use a wet film gauge in accordance with ASTM D4414 to determine if the wet film thickness is the same at each edge and at the center of the marking. Adjust each paint gun to provide a uniform wet film thickness for the width of the marking.

Collect a sample of glass beads directly from the glass bead dispenser along a measured distance. Weigh the glass beads captured and determine the coverage by dividing the weight by the area of the line placed during the calibration. Adjust the glass bead dispenser to provide an application rate necessary to meet or exceed the reflectivity specified. After determining the application rate, apply a reflective marking using the wet film thickness to be used for the color and marking element. Using a magnifying glass, examine the distribution and embedment of the glass beads. Beads are to be distributed uniformly for the width of the marking. Adjust the wet film thickness if the beads are submerged or predominantly on the surface of the marking.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Surface Preparation for Airfields

2.1.1.1 Water Blasting Equipment

Use mobile water blasting equipment capable of producing a pressurized stream of water that effectively cleans existing markings and pavement surfaces without damage to stable markings, pavement, or joint seals. Provide equipment, tools, and machinery which are safe and in good working order.

2.1.2 Markings Application Equipment

Submit a marking applications equipment list appropriate for the material(s) to be used. Include manufacturer's descriptive data and certification for the planned use that indicates the area of coverage per pass, pressure adjustment range, tank and flow capacities, and all safety precautions required for operating and maintaining the equipment. Provide and maintain machines, tools, and equipment used in the performance of the work in satisfactory operating condition, or remove equipment that is not providing satisfactory performance from the work site. Provide mobile and maneuverable application equipment to the extent that straight lines can be followed and normal curves can be made in a true arc.

2.1.2.1 Airless or Atomizing Equipment

Provide mobile airless or pneumatic air-atomized application equipment that is maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. Mount equipment on trucks, skids or tractors. Use equipment suitable for application of the marking material specified. Airless systems are used to only apply waterborne coatings. Pneumatic systems are used to apply waterborne coatings and durable materials. Provide equipment capable of applying a marking from 4 inches to 36 inches wide in a single pass and applying two single solid or intermittent lines using a minimum of two colors.

Provide equipment with tanks or reservoirs equipped with mechanical agitators, pressure regulators, and gages in full view of the equipment

operator. Use paint strainers suitable to screen paint flowing in all supply lines.

2.1.2.2 Hand-Operated Machines

Provide a hand-operated push-type applicator machine for applying water-based paint, or preformed tape, to pavement surfaces for small marking projects such as surface painted signs. Provide an applicator machine with the necessary tanks and spraying nozzles to apply paint uniformly at the specified wet film thickness. Provide spray guns for hand application of paint in areas where push-type machines cannot be used.

2.1.2.3 Reflective Media Dispenser

Mount glass bead dispensers that are automatically triggered when paint guns are activated. The dispensers may be pressurized or gravity-drop systems. Pressurized systems require moisture control.

2.2 AIRFIELD MATERIALS

Submit safety data sheets for each paint type as well as manufacturer data sheets for all marking materials and manufacturer data sheets for all reflective materials; include with the submittal a manufacturer certificate of compliance for marking materials and a manufacturer certificate of compliance for reflective materials.

2.2.1 Airfield Marking Colors

Provide markings for airfield pavements that conform to SAE AMS-STD-595A color numbers as listed in Table II.

Table II - SAE AMS-STD-595A Color Numbers

Paint Color	SAE AMS-STD-595A Color Number
White	37925
Yellow	33538
Black	37038
Green	34108
Red	33411

2.2.2 Waterborne Paint

Use MPI 97 paint.

2.2.3 Reflective Media for Airfields

Provide AASHTO M 247 reflective media. Paint and glass bead types used with markings are designated on the drawings. Provide glass beads with those coatings that promote adhesion, limit flotation, and absorb moisture to preclude bundling and dual coatings for waterborne materials.

PART 3 EXECUTION

3.1 TEST SECTIONS

Before the performance of any marking application, demonstrate to the Government, using the equipment, materials, and personnel identified in the approved quality control plan, that the requirements for acceptance of the final product(s) are attainable. The minimum length of the test section is 50 feet of marking for each line width, color, and wet film thickness. Perform demonstrations in a location designated by the Contracting Officer within the project scope of work. Do not perform the test section(s) until the Contracting Officer is present to observe the test. Table III identifies minimum and maximum wet film thickness based on glass bead type. Each test section’s result is the standard of performance for the color, width, wet film thickness, and glass bead application rate for each marking element. Submit the width, color, wet film thickness, and measured reflectivity.

3.1.1 Wet Film Thickness Test Section

Adjust the marking application rate for equipment speed, operating pressure, and line width, to provide a minimum wet film thickness, full coverage, and reflective media anchoring. Minimum and maximum wet film thickness is identified in Table III. Measure the wet film thickness using a wet film gauge at three points along the test section. Wet film thickness is determined using ASTM D4414 as the performance standard. When the average of the three readings is less than the minimum specified in Table III, repeat the test section. Submit the results of the marking application wet film thickness test to the Contracting Officer before proceeding with work on the project.

3.1.2 Reflective Value Test Section

Measure the reflectivity at three points, along the length of the marking placed for wet film thickness. After the application is cured, measure the retro-reflective value using a Retro-Reflectometer with a direct readout in millicandelas per square meter per lux (mcd/m2/lx) using ASTM E1710. Take three readings on each test section. When the average of the three readings is less than the minimum specified in Table V, repeat the test section. Document the application rate of the reflective media required to meet the specified minimum reflectivity. Submit the results of the reflective media reflectivity test to the Contracting Officer before proceeding with work on the project.

3.2 SURFACE PREPARATION

Clean surfaces before the application of marking materials. Remove all dirt, dust, oil, grease, algae, mildew, mold, loose paint and mineral deposits such as iron stains by use of water blasting or chemical removal. Follow the cleaning with sweeping, blowing or using water rinse. Do not begin painting in any location prepared for marking until surfaces are dry and clean.

Scrub areas with oil or grease present with applications of trisodium phosphate solution or other approved detergent or degreaser. Rinse thoroughly after each application to prevent staining of the new marking. After cleaning oil-soaked areas, seal with shellac or primer as the manufacturer recommends to prevent bleeding through the new paint.

3.3 PRE-APPLICATION TESTING

Test the pavement surface for moisture before beginning pavement marking after each period of rainfall, fog, high humidity, or cleaning or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the Contracting Officer has approved the pavement condition.

Employ the plastic wrap method, described as follows, to test the pavement for moisture:

a. Cover the pavement with a 12 inch by 12 inchsection of clear plastic wrap and seal the edges with tape.

b. After 15 minutes, examine the plastic wrap for any visible moisture accumulation. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap.

c. Re-test surfaces when work has been stopped due to a precipitation event.

3.4 MARKINGS APPLICATION

3.4.1 Marking Materials for Airfield Pavement

3.4.1.1 Waterborne Paint

Dilution or thinning of paint prior to application is not allowed.

Provide FS TT-P-1952 waterborne paint and FS TT-B-1325 glass beads. Apply reflective and non-reflective markings in accordance with Table III. Use the paint type and bead type as shown on the drawings.

The paint wet film thickness and glass bead application rate is provided in Table III. Perform the marking and bead application test section beginning at the minimum value and adjust the application rate up or down until the requirements of paragraphs WET FILM THICKNESS TEST SECTION and REFLECTIVE VALUE TEST SECTION are satisfied. The values of wet film thickness and bead application rate established by the test section will be the standard of performance for the respective marking type and color.

Table III. Paint Wet Film Thickness and Bead Application Rate

Paint Type	Non-Reflectorized Marking Wet Film Thickness (mil)	Reflectorized Marking			
		Wet Film Thickness (mil) based on Glass Bead Type	Minimum Bead Application Rate		
		Type IV Gradation B	Type I Gradation A	Type III	Type IV Gradation B

Table III. Paint Wet Film Thickness and Bead Application Rate					
Type III	16-20	25-30	--	10 lb/gal	8 lb/gal

3.5 FIELD QUALITY CONTROL AND ACCEPTANCE

3.5.1 Material Inspection

The Contractor is responsible to examine all materials accepted for delivery with the certificate of compliance.

3.5.2 Sampling and Testing

As soon as the marking materials are available for sampling, obtain materials by random selection directly from equipment already calibrated. Four quarts of paint are to be collected; two quarts for the Contractor and two quarts for the Government. Samples of marking materials and samples of each reflective media are to be collected by the Contractor in the presence of the Contracting Officer. Identify samples by project name and number, manufacture date, batch number, and the square yards of markings represented by the sample.

The Government will retain samples for the warranty period under storage conditions recommended by the manufacturer. If there is an issue with a material defect during the period of the warranty, the Contractor will incur the cost for an accredited independent laboratory to test the material(s) for conformance with the certifications and the contract specifications. If a sample fails to meet the specification, replace the material in the area represented by the sample and retest the replacement material as specified above. The Government reserves the right to test the samples for verification of materials.

3.5.3 Dimensional Tolerance

The Contractor responsible for layout markings. All layout markings are placed before the marking material application. The edges of markings will not vary from a straight line drawn between the beginning and end of the marking by more than 1/2 inch in 50 feet. Marking dimensions and spacing must be within the tolerances provided in Table IV.

Table IV - Dimensional Tolerance for Marking Elements	
Dimension and Spacing	Tolerance
36 inches or less	+/- 1/2 inch
Greater than 36 inches to 6 feet	+/- 1 inch
Greater than 6 feet to 60 feet	+/- 2 inches
Greater than 60 feet	+/- 3 inches

3.5.4 Coating and Reflective Media Application Reporting

3.5.4.1 Reporting Wet Film Thickness, Glass Bead Distribution, and Reflectivity

Submit documentation on the wet film thickness and reflectivity for each marking element. Provide a reading at the rate of one reading per 1000 linear feet of line marking. For airfield marking elements, such as runway threshold bars or numerals, provide a reading for every 500 square feet of marking area. A reading is the average of 10 measurements at random locations within the marking element area. Submit the results of the Marking Application Wet Film Thickness test and Reflective Media Reflectivity Test to the Contracting Officer.

3.5.4.2 Wet Film Thickness

Conduct a Marking Application Wet Film Thickness test. Provide a wet film thickness gauge to measure the wet film thickness using ASTM D4414 at the edge(s) and one interior location of the marking. When more than 3 in 10 consecutive measurements of wet film thickness are outside of the tolerances in Table III, remove and replace areas not meeting the wet film thickness requirement.

3.5.4.3 Reflectivity

Conduct a Reflective Media Reflectivity Test. Provide documentation that records the readings for white, yellow and red reflective markings. Measure the reflectivity using a Retro-Reflectometer using ASTM E1710. The minimum reading for white, yellow, and red markings is provided in Table V in millicandelas per square meter per lux (mcd/m2/lx) at the time of marking. When more than 3 in 10 consecutive measurements of reflectivity are outside of the minimum in Table V, remove and replace the areas not meeting the minimum reflectivity requirements.

Table V - Minimum Reflectivity (millicandelas per square meter per lux)

	Minimum Reflectivity at Time of Marking by Paint Color		
Bead Type	White	Yellow	Red
Type IV	300	200	35

3.6 CLEANUP AND WASTE DISPOSAL

The worksite and the material staging area must be free of debris, dirt, and items that will blow away during periods of elevated wind speeds. Dispose of all materials at a site approved by the Contracting Officer. Dispose of waste from cleaning the marking equipment at a facility that is permitted to accept the material.

3.6.1 Cleanup Requirements

Provide a vacuum sweeper at each work area when markings are cured. Vacuum sweep the entire pavement surface to provide a clean pavement without fugitive glass beads and debris.

-- End of Section --

SECTION 32 31 13.53

HIGH-SECURITY FENCES (CHAIN LINK) AND GATES
11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2017) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM C94/C94M	(2025) Standard Specification for Ready-Mixed Concrete
ASTM F567	(2023) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2014; R 2023) Standard Specification for Fence Fittings
ASTM F668	(2017; R 2022) Standard Specification for Polyvinyl Chloride (PVC) and Other Polymer-Coated Steel Chain Link Fence Fabric
ASTM F900	(2011; R 2017) Standard Specification for Industrial and Commercial Swing Gates
ASTM F934	(2016; R 2022) Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials
ASTM F1043	(2018; R 2022) Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1145	(2005; R 2017) Standard Specification for Turnbuckles, Swaged, Welded, Forged
ASTM F1184	(2023; E 2023) Standard Specification for

	Industrial and Commercial Horizontal Slide Gates
ASTM F1664	(2008; R 2022) Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence
ASTM F1665	(2008; R 2022) Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Installation Drawings; G

SD-03 Product Data

Fabric

Posts

Post Caps

Chain Link Braces

Rails

Barbed Wire

Barbed Wire Supporting Arms

Latches

Hinges

Stops

Keepers

Rollers

Wire Ties

Swing Gates

SD-07 Certificates

Chain Link Fence

Fabric

Barbed Wire

Gate Hardware and Accessories

Concrete

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials elevated off of the ground to protect against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Chain Link Fence Fabric

2.1.1.1 General

Contractor must provide design calculations including post spacing and pipe footing diameter and depths from fencing manufacturer demonstrating the ability to meet 195 mph wind loads calculated in accordance with ASCE 7. Based on the provided calculations, footing depths and diameters and diameter of posts may change from what is shown in plan details. Provide Class 2b polyvinyl chloride-coated steel fabric with 0.3 ounces of zinc coating per square foot in accordance with ASTM F668. Provide manufacturer's standard brown in color for polyvinyl chloride coating for fabric and all other fence components complying with ASTM F934. Fabricate fence fabric of 9 gauge wire woven in 2 inch diamond mesh.

2.1.1.2 Approval Of Polyvinyl Chloride-Coated Fence Materials

Inspect polyvinyl chloride-coated fence materials for cracking, peeling, and conformance with the specifications prior to installation. Replace any fence materials rejected by the Contracting Officer with approved materials at no additional cost to the Government.

2.1.2 Posts

2.1.2.1 Metal Posts for Chain Link Fence

Group IA steel pipe, zinc-coated with PVC polymer overcoat. Provide posts with polyvinyl chloride coating, minimum thickness, 10 mil conforming to ASTM F1043; color of PVC coating to match that of fabric. Provide sizes as shown on the drawings. Use line posts and terminal (corner, gate, and pull) posts of the same designation throughout the fence. Provide gate post for the gate type specified subject to the limitation specified in ASTM F900 or ASTM F1184.

2.1.2.2 Accessories

a. Provide accessories conforming to ASTM F626. Coat ferrous accessories with polyvinyl chloride-coated, minimum thickness of 10 mil. Match color coating of fittings to color coating of the fabric.

b. Provide truss rods (with turnbuckles or other means of adjustment)for each terminal post.

c. Provide barbed wire supporting arms of the 45 degree outward angle 3-strand arm type and of the design required for the post furnished. Secure arms by top tension wire.

d. Furnish post caps in accordance with manufacturer's standard accessories with coating matching that of fence posts.

e. Provide 9 gauge tie wire for attaching fabric to rails, braces, and posts and match the material and coating of the fence fabric. Provide miscellaneous hardware coatings which conform to ASTM A153/A153M unless modified.

2.1.3 Chain Link Braces and Rails

Provide Group IA steel pipe, zinc-coated, with PVC polymer overcoat that meets the strength and coating requirements of ASTM F1043. Provide rails and braces with polyvinyl chloride coating, minimum thickness, 10 mil conforming to ASTM F1043; color of PVC coating to match that of fabric.

2.1.4 Chain Link Gates

2.1.4.1 Gate Assembly

Provide gate assembly conforming to ASTM F900 and/or ASTM F1184 of the type and swing shown. Provide gate frames made of polyvinyl chloride-coated steel pipe (Group IA) a nominal pipe size (NPS) 1-1/2, conforming to ASTM F1043. Use gate fabric that matches the specified chain link fabric.

2.1.4.2 Gate Leaves

For gate leaves, more than 8 feet wide, provide either intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. For gate leaves less than 8 feet wide, provide truss rods or intermediate braces. Provide intermediate braces on all gate frames with an electro-mechanical lock. Attach fabric to the gate frame by method standard with the manufacturer. Welding is not an acceptable method for attaching fabric to gate frames.

2.1.4.3 Gate Hardware and Accessories

Submit manufacturer's catalog data. Furnish and install latches, hinges, stops, keepers, rollers, and other hardware items as required for the operation of the gate. All items are required to match the material characteristics of the fence system being installed. Provide hinge with stainless steel pin. Arrange latches for padlocking so that the padlock will be accessible from both sides of the gate. Provide stops for holding the gates in the open position. For high security applications, extend each end member of gate frames sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Coating for steel latches, stops, hinges, keepers, and accessories, must be PVC, minimum thickness of 10 mil.

2.1.5 Fence Gates

2.1.5.1 Swing Gates

Submit manufacturer's catalog data. Fabricate swing gates by welding 2 sq

in tubular steel ends and rails. Use pickets that match the adjacent fence construction. Reinforce gates to ensure assembly sags no more than 1% of the gate leaf width or 2 in, whichever is less. Size gate posts to accommodate the weight and width of each gate leaf. Mount gates to posts with weldable steel plates or blocks, pressed steel, or malleable iron hinges. Hot-dip galvanize all hinges with a minimum zinc weight of 1.20 oz/sq ft. Provide hinge with stainless steel pin. Secure all tamper points by welding or peening the threads. Use swing gate latches and drop bar guides manufactured of pressed steel, hot-dipped galvanized with a minimum zinc weight of 1.20 oz/sq ft. Finish all gate hardware in the same color/coating as the fence system.

2.2 MATERIALS

2.2.1 Wire

2.2.1.1 Wire Ties

Submit samples as specified. Provide wire ties constructed of the same material and finish as the fencing fabric.

2.2.1.2 Barbed Wire

Provide barbed wire conforming to ASTM F1665, PVC-coated, Class 2b, with 12.5 gauge wire with 12 gauge, round, 4-point barbs spaced no more than 5 inches apart.

2.2.1.3 Tension Wire

Provide PVC-coated tension wire of the same class and color as the fencing fabric complying with ASTM F1664.

2.2.2 Concrete

ASTM C94/C94M, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Use grout consisting of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.3 FENCE FABRIC REINFORCEMENT

2.3.1 Turnbuckles

Turnbuckles shall be 1-1/4 inches x 12 inches x inches Type I, Grade 1 galvanized, in accordance with ASTM F1145.

PART 3 EXECUTION

3.1 PREPARATION

Perform complete installation conforming to ASTM F567.

3.1.1 Line and Grade

Install fence to the lines and grades indicated. Clear the area on either side of the fence line to the extent indicated. Space line posts equidistant at intervals not exceeding 10 feet. Set terminal (corner, gate, and pull) posts whenever abrupt changes in vertical and horizontal alignment are encountered. Provide continuous fabric between terminal

posts; however, ensure runs between terminal posts do not exceed 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A780/A780M.

3.1.2 Excavation

Excavate holes to depths indicated. Clear all post holes of loose material and spread waste material where directed. Eliminate ground surface irregularities along the fence line to the extent necessary to maintain a 1 inch clearance between the bottom of the fabric and finish grade.

3.2 INSTALLATION

3.2.1 Installation Drawings

Submit complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment. Submit drawing details that include, but are not limited to the following information: Fence Installation Drawings, Location of gate, corner, end, and pull posts, Gate Assembly, Turnstiles, and Gate Hardware and Accessories. Install fence system per approved drawings.

3.2.2 Security Fencing

Install new security fencing, remove existing security fencing, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer.

3.2.3 Posts

3.2.3.1 Earth and Bedrock

a. Set posts plumb and in alignment. Except where solid rock is encountered, set posts in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, set posts to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, set posts to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case terminate depth of penetration. Grout all portions of posts set in rock.

b. Set portions of posts not set in rock in concrete from the rock to ground level. Set posts in holes not less than the diameter shown on the drawings. Make diameters of holes in solid rock at least 1 inch greater than the largest cross section of the post. Thoroughly consolidate concrete and grout around each post, free of voids and finished to form a dome. Allow concrete and grout to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Set driven posts to a minimum depth of 3 feet and protect with drive caps when setting.

c. Test fence post rigidity by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Ensure post movement measured at the point where the force is applied is less than or equal to 3/4 inch from the relaxed position. Test every tenth post for rigidity. When a post fails this test, make further tests on the

next four posts on either side of the failed post. Remove, replace, and retest all failed parts at the Contractor's expense.

3.2.4 Rails

Bolt bottom rail to double rail ends and securely fasten double rail ends to the posts. Peen bolts to prevent easy removal. Install bottom rail before chain link fabric.

3.2.5 Fabric

a. Set fabric height at 7 feet.

b. Attach fabric to terminal posts with stretcher bars and tension bands. Space bands at approximately 15 inch intervals. Install fabric and pull taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fasten fabric to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 24 inch intervals.

c. Cut fabric by untwisting and removing pickets. Accomplish splicing by weaving a single picket into the ends of the rolls to be joined. Install the bottom of the fabric 2 plus or minus 1/2 inch above the ground.

d. After the fabric installation is complete, exercise the fabric by applying a 50 pound push-pull force at the center of the fabric between posts; use a 30 pound pull at the center of the panel to ensure fabric deflection of not more than 2.5 inches when pulling fabric from the post side of the fence. Every second fence panel is required to meet this requirement. Resecure and retest all failed panels at the Contractor's expense.

3.2.6 Supporting Arms

Install barbed wire supporting arms and barbed wire as indicated on the drawings and as recommended by the manufacturer. Anchor supporting arms to the posts in a manner to prevent easy removal with hand tools. Pull barbed wire taut and attach to the arms with clips or other means that will prevent easy removal.

3.2.7 Gate Installation

a. Install gates at the locations shown. Mount gates to swing as indicated. Install latches, stops, and keepers as required. Install Slide gates as recommended by the manufacturer.

b. Attach padlocks to gates or gate posts with chains. Weld or otherwise secure hinge pins, and hardware assembly to prevent removal.

3.2.8 Grounding

a. Ground fencing as indicated on drawings and specified.

b. Ground fences on each side of all gates, at each corner, at the closest approach to each building located within 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Ensure grounding locations are located no more than 650 feet apart. Bond

each gate panel with a flexible bond strap to its gate post. Ground fences crossed by powerlines of 600 volts or more at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing.

c. Provide ground conductor consisting of No. 8 AWG solid copper wire. Use grounding electrodes that measures 3/4 inch by 10 foot long and are a copper-clad steel rod. Drive electrodes into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, bury electrodes a minimum of 12 inches deep and radially from the fence. Install the top of the electrode to be less than 2 feet or more than 8 feet from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Measure total resistance of the fence to ground and ensure it is not greater than 25 ohms.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Cleanup

Remove waste fencing materials and other debris from the work site each workday.

-- End of Section --

SECTION 32 84 24

TEMPORARY IRRIGATION SPRINKLER SYSTEMS
08/11, CHG 1: 05/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Std 598	(2009) Valve Inspecting and Testing

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 189.1	(2014) Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.15	(2024) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2021) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2021) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B40.100	(2022) Pressure Gauges and Gauge Attachments

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE Series 5000	(2022) Cross-Connection Control Professional Qualification Standard

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C500	(2019) Metal-Seated Gate Valves for Water Supply Service
AWWA C511	(2017; R 2021) Reduced-Pressure Principle Backflow Prevention Assembly
AWWA C651	(2023) Standard for Disinfecting Water Mains

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B32	(2020) Standard Specification for Solder Metal
ASTM B43	(2020) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B88	(2022) Standard Specification for Seamless Copper Water Tube
ASTM D1785	(2021) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2020) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2023) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2564	(2020) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2855	(2020) Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2011) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code

NSF INTERNATIONAL (NSF)

NSF/ANSI 14	(2023) Plastics Piping System Components and Related Materials

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-51145	(Rev D; Notice 1; Notice 2; Notice 3; Notice 4) Flux, Soldering, Non-Electronic, Paste and Liquid

UL SOLUTIONS (UL)

UL 651	(2011; Reprint May 2022) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

1.2 SYSTEM DESCRIPTION

Provide a design for the temporary irrigation sprinkler system to provide aminimum 1-inch of water (potable) per week to new landscaped and grassed areas. The temporary system piping may be installed on grade, but shall not create a trip hazard for pedestriansor block vehicular paths. Sleeves shall be installed under walks and drivesas required. Contractor shall evaluate water pressure and temporary irrigation system pressure requirements to determine if an irrigation booster pump is required. The temporary irrigation system shall be removed after one year.

Submit temporary irrigation sprinkler system drawings including irrigation legend point of connection, backflow preventer, piping, sleeving, heads, valves, controllers, etc., prepared by a licensed, registered or certified Irrigation Specialist must be provided. Provide a watering schedule that will demonstrate a slow reduction of watering frequency and amount over the landscape establishment period, to acclimate plant materials to natural rainfall.

For temporary irrigation sprinkler system, indicate the following:

a. Head, piping, valve, controller, sensor layout. Provide separate hydrozones for plant materials with different water requirements.

b. Pipe, valve, backflow preventer, and controller.

c. Point of connection to water source.

d. Indicate wiring diagram between existing power source and controller/water pump.

e. Number and extent of control valve circuits.

f. Provide details of all irrigation components and accessories.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Temporary Irrigation Sprinkler System

Drawings including irrigation legend prepared by a licensed, registered or certified Irrigation Specialist.

SD-03 Product Data

Piping Materials, tubing, and fittings; G

Valves and Accessories; G

Sprinkler Heads; G

Backflow Preventers; G

Automatic Controller; G

Controller Enclosure; G

Solvent Cement; G

Control Wiring; G

Water Meter; G

Rain Shut-Off Device; G

SD-06 Test Reports

Valves, and Accessories Tests

Backflow Preventers

Pressure Test

Operation Test

SD-07 Certificates

Backflow Preventers

ASSE Series 5000, Submit a certificate of Full Approval or a current Certificate of Approval from FCCCHR List for size, and make of backflow preventer being provided for this project. A Certificate of Provisional Approval will not be acceptable.

SD-08 Manufacturer's Instructions

Automatic Controller

Sprinkler Heads

Backflow Preventers

Valves

Rain Shut-Off Device

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in original rolls, packages, cartons, and containers with the name of manufacturer, brand, and model. Inspect materials delivered to the site for damage.

1.4.2 Storage

Store materials on site in enclosures or under protective covering. Store plastic piping and rubber gaskets under cover out of direct sunlight. Do not store materials directly on ground. Keep inside of pipes and fittings free from dirt and debris.

1.4.3 Handling

Handle and carry pipe, fittings, valves, and accessories in such a manner as to ensure delivery to trench in sound undamaged condition. Do not drag pipe.

1.5 EXTRA STOCK

a. Additional sprinkler heads (nozzles, bodies, screens, pressure compensating devices) of each size and type;

b. Wrenches for removing and installing each type of head;

c. Irrigation controller housing keys.

d. Irrigation controller enclosure keys; and

e. Hand-held remotes compatible with controller system.

1.6 QUALITY ASSURANCE

1.6.1 Required Test

Submit tests signed by an authorized official of a testing laboratory of sprinkler head, valve, automatic controller, emitter heads, vacuum breaker, backflow preventer, and water hammer arrester.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

2.1.1 Copper Tubing and Associated Fittings

2.1.1.1 Tubing

ASTM B88, Type K.

2.1.1.2 Fittings

ASME B16.22 and ASME B16.18, solder joint. Solder, ASTM B32 alloy Grade Sn95 or Sn94. Flux, CID A-A-51145, Type I.

2.1.2 Red Brass Pipe and Associated Fittings

2.1.2.1 Pipe

ASTM B43, regular.

2.1.2.2 Fittings

ASME B16.15, Class 250, cast bronze threaded.

2.1.3 Galvanized Steel Pipe and Associated Fittings

2.1.3.1 Pipe

ASTM A53/A53M, Schedule 40.

2.1.3.2 Fittings

ASME B16.3, Class 150.

2.1.4 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

NSF/ANSI 14, seal of approval for potable water.

2.1.4.1 Pipe

ASTM D1785, PVC 1120 Schedule 40; or ASTM D2241, PVC 1120 SDR 21, Class 200. Provide ultra-violet resistant piping for on-grade use.

2.1.4.2 Fittings

a. Solvent Welded Socket Type: ASTM D2466, Schedule 40. Provide ultra-violet resistant fittings.

b. Threaded Type: ASTM D2464, Schedule 80. Provide ultra-violet resistant fittings.

2.1.4.3 Solvent Cement

ASTM D2564.

2.2 IRRIGATION AND DRIP SPRINKLER HEADS

Provide lavender-colored body, nozzle, and/or cap indicator for

non-potable use.

2.2.1 Fixed Riser Irrigation Heads

2.2.1.1 Stream Rotors, Full or Part Circle

Sprinkler body, nozzle, and screen constructed of heavy-duty, ultra-violet resistant plastic. Heavy duty, stainless steel internal construction with plastic body. Provide check valve below each sprinkler body on riser.

2.2.1.2 Gear Rotor Irrigation Head, Full or Part Circle

Single-stream, water lubricated, gear drive type capable. Part circle sprinkler with an adjustable arc coverage of 30 to 360 degrees. Stainless steel internal construction with plastic body, with matched precipitation rate nozzles in standard /low/ flat angle trajectories, filter screen, reducible watering radius, and choice of nozzles.

2.2.1.3 Impact Irrigation Head

Provide one or two nozzles to prevent debris from clogging nozzles, and non-corrosive plastic head and stainless steel assemblies. Seal bearing assembly from abrasives. Provide entire assembly including strainer removable from top of case without disturbing case installation. Provide plastic housing.

2.2.1.4 Spray Irrigation Heads, Full or Part Circle

Sprinkler body, nozzle, and screen constructed of heavy-duty, ultra-violet resistant plastic. Matched precipitation rate plastic nozzle with an adjustable screw capable of regulating the radius and the flow. Capable of housing under the nozzle; protective, non-clogging filter screen and/or pressure compensating devices. Screen used in conjunction with the adjusting screw from regulating. Provide check valve below each sprinkler body on riser.

2.3 VALVES

2.3.1 Isolation Valve

2.3.1.1 Ball Valves, Less than 3 inches

API Std 598, plastic body, threaded ends.

2.3.1.2 Gate Valves, 3 inches and Larger

AWWA C500, bottom wedging double discs, parallel seats, non-rising stems, open by counterclockwise turning. Provide flanged end connections. Provide bronze interior construction of valves including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

2.3.2 Control Valves

2.3.2.1 Pressure Regulating Master Control Valve

Automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current (ac) with 0.70 amperes at 24 volts. Valve shall close slowly and be free of chatter in each diaphragm position. Provide a manual flow stem to

adjust closing speed and internal flushing. Provide an adjusting screw for setting pressure and schrader valve for monitoring pressure. Provide two inlet tappings capable of being installed as a straight pattern valve. Provide heavy duty plastic valve body with brass seat that is removable and serviceable from top without removing valve body from system. Maximum working pressure of valve is 150 psi and pilot range from 10 to 125 psi.

2.3.2.2 Remote Control Valve, Electrical

Solenoid actuated globe valves of 3/4 to 3 inch size, alternating current (ac), 60/50 cycle .41 amps in rush current and .28 amps holding current. Provide plastic valve housing suitable for service at 150 psi operating pressure. Provide pressure regulating module capable of regulating outlet pressure between 15 to 25 psi (plus or minus) 5 psi and adjustable screw for setting pressure schrader valve connection for monitoring pressure.

2.3.2.3 Manual Angle Control Valve, Manual Globe Control Valve

Less than 2 1/2 inch MSS SP-80, type 3, Class 150 threaded ends. Angle valve 2 1/2 inch and larger MSS SP-85, Type II, Class 250 threaded ends.

2.3.3 Drain Valves

2.3.3.1 Manual

MSS SP-80, Type 3, Class 150 threaded ends for sizes less than 2 1/2 inches. MSS SP-85, Type II, Class 250 threaded ends for sizes 2 1/2 inches and larger.

2.3.4 Backflow Preventers

2.3.4.1 Reduced Pressure Type Backflow Preventers

AWWA C511. Provide backflow preventers complete with 150 psi rated flanged cast iron, brass mounted ball valve and strainer, 304 stainless steel or bronze, internal parts. Total pressure drop through complete assembly shall be a maximum of 10 psi at rated flow. Listing of particular make, model/design, and size in FCCCHR List will be acceptable as required proof for testing and certification.

a. Piping Assembly: Galvanized steel pipe and fittings.

b. Strainers: Bronze or brass construction with gasket caps. Equip units with No. 200 mesh stainless steel screen elements.

2.4 ACCESSORIES AND APPURTENANCES

2.4.1 Water Meter

Provide a submeter in accordance with ASHRAE 189.1. Meter to include roll sealed register, magnetic drive, straight reading (odometer shall indicate in gallons, large numerals, glass lens for legibility,) low flow indicator to detect leaks, tamper proof seal pin to detect theft; sturdy durable, corrosion resistant main case, electrical grounding continuity; nutating disc measuring chamber with minimum head loss.

2.4.2 Backflow Preventer Accessories

2.4.2.1 Pressure Gages

ASME B40.100, single style pressure gage for water with 4 1/2 inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and siphon. Provide scale range suitable for irrigation systems.

2.4.2.2 Concrete Pads

Cast-in-place reinforced concrete construction for reduced pressure type backflow preventers.

2.4.3 Moisture Sensing Device

2.4.3.1 Automatic Rain Shut-Off Device

One piece, maintenance and adjustment free, reacts to a minimum 1/8 inch of rain water, unaffected by humidity levels, commercial grade materials, no exposed mechanical switch or electrodes, solid state construction with internal relay operating voltage of 24 to 30 VAC, static charge pretested, maximum switch current of one amp.

2.5 AUTOMATIC CONTROLLER ELECTRICAL

Controller must becommercially/industrially rated, , for outdoor location with 120-volt single phase service with surge protection, operating with indicated stations, and grounded chassis. Provide in an enclosure with locking hinge cover.

2.5.1 Controller Enclosure

Controller Enclosure must be NEMA ICS 2 mounted. Enclosure must be outdoor wall mounted weatherproof plastic.

2.6 ELECTRICAL CIRCUITS

2.6.1 Control Wiring for Electrically Operated Valves

NFPA 70, copper conductor 14 gage wire, Type UF.

2.6.2 Conduit

UL 651, rigid polyvinyl chloride conduit, Schedule 40.

PART 3 EXECUTION

3.1 INSTALLATION

Install sprinkler system after site grading has been completed.

3.1.1 Piping System

3.1.1.1 Sterilization

Sprinkler system fed from a potable water system sterilized upstream of backflow preventer in accordance with AWWA C651. Sterilize new water lines for a minimum of 24 hours to meet Territory of Guam and federal health test requirements before placing in service. Minimum retention

period shall be 3 hours.

3.1.2 Piping Installation

3.1.2.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-Cemented Joints: ASTM D2855.

b. Threaded Joints: full cut with a maximum of three threads remain exposed on pipe and nipples. Make threaded joints tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping: ASTM D2855, and pipe manufacturer's instructions. Install pipe on-grade.

3.1.3 Irrigation Heads

Install level with terrain. Irrigation heads must not spray directly on or within 3-feet of building.

3.1.3.1 Fixed Riser Irrigation Heads

Nozzle mounted on fixed riser minimum 6 inches above grade.

3.1.4 Valves

3.1.4.1 Isolation Valves

Install per manufacturer's recommendations.

3.1.4.2 Control Valves

Install per manufacturer's recommendations.

3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Equip low point of each underground line with drain valve draining into an excavation containing gravel. Cover gravel with building paper.

3.1.5 Backflow Preventers

a. Install backflow preventer in new connection to existing water distribution system, between connection and control valves. Install with concrete pads.

b. Flush pipe lines prior to installing device.

c. Device shall not be installed in pits or where any part of the device could become submerged in standing water

d. Install device a minimum of 12 inches from trees, walls, fences, structures and other obstructions.

3.1.5.1 Reduced Pressure Backflow Preventer

a. Protect device by a strainer located upstream.

b. Install device a minimum of 12 inches between finish grade and bottom of relief port.

c. Install water meter above grade, upstream of unit of unit as a part of assembly. Provide galvanized steel support with concrete footing.

3.1.6 Accessories

To use a fire hydrant for irrigation, obtain prior clearance from the Contracting Officer and provide the tools and connections approved for use on fire hydrants. If a fire hydrant is used, provide a reduced pressure backflow preventer for each connection between hose and fire hydrant. Backflow preventer used must be tested once per month by a certified backflow preventer tester.

3.1.6.1 Water Meter

Install meter upstream of backflow preventer per manufacturer's recommendations and local PWC Utility Department.

3.1.6.2 Rain Shut-Off Devices

a. Install as per manufacturer's recommendations.

b. For wall mounted controllers, attach devices to side of building or eave, minimum 8 feet above finish grade and a minimum of 12 inches from building wall or eave.

3.1.7 Electrical Circuits

Provide gray electrical conduit. Tag wires at controller and control valve location with plastic tie wrapped tags. Provide one control wire to each control valve location and one common wire looped from controller to each control valve.

3.1.7.1 Loops

Provide a 12 inch loop of wire at each valve where controls are connected.

3.1.7.2 Expansion and Contraction

Bundle multiple tubes or wires and tape together at 20 foot intervals with 12 inch loop for expansion and contraction.

3.1.7.3 Splices

Make electrical splices waterproof. Locate all field electrical splices in valve boxes.

3.1.8 Automatic Controller

Determine exact location of controllers in field before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

3.1.9 Flushing

After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads and valves, flush piping system under a

full head of water. Maintain flushing for 3 minutes.

3.1.10 Sterilization

Sprinkler system fed from a potable water system shall be sterilized upstream of backflow preventer in accordance with AWWA C651. Sterilize new waterlines for a minimum of 24-hours, to meet Territory of Guam and federal, health test requirements before placing in service. Minimum retention period shall be 3 hours.

3.2 FIELD QUALITY CONTROL

The Contractor will conduct and the Contracting Officer and the QC representative will witness field inspections and field tests specified in this section. Perform field tests, and provide labor, equipment, and incidentals required for testing.

3.2.1 Pressure Test

3.2.1.1 Duration

During pressure test, maintain a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi.

3.2.1.2 Leaks

Correct leaks. Make necessary corrections to stop leakage.

3.2.1.3 Retest

Retest system twice until pressure can be maintained for duration of test.

3.2.2 Operation Test

3.2.2.1 Accessories

At conclusion of pressure test, install irrigation heads and test entire system for operation under normal operating pressure. Make necessary corrections or adjustments to raise or lower pressure for each system if tests results do not match pressure requirements.

3.2.2.2 Acceptance

Operation test is acceptable if system operates through at least one complete cycle for areas to be irrigated.

3.2.3 Project Closeout

Remove temporary irrigation system at end of the establishment period (one year). Repair planting and grassed areas disturbed during removal.

-- End of Section --

SECTION 32 92 19

SEEDING
08/17, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C602	(2023) Agricultural Liming Materials
ASTM D4972	(2018) Standard Test Methods for pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(2022) Kellogg Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report, No. 42, Version 6.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood Cellulose Fiber Mulch

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil Composition Tests (reports and recommendations).

SD-07 Certificates

Certification and Approval for Seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Gypsum. Sulfur, Iron, and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to Territory of Guam and federal laws. Instead of containers, fertilizer, gypsum, sulphur, iron, and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer, Gypsum, Sulfur, Iron, and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide Territory of Guam-approved seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable Territory of Guam seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Design Builder.

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	All Year

2.1.3 Seed Purity

Botanical Name	Common Name	Minimum Percent Pure Seed
Cynodon dactylon	Common Bermudagrass	50
Eremochloa ophiuroides	Centipede grass	50

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph COMPOSITION. When available topsoil must be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph COMPOSITION. Additional topsoil must be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with

maximum 3 percent retained on 1/4 inch screen. The pH must be tested in accordance with ASTM D4972. Topsoil must be free of sticks, stones, roots, and other debris and objectionable materials. Other components must conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade hydrate limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C602 of not less than 100 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Sand

Clean and free of materials harmful to plants.

2.3.6 Perlite

Horticultural grade.

2.3.7 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.7.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen 95

No. 8 mesh screen	80

2.3.7.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.8 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 80 percent, calcium 18 percent, sulfur 14 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.9 Calcined Clay

Calcined clay must be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent must pass a No. 8 sieve; a minimum 99 percent must be retained on a No. 60 sieve; and material passing a No. 100 sieve must not exceed 2 percent. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Granular controlled release fertilizer shall follow soil testing recommendations.

2.4.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months shall follow soil testing recommendations.

2.5 MULCH

2.5.1 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent post-consumer content) or wood-based (100 percent total recovered content) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.6 WATER

Source of water must be approved by Designer of Record and of suitable quality for irrigation, containing no elements toxic to plant life.

2.7 EROSION CONTROL MATERIALS

Erosion control material must conform to the following:

2.7.1 Erosion Control Blanket

70 percent agricultural straw/30 percent coconut fiber matrix stitched with a degradable nettings, designed to degrade within 12 months.

2.7.2 Erosion Control Fabric

Fabric must be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips must have a minimum life of 6 months.

2.7.3 Erosion Control Net

Net must be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately one inch square.

2.7.4 Hydrophilic Colloids

Hydrophilic colloids must be physiologically harmless to plant and animal life without phytotoxic agents. Colloids must be naturally occurring, silicate powder based, and must form a water insoluble membrane after curing. Colloids must resist mold growth.

2.7.5 Erosion Control Material Anchors

Erosion control anchors must be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation prior to planting (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Designer of Record. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the

soils at the job site.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Designer of Record stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method must be hydroseeding.

3.2.2.1 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper must be applied as part of the hydroseeding operation. Fiber must be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed must be mixed to ensure broadcasting at the rate of 1.5 pounds per 1000 square feet. When hydraulically sprayed on the ground, material must form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch must be spread uniformly at the rate of 2 tons per acre. Mulch must be spread by hand, blower-type mulch spreader, or other approved method. Mulching must be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch must not be bunched or clumped. Sunlight must not be completely excluded from penetrating to the ground surface. All areas installed with seed must be mulched on the same day as the seeding. Mulch must be anchored immediately following spreading.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Designer of Record.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination

process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 32 93 00

EXTERIOR PLANTS
08/17, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4427	(2018) Standard Classification of Peat Samples by Laboratory Testing
ASTM D4972	(2018) Standard Test Methods for pH of Soils
ASTM D5268	(2019) Topsoil Used for Landscaping Purposes
ASTM D5852	(2000; R 2007; E 2014) Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
ASTM D6629	(2001; R 2012; E 2012) Selection of Methods for Estimating Soil Loss by Erosion

U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA SSIR 42	(2022) Kellogg Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report, No. 42, Version 6.0

1.2 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, Section 32 92 19 SEEDING, and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

State Landscape Contractor's License

Time Restrictions and Planting Conditions

Indicate anticipated dates and locations for each type of

planting.

SD-03 Product Data

Peat

Composted Derivatives

Gypsum

Fertilizer

SD-06 Test Reports

Topsoil Composition Tests; Soil Test of current growing area; Soil Test of proposed area; Soil Test location map

1.4 QUALITY ASSURANCE

1.4.1 Topsoil Composition Tests

Commercial test from an independent testing laboratory including basic soil groups (moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D4972), soil salinity), secondary nutrient groups (calcium, magnesium, sodium, Sodium Absorption Ratio (SAR)), micronutrients (zinc, manganese, iron, copper), toxic soil elements (boron, chloride, sulfate), cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being transplanted. Soil required for each test must include a maximum depth of 18 inches of approximately one quart volume for each test. Areas sampled should not be larger than one acre and should contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.

1.4.2 State Landscape Contractor's License

Construction company must hold a landscape contractors license in the state where the work is performed and have a minimum of five years landscape construction experience. Submit copy of license and three references for similar work completed in the last five years.

1.4.3 Erosion Assessment

Assess potential effects of soil management practices on soil loss in accordance with ASTM D6629. Assess erodibility of soil with dominant soil structure less than 2.8 to 3.1 inches in accordance with ASTM D5852.

1.4.4 Pre-Installation Meeting

Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this section. Review conditions of operations, procedures and coordination with related work. Agenda must include the following:

a. Tour, inspect, and discuss conditions of planting materials.

b. Review planting schedule and maintenance.

c. Review required inspections.

d. Review environmental procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Soil Amendment Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulfur, iron, and lime may be furnished in bulk with a certificate indicating the above information. Store in dry locations away from contaminates.

1.5.2 Storage

1.5.2.1 Fertilizer, Gypsum, pH Adjusters and Mulch Storage

Store in dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks prior to stockpiling existing topsoil.

1.5.3 TIME LIMITATION

Except for container-grown plant material, the time limitation from digging to installing plant material must be a maximum of 90 days. The time limitation between installing the plant material and placing the mulch must be a maximum of 24 hours.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.

1.6.1 Planting Dates

All year.

1.6.2 Restrictions

Do not plant when ground is muddy, or when air temperature exceeds 90 degrees Fahrenheit

1.7 GUARANTEE

All plants must be guaranteed for one year beginning on the date of inspection by the Contracting Officer to commence the plant establishment period, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse

by the Government or by weather conditions unusual for the warranty period.

Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season. At end of warranty period, replace planting materials that die or have 25 percent or more of their branches that die during the construction operations or the guarantee period.

PART 2 PRODUCTS

2.1 TOPSOIL

2.1.1 Existing Soil

Modify to conform to requirements specified in paragraph COMPOSITION.

2.1.2 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph COMPOSITION. When available topsoil must be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.1.3 Off-Site Topsoil

Conform to requirements specified in paragraph COMPOSITION. Additional topsoil must be furnished by the Contractor.

2.1.4 Composition

Evaluate soil for use as topsoil in accordance with ASTM D5268. From 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH must be tested in accordance with ASTM D4972. Topsoil must be free of sticks, stones, roots, plants, and other debris and objectionable materials. Other components must conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.2 SOIL CONDITIONERS

Provide singly or in combination as required to meet specified requirements for topsoil. Soil conditioners must be nontoxic to plants.

2.2.1 Lime

Lime to meet topsoil test report recommendations.

2.2.2 Aluminum Sulfate

Commercial grade.

2.2.3 Sulfur

100 percent elemental

2.2.4 Iron

100 percent elemental

2.2.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D4427 as modified herein. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation. Peat must not contain invasive species, including seeds.

2.2.6 Sand

Clean and free of materials harmful to plants.

2.2.7 Perlite

Horticultural grade.

2.2.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, invasive species, including seeds, and soil stabilized with nitrogen and having the following properties:

2.2.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.2.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.2.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 80 percent, calcium 18 percent, sulfur 14 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3 PLANTING SOIL MIXTURES

100 percent on-site topsoil.

Sandy topsoil: one part topsoil to one part peat; clay topsoil: two parts topsoil to one part peat. Thoroughly mix all parts of planting soil

mixture to a uniform blend throughout.

2.4 FERTILIZER

Fertilizer for groundcover, wildflowers and grasses is not permitted. Fertilizer for trees, plants, and shrubs must be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

16 percent available nitrogen
16 percent available phosphorus
16 percent available potassium

2.5 WATER

Source of water to be approved by Contracting Officer and suitable quality for irrigation and must not contain elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide soil preparation, including soil conditioners and soil amendments prior to planting. Provide seed, planting, post-planting fertilizer, installation, of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 PREPARATION

3.2.1 Protection

Protect existing and proposed landscape features, elements, and sites from damage or contamination. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than the drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.

3.2.2 Erosion Control

Provide erosion control and seeding with native plant species to protect slopes.

3.2.3 Soil Preparation

3.2.3.1 pH Adjuster Application Rates

Apply pH adjuster at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

3.2.3.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.3.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.3 RESTORATION AND CLEAN UP

3.3.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation must be restored to original condition at the Contractor's expense.

3.3.2 Clean Up

Excess and waste material must be removed from the installed area and must be disposed offsite at an approved landfill, recycling center, or composting center. Adjacent paved areas must be cleared.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 08 53

AVIATION FUEL DISTRIBUTION SYSTEM START-UP
08/18

PART 1 GENERAL

a. The P-012 hydrant loop piping must be flushed and cleaned by the use of temporary pigging equipment, pumps, filters, and mobile storage tanks, prior to tie-in connection with the existing Pump House 3 and 4 hydrant loop. The temporary pigging equipment must be installed at the stub-out companion flanges in IVV-1.

b. The existing Pump House 3 and 4 hydrant loop piping must be maintenance flushed (by Base Fuels Operator using existing Pump House 3 and/or 4) and cleaned before tie-in connection with the P-012 hydrant loop piping. After satisfactory flushing and cleaning in accordance with this section, the existing Pump House 3 and 4 hydrant loop must be drained down by Base Fuels Operator prior to tie-in connection with P-012 hydrant loop near IVV-2.

c. The existing Pump House 3 and 4 hydrant loop piping combined with the new P-012 hydrant loop must be flushed and cleaned after final tie-in connection with the P-012 hydrant loop. Contractor must limit outage to the minimum amount of time necessary up to a maximum of four weeks for outage associated with tie-in connections to the existing hydrant loop, inclusive of 1 week for Base fuels operator activities as described below. Contractor must coordinate the outage duration with the Contracting Officer within 120 (OCONUS) days of contract award. Outage duration must be planned for the months of September through December. Contractor must assume one week for Base fuels operator led maintenance flush and drain down of the existing hydrant loop for Pump House 3. Outage duration must include the following construction activities.

   (1) Maintenance flush of the existing hydrant loop for Pump House 3 performed by Base fuels operator.

   (2) Drain down of the existing hydrant loop for Pump House 3 performed by Base fuels operator.

   (3) Tie-in connections of the new hydrant loop to the existing hydrant loop performed by Contractor.

   (4) Flushing and cleaning of the combined new and existing hydrant loop after tie-in performed by Contractor.

   (5) System start-up of the combined new and existing hydrant loop performed by Contractor.

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-8167	(2016) Engineering and Design -- Petroleum, Oil, and Lubricants Mandatory Center Of Expertise

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 System Start-up Plan

Submit a detailed written plan prepared by the System Supplier for implementation of System Start-Up. The detailed written plan must include all sequencing of work specified in Part 3 EXECUTION of this section. Submit the plan 120 (OCONUS) days prior to System Start-Up. Include a list of personnel by trade, list of key personnel, safety equipment, list of miscellaneous equipment (such as two-way radios personnel transportation vehicles etc.) and detailed procedures and schedules. The Contractor and System Supplier are responsible for implementing System Start-Up in coordination with ongoing base operations.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

System Start-Up Plan; G

Performance Testing Plan; G

SD-06 Test Reports

Equipment Tests; G

Final Reports; G

SD-11 Closeout Submittals

Certification of Entire System

1.4 CLOSEOUT SUBMITTALS

1.4.1 Final Reports

Submit a final report which includes the project closeout activities and system commissioning documentation.

1.5 QUALITY ASSURANCE

1.5.1 Definitions

Subject Matter Expert (SME) is defined as Service Headquarters Subject Matter Experts. SME for this project is the AFIMSC Detachment 2 Fuels Engineer.

1.5.2 Certification of Entire System

Prior to the acceptance of the newly constructed system by the Government, all installed mechanical and electrical equipment must be inspected and approved by the Contracting Officer. Provide the Contracting Officer 120 days notice in order to schedule the Installation and SME for participation in the inspection, Performance Testing, and approval. Any deficiencies observed must be corrected by the Contractor without cost to the Government. ER 1110-1-8167 Engineering and Design Petroleum, Oil, and Lubricants Mandatory Center of Expertise must be followed.

PART 2 PRODUCTS

2.1 GOVERNMENT-FURNISHED MATERIAL AND EQUIPMENT

The Government will furnish the following materials, equipment and services during the performance of the work under this section.

2.1.1 Aircraft Turbine Fuel

The Government will provide the fuel necessary for the System Start-Up. The Contractor must provide an approved copy of the System Start-Up Plan 120 days in advance for locations outside the Continental United States to the Government entity (DLA) providing fuel before any fuel is provided.

Fuel will not be delivered to the system until the Contractor has satisfactorily completed all work and, in particular, the cleaning of the interior surfaces of the temporary tanks and the removal of preservatives and foreign matter from those portions coming in contact with the fuel valves, pumps, filter separators and other such equipment.

The Contractor is responsible for reimbursing the Executing Agent (EA) for any loss of fuel and contaminated fuel. The EA will reimburse DLA for lost and contaminated fuel. The Contractor is responsible for the disposal of any contaminated fuel. Some fuel loss, 1 BBL (42 gallons), is expected during Flushing, Cleaning, and Performance Testing.

The System Start-Up Plan must specify what grade of fuel, volume (gallons), recommended delivery dates, and phase of System Start-Up (Initial Fuel Receipt, Fuel Filling and Packing, Flushing, Cleaning, and Performance Testing). Fuel used for Flushing and Cleaning will possibly become contaminated, the fuel must be isolated and is considered off-specification until the fuel sampling results are provided.

Upon satisfactory completion of the flushing and cleaning operations, the Government will supply the additional quantities of fuel required to complete the other work under this section. Approximately 200,000 gal of fuel will be required for cleaning, flushing, hydrostatic testing, and system start-up of the P-012 hydrant loop.

An empty Operating Tank must never be filled at a velocity greater than 3 feet per second (fps) in the fill line until fuel is in contact with the floater (or 3 feet above the fill nozzle).

2.1.2 Tank Trucks

Refueler tank trucks and operation of same will be furnished by the Government. Contractor must coordinate with Base Fuels Operator for the number of refueler tank trucks needed.

2.1.3 Hydrant Hose Trucks

The Government will furnish and operate the hydrant hose trucks required for ground refueling and defueling of aircraft at hydrant pits. Contractor must coordinate with Base Fuels Operator for the number of hydrant hose trucks needed.

2.1.4 Utilities

Electric power required for the performance of the work under this section will be furnished at no charge to the Contractor.

2.2 MATERIAL AND EQUIPMENT

2.2.1 Contractor Furnished

Provide material, equipment and labor not specified to be Government-furnished and required for proper System Start-Up of the system. Equipment must include but not be limited to the following:

a. Temporary strainers.

b. Pipe spools.

c. Flow meters.

d. Pressure gauges.

e. The Contractor must have on hand sufficient filter elements and coalescer cartridges to adequately clean the system. During cleaning operation, provide a flow versus pressure drop graph for each filter separator. Change coalescers and cartridges upon reaching a differential pressure of 15 psi or when pressure drop is less than previous graph or fails to increase properly. Isolate each filter separator, one at a time and use one fueling pump to obtain rated flow rate. A minimum of one complete set of coalescer elements and separator cartridges for each filter separator must be turned over to the Government after new coalescer elements and separator cartridges are installed in each filter separator vessel after completion of Performance Testing.

f. Pigging equipment and services as called out in paragraph PIPELINE PIGGING VERIFICATION, Section 33 52 43.13 AVIATION FUELING PIPING. Pigging equipment must include temporary pigging launcher and receiver and associated equipment.

g. Temporary pumps and filter separators with a total flow rate of 3,600 gpm to maintain minimum flow velocity of 10 feet/sec.

h. Temporary manifolds and sufficient number of single compartment tanks or tank trucks and hoses to allow desired flow rates in a safe manner.

2.2.2 Design Conditions

Use temporary flushing lines and equipment that are equal in strength, stability, and materials to the associated permanent components. However, spools may be carbon steel. Additional design conditions must be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT.

PART 3 EXECUTION

3.1 PREPARATIONS FOR FLUSHING

Upon completion of the system to the satisfaction of the Contracting Officer and the SME, make the following preparations for flushing the system.

3.1.1 Protection of Equipment

The following items must be removed from the new P-012 hydrant loop prior to start of flushing operations and, where applicable, replaced with spools of pipe, diameter equal to the item removed.

a. Hydrant valves if flushing outlets into tank trucks.

After flushing, the above items must be reinstalled in the system and the spool sections turned over to the Contracting Officer.

3.1.2 Strainers

Temporary 100 mesh cone type strainers with minimum 300 percent open area must be installed in the suction line ahead of each fueling pump and will be left in place. Any damaged strainers must be replaced by the Contractor at no additional cost to the Government.

3.1.3 Water Draw-off

Remove any accumulated water from Operating Tanks' sumps and bottoms.

3.2 FLUSHING

Flushing procedures must precede cleaning procedures. Hydrostatic Testing of new piping must precede flushing procedures in accordance with paragraph HYDROSTATIC TEST, Section 33 52 43.13 AVIATION FUEL PIPING. The new and existing hydrant apron loop, existing supply and return lines to the Pump House 3 and 4 operating tanks, and new hydrant laterals must be flushed with fuel until the fuel being delivered is free of construction debris to the satisfaction of the Contracting Officer. Samples of fuel must be taken and tested by the designated Government agency and must be free of gross contamination, maximum of 8.0 mg/gallon solids and free water not to exceed 2 ml per quart.

3.2.1 Fueling System Piping

3.2.1.1 Flush New Fueling System Apron Piping (between IVV-1 and IVV-2)

The flushing of new apron system pipelines must be accomplished by pumping fuel from temporary tank(s) through the fueling system piping and temporary filtration, and back to temporary tank(s). Air must be bled from system high points. The procedure must be continued until the fuel being delivered into the tank(s) is acceptable to the Contracting Officer.
At the specified and indicated flow velocity/rate, flushing must be continuous until, at a minimum, the volume of fuel displaced meets or exceeds five times the volume of the piping segment being flushed. However, flushing and testing of fuel quality must continue until fuel quality is acceptable. After the system has been flushed to the satisfaction of the Contracting Officer, remove any water remaining in the

low point drains and remove any accumulated water from the temporary tanks. Cone strainers must be kept clean in order to insure maximum flow rate. In addition, baskets from all strainers must be removed and cleaned. Contractor must use temporary pumps and filter separators with a total flow rate of 3,600 gpm to maintain minimum flow velocity of 10 feet/sec.

3.2.1.2 Flush Existing Fueling System Piping before Tie-in

The maintenance flushing of existing 14-inch main hydrant loop for Pump House 3 and 4 must be performed by Base Fuels Operator using existing Pump House 3 and/or 4, prior to tie-in connection with new 12-inch hydrant loop for the P-012 project. Flushing of apron system pipelines must be accomplished by pumping fuel from one of the Pump House 3 or 4 operating tanks through the fueling system piping and back to another tank. Existing hydrant laterals must not be flushed. Air must be bled from system high points. The procedure must be continued until the fuel being delivered into the tanks is acceptable to the Contracting Officer. After the system has been flushed to the satisfaction of the Contracting Officer, remove any water remaining in the low point drains and remove any accumulated water from Operating Tank sumps and bottoms by means of the Water Draw-off systems. Cone strainers must be kept clean in order to insure maximum flow rate. In addition, baskets from all strainers must be removed and cleaned. Base Fuels Operator must follow Base maintenance flushing procedures using Pump House 3 and/or 4 with a total flushing flow rate of 3,000 gpm.

3.2.1.3 Flush Existing and New Fueling System Piping after Tie-in

The flushing of existing 14-inch main hydrant loop for Pump House 3 and 4 combined with the new 12-inch P-012 hydrant loop must be performed by the Contractor after tie-in connection (with new P-012 hydrant loop) to flush the new tie-in pipe sections adjacent to IVV-2. Flushing of apron system pipelines must be accomplished by pumping fuel from one of the Pump House 3 or 4 operating tanks through the fueling system piping and back to another tank. Existing hydrant laterals must not be flushed. Air must be bled from system high points. The procedure must be continued until the fuel being delivered into the tanks is acceptable to the Contracting Officer. After the system has been flushed to the satisfaction of the Contracting Officer, remove any water remaining in the low point drains and remove any accumulated water from Operating Tank sumps and bottoms by means of the Water Draw-off systems. Cone strainers must be kept clean in order to insure maximum flow rate. In addition, baskets from all strainers must be removed and cleaned. Flushing must be performed using Pump House 3 and/or 4 with a total flushing flow rate of 3,000 gpm.

3.2.1.4 Flush New Apron Loop Piping After Tie-in

Position manual valves to circulate fuel through the new P-012 apron loop and back to the operating tank at Pump House 3 or 4. Begin flushing the apron loop at a flow rate of 600 gpm. Increase flushing flow rate one pump at a time to the maximum available number of pumps (5 pumps total) for a minimum of 8 hours.

3.2.1.5 New Fueling System Hydrant Outlets

Remove equipment as specified in paragraph "PROTECTION OF EQUIPMENT" of this section. Position a tank truck at the hydrant outlet and flush each hydrant lateral. Sample the fuel at the connection to the truck. Flushing must be continuous until, at a minimum, the volume of fuel displaced meets

or exceeds five times the volume of the piping segment being flushed. However, flushing and testing of fuel quality shall continue until fuel quality is acceptable by the Contracting Officer.

3.3 CLEANING

After initial flushing is completed, clean the apron loop piping and pump house piping in accordance with the procedure specified hereafter. Isolate Operating Tanks from the system and clean.

3.3.1 Preparation for Cleaning

Filter elements must be installed in the filter separators. Adjust filter separator flow control valve. Operating Tanks must be drained, vapor freed and cleaned. Transfer the contents from one operating tank to the other for the purposes of cleaning.

3.3.2 Cleaning Requirements

Cleaning must continue until the Contracting Officer certifies that the fuel passes the color and particle assessment method as defined in T.O. 42B-1-1 or contains 2 milligrams per gallon (mg/gallon) or less of particulate. Fuel must also contain 10 parts per million (ppm) or less of free water. Sampling must be performed by the contractor and testing must be done by an approved independent testing laboratory.

3.3.3 Cleaning Procedure

During cleaning procedure, periodically bleed air through high point vent and drain water through low point drains.

3.3.3.1 Clean New Fueling System Apron Piping (between IVV-1 and IVV-2)

The cleaning of new P-012 hydrant loop piping must be performed prior to tie-in connection with existing 14-inch main hydrant loop for Pump House 3 and 4 as follows:

a. Position manual valves to circulate fuel through the apron loop and back to the temporary tank through the temporary filtration.

b. First clean the pipe using pigs as called out in paragraph PIPELINE PIGGING VERIFICATION, Section 33 52 43.13 AVIATION FUEL PIPING. During this, low point drains and high point vents must be blown clean. Monitor pressure drop through the filter separators during the cleaning operation. Temporary pig launcher and receiver must be installed at the stub-out companion flanges in IVV-1.

c. Inspect the pipe as called out in paragraph PIPELINE PIGGING VERIFICATION, Section 33 52 43.13 AVIATION FUEL PIPING.

d. Initially pump fuel through the apron loop at a lower flow rate (using one pump), then increase flow rate up to the full capacity (3,600 gpm) to maintain minimum flow velocity of 10 feet/sec, starting manually one pump at a time.

e. Monitor pressure drop through the filter separators during the cleaning operation.

f. Remove equipment as specified in paragraph "PROTECTION OF EQUIPMENT"

of this section. Position a tank truck at the hydrant outlet and clean each hydrant lateral, one at a time.

g. Periodically take samples from all sample connections. Continue cleaning until the fuel meets specified requirements of paragraph CLEANING REQUIREMENTS.

3.3.3.2 Clean Existing and New Fueling System Piping after Tie-in

The cleaning of existing 14-inch main hydrant loop for Pump House 3 and 4 combined with the new 12-inch P-012 hydrant loop must be performed by the Contractor after tie-in connection (with new P-012 hydrant loop) to clean the new tie-in pipe sections adjacent to IVV-2.

a. Position manual valves to circulate fuel through the apron loop and back to the Pump House 3 or 4 operating tank through the receiving filter separators.

b. Initially pump fuel through the apron loop at a flow rate of 600 gpm, then increase flow rate up to the full capacity (all 5 pumps running) starting manually one pump at a time.

c. Monitor pressure drop through the filter separators during the cleaning operation and provide flow vs. pressure drop graphs as specified herein before.

d. Position a tank truck at the new P-012 hydrant outlet and clean each hydrant lateral, one at a time. Only new fueling system hydrant laterals will be cleaned. Existing hydrant laterals must not be flushed.

e. Periodically take samples from all sample connections. Continue cleaning until the fuel meets specified requirements of paragraph CLEANING REQUIREMENTS.

f. Continuously monitor tank levels throughout cleaning.

3.3.3.3 Pump House Piping

Contractor must clean pump house piping after cleaning of existing and new fuel system piping after Tie-in as spcified in paragraph "CLEAN EXISTING AND NEW FUELING SYSTEM PIPING AFTER TIE-IN" of this section. The pump house (Pump House 3 and/or 4) piping used for flushing and cleaning operations must be cleaned as follows:

a. Position manual valves so that fuel is withdrawn from one operating tank, circulated through one fueling pump and filter separator, then returned to the Pump House 3 or 4 operating tank through the receiving filter separators.

b. Clean the piping system using one pump at a time. Alternate the fueling pumps and filter separators during the operation to clean the individual fueling pump suction and discharge lines.

c. Monitor pressure drop through the filter separators during each cleaning operation and provide flow vs. pressure drop graphs as specified herein before.

d. Periodically take samples from all sample connections. Cleaning must

continue until the fuel meets the specified requirements.

e. Continuously monitor tank levels throughout cleaning.

3.3.3.4 Cleaning of Existing Hydrant Hose Truck Checkout Position

a. Prior to fit-up, Contractor must clean new piping segment by swabbing and visually inspect to ensure system cleanliness. Care must be taken during fabrication and installation to maintain pipe cleanliness to the maximum extent possible. All new piping (and existing pipe at points of connection) shall be swabbed clean with fuel-soaked burlap or swabs designed of a jet fuel compatible material for cleaning insides of pipes until no residue can be further removed. Swabs must be propelled through the new piping by pulling the swabs through the piping by hand with ropes, pneumatically, or as otherwise approved by Contracting Officer's designated personnel and Engineer. Swabbing of the new piping shall be repeated until new piping is completely clean to the satisfaction of the Contracting Officer's designated personnel and Engineer. Detergents, surfactants, and other cleaners are strictly prohibited for use in cleaning jet fuel piping.

b. Contractor must coordinate and arrange for witnessing of pipe swabbing and inspection by Contracting Officer's designated personnel and/or Engineer prior to performing final connections. Pipe shall be cleaned repeatedly as necessary to satisfaction of Contracting Officer's designated personnel and/or Engineer.

c. New fuel piping 2 ½-inch and larger must be completely swabbed and cleaned with Jet A soaked swabs prior to completing tie-ins / fit-ups of new to existing piping.

3.4 EQUIPMENT TESTS

After completion of flushing, cleaning, and control valve and electrical components adjusting operations, the tests specified hereinafter must be performed. After cleaning is complete and prior to Performance Testing, Equipment Tests must be performed. Field adjustment of automatic control valves and automatic pump controls while in operation must be made only by the valve manufacturer's authorized field test engineer. For final adjustment of installed electrical control equipment provide an experienced electrical engineer, factory representative of PCP manufacturer and factory representative of PIT and DPT manufacturers. Both the mechanical and electrical components must be adjusted concurrently. Record required data necessary to prepare Equipment Tests Report.

3.4.1 Equipment Tests

System Supplier must complete and submit the Equipment Tests, see Attachment 1 - Equipment Tests. Submit Equipment Tests prior to Performance Testing (Government approval not required prior to Performance Testing.)

3.4.2 Fuel Delivery

Deliver fuel to each fueling point against a backpressure at the outlet of the hydrant control valve created by the tank trucks and hoses used during the tests. The flow rate must be not less than 600 gallons per minute for a 4-inch valve. Flow rates might be affected by aircraft capability.

3.4.3 Emergency Shutdown

With one fueling pump circulating fuel through the system, test each "Emergency Stop" pushbutton station to verify that the pump stops and the emergency shutoff solenoid activates and the control valve closes. Repeat above procedure for each fueling pump and "Emergency Stop" pushbutton station. Conduct tests for both the automatic and manual modes. With all the fueling pumps circulating fuel through the system, push an "Emergency Stop" pushbutton station.

3.4.4 Hydrant Control Valve

Each Hydrant Control Valve must be operated to demonstrate the following:

3.4.4.1 Surge Shut-Down Capability

Surge from shut-off of on-board aircraft fill valve can be simulated by closing a fill line valve to the tank truck or bladder, use a 3 second closure.

3.4.4.2 Pressure Control at Setpoint + 2 psi

Requires use of a pressure gage at the pressure fueling nozzle

3.5 PERFORMANCE TESTING

Performance testing must demonstrate to the satisfaction of the Contracting Officer and SME these portions of the fueling system are working as specified. Performance testing must consist of operating the fueling system during actual fueling and defueling operations in the presence of Government Witnesses. The maximum rated capacity of the system must be demonstrated. The Contractor must notify the Contracting Officer 30 calendar days in advance of the test to permit arrangement for the use of Government-furnished items. During the time period of performance testing, no construction activities will be allowed on the project site. The project site must be considered an operational (fuel) zone (verses a construction zone) during this performance testing period. Personnel, dressed for fuel's operation, will be present to witness testing and participate in Contractor provided training.

3.5.1 Final Performance Test

A final performance test must consist of fueling aircraft if the installation has aircraft available.

3.5.1.1 Satisfactory Performance

In the event a portion of the system or any piece of equipment fails to meet the test, make the necessary repairs or adjustments and repeat the Performance Test until satisfactory performance is obtained. The determination of satisfactory performance must be made by the Contracting Officer and the SME.

3.5.2 Performance Testing Plan

System Supplier must submit a Performance Testing plan for approval. Submit plan a minimum of 120 days prior to performance testing.

3.5.3 Equipment Tests

System Supplier must provide 10 hard copies of the completed Equipment Tests to the SME at the start of Performance Testing for validation during Performance Testing.

3.5.4 Final Acceptance

Fill the system with fuel and operate leak-free prior for acceptance. Anything wet with fuel is considered to be leaking.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

EQUIPMENT TESTS

04/18

PROJECT: _____

LOCATION: _____

To be performed after flushing, cleaning, and control valve and electrical component adjustments

ITEM 1 – R12 (HHT1) CAPABILITIES

EQUIPMENT – TRUCK NO. _____	ADJUST AND VERIFY	
	ACTION	VALUE
CONTROL VALVE	CLOSURE RATE (SEC), DEADMAN RELEASE	
CONTROL VALVE	NOZZLE PRESSURE SET POINT (PSI)	
CONTROL VALVE	NOZZLE PRESSURE SET POINT (SEC), SURGE	
CONTROL VALVE	CLOSURE RATE (SEC), DURING SURGE	
VENTURI	CALIBRATED TO DESIGN FLOW	
SURGE SUPPRESSOR FRONT	PROPERLY CHARGED AND WORKING	
SURGE SUPPRESSOR REAR	PROPERLY CHARGED AND WORKING	
PRESSURE GAUGE, GROUND NOZZLE	CALIBRATED	
PRESSURE GAUGE, UNDERWING NOZZLE	CALIBRATED	
DEFUEL	FLOW (GPM)	
DEFUEL	PRESSURE (PSI)	
DEFUEL	OPERATION	
HYDRANT PRESSURE GAUGE	CALIBRATED	
AIR SENSE PRESSURE GAUGE	CALIBRATED	
GROUND HOSE 1	FLOW AND INLET PRESSURE (GPM AND PSI)	
GROUND HOSE 2	FLOW AND INLET PRESSURE (GPM AND PSI)	
GROUND HOSES COMBINED	FLOW AND INLET PRESSURE (GPM AND PSI)	
UNDERWING HOSE 1	FLOW AND INLET PRESSURE (GPM AND PSI)	
UNDERWING HOSE 2	FLOW AND INLET PRESSURE (GPM AND PSI)	
UNDERWING HOSES COMBINED	FLOW AND INLET PRESSURE (GPM AND PSI)	

+ No tests to be repeated for Performance Testing

DATE: _____

TIME: _____

TEST CONDUCTED BY: _____

ITEM 1 – R12 (HHT2) CAPABILITIES

EQUIPMENT – TRUCK NO. _____	ADJUST AND VERIFY	
	ACTION	VALUE
CONTROL VALVE	CLOSURE RATE (SEC), DEADMAN RELEASE	
CONTROL VALVE	NOZZLE PRESSURE SET POINT (PSI)	
CONTROL VALVE	NOZZLE PRESSURE SET POINT (SEC), SURGE	
CONTROL VALVE	CLOSURE RATE (SEC), DURING SURGE	
VENTURI	CALIBRATED TO DESIGN FLOW	
SURGE SUPPRESSOR FRONT	PROPERLY CHARGED AND WORKING	
SURGE SUPPRESSOR REAR	PROPERLY CHARGED AND WORKING	
PRESSURE GAUGE, GROUND NOZZLE	CALIBRATED	
PRESSURE GAUGE, UNDERWING NOZZLE	CALIBRATED	
DEFUEL	FLOW (GPM)	
DEFUEL	PRESSURE (PSI)	
DEFUEL	OPERATION	
HYDRANT PRESSURE GAUGE	CALIBRATED	
AIR SENSE PRESSURE GAUGE	CALIBRATED	
GROUND HOSE 1	FLOW AND INLET PRESSURE (GPM AND PSI)	
GROUND HOSE 2	FLOW AND INLET PRESSURE (GPM AND PSI)	
GROUND HOSES COMBINED	FLOW AND INLET PRESSURE (GPM AND PSI)	
UNDERWING HOSE 1	FLOW AND INLET PRESSURE (GPM AND PSI)	
UNDERWING HOSE 2	FLOW AND INLET PRESSURE (GPM AND PSI)	
UNDERWING HOSES COMBINED	FLOW AND INLET PRESSURE (GPM AND PSI)	

+ No tests to be repeated for Performance Testing

DATE: _____

TIME: _____

TEST CONDUCTED BY: _____

ITEM 3 - EMERGENCY SHUTDOWN

EMERGENCY SYSTEM				
DEVICE LOCATION FOR SHUT DOWN	LOCATION ID LIGHT ILLUMINATED		RED PCP ALARM	
	YES	NO	YES	NO
PUMPHOUSE 1				
PUMPHOUSE 2				
PUMPHOUSE 3				
CONTROL RM PCP				
CONTROL RM DOOR				
HHT				
TRUCK FILL STAND 1				
TRUCK FILL STAND 2				
TRUCK OFFLOAD 1				
TRUCK OFFLOAD 2				
TANK NORTH				
TANK SOUTH				
TANK EAST				
TANK WEST				
APRON 1				
APRON 2				
APRON 3				
APRON 4				
APRON 5				
APRON 6				
EWS				
FIRE ALARM SYSTEM				
PRT HIGH-HIGH LEVEL ALARM				

EMERGENCY SYSTEM ACTIVATION			
EQUIPMENT	VERIFY		
	ACTION	YES	NO
FP1 – AUTOMATIC	STOP		
FP2 – AUTOMATIC	STOP		
FP3 – AUTOMATIC	STOP		
FP4 – AUTOMATIC	STOP		
FP5 – AUTOMATIC	STOP		
FP1 – MANUAL	STOP		
FP2 – MANUAL	STOP		
FP3 – MANUAL	STOP		
FP4 – MANUAL	STOP		
FP5 – MANUAL	STOP		
FTP – AUTOMATIC	STOP		
FTP – MANUAL	STOP		
JP - AUTOMATIC	STOP		
JP - HAND	STOP		
OP1	STOP		
OP2	STOP		
BOWSER PUMP	STOP		
RP-1	STOP		
FSCV – 1 (EMERG SHUTOFF)	SOLENOID DE-ENERGIZED		
FSCV – 2 (EMERG SHUTOFF)	SOLENOID DE-ENERGIZED		
FSCV – 3 (EMERG SHUTOFF)	SOLENOID DE-ENERGIZED		
FSCV – 4 (EMERG SHUTOFF)	SOLENOID DE-ENERGIZED		
FSCV – 5 (EMERG SHUTOFF)	SOLENOID DE-ENERGIZED		

+ Repeat all tests for Performance Testing

DATE: _____

TIME: _____

TEST CONDUCTED BY:

ITEM 9 – TIGHTNESS MONITORING SYSTEM

SECTION TESTED	PASS/FAIL	DURATION (MINUTES)	DETECTED LEAK RATE

+ Initiate test and run for 15 minutes for Performance Testing

DATE: _____

TIME: _____

TEST CONDUCTED BY: _____

ITEM 14 – HYDRANT/TRUCK FILL/HHT CONTROL VALVES

Hydrant Control Valve (HCV) No.	HCV Size (Inch)	HCV Inlet Pressure (PSIG)	HCV Outlet Pressure (PSIG)	HCV Deadman Closure Rate (SEC)	HCV Max Outlet Pressure During Surge* (PSIG)	HCV Flow Rate (GPM)	Nozzle* Outlet Pressure (PSIG)

Nozzle* - Nozzle outlet pressure (skin of the aircraft 45 psi, skin of the truck 35)
Surge* (50 psi max aircraft, 40 truck) - Simulate surge by closing truck valve using a 3 second count
One pump in operation
+ All control valves to be witnessed during Performance Testing

DATE: _____

TIME: _____

TEST CONDUCTED BY: _____

ITEM 18 – FUEL SAMPLING RESULTS

SAMPLING LOCATION	COLOR (PASS/FAIL)	PARTICULATE (MG/GALLON)	FREE WATER (PPM)
Issue Filter Separator Receipt			
Pumphouse Return			
Hydrant Outlet (30% of the outlets)			
Truck Fill Stand			
HHT Check Out Station			
Tank 1			
Tank 2			
≤ 2 mg/gallon particulates ≤10 ppm free water			
	QUANTITY (GALLONS)		
Contaminated Fuel			

DATE: _____

TIME: _____

TEST CONDUCTED BY: _____

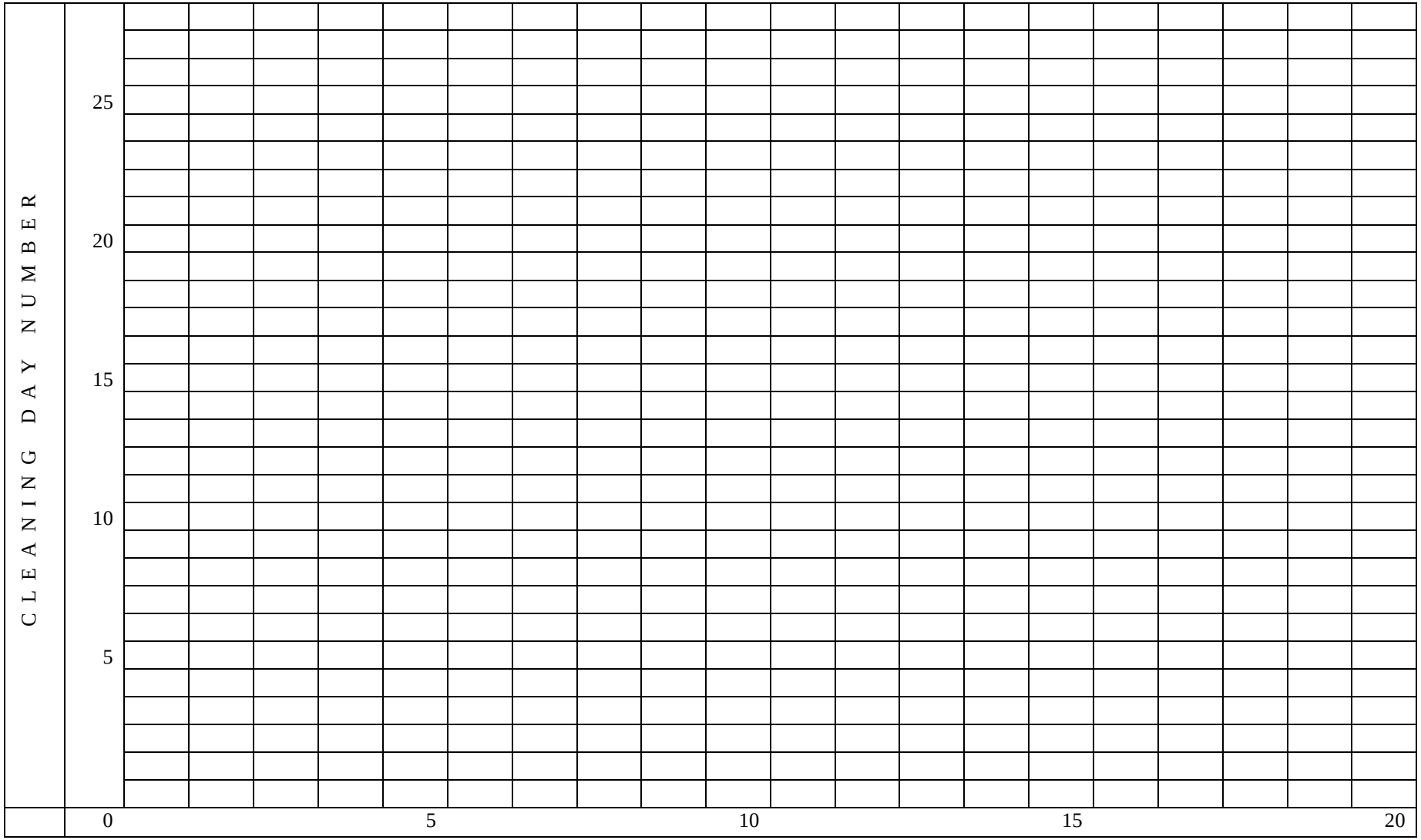
I certify that the values recorded in Items 1-17 are accurate and correct. (To be signed by System Supplier during Equipment Tests)
DATE:
SIGNATURE:
ORGANIZATION:

I witnessed designated (+) Equipment Tests during Performance Testing. (To be signed by Government Witness(es) during Performance Testing)
DATE:
SIGNATURE:
ORGANIZATION:

PERSONNEL PRESENT DURING PERFORMANCE TESTING

NAME	ORGANIZATION	COMMERCIAL PHONE NO.

REMARKS:

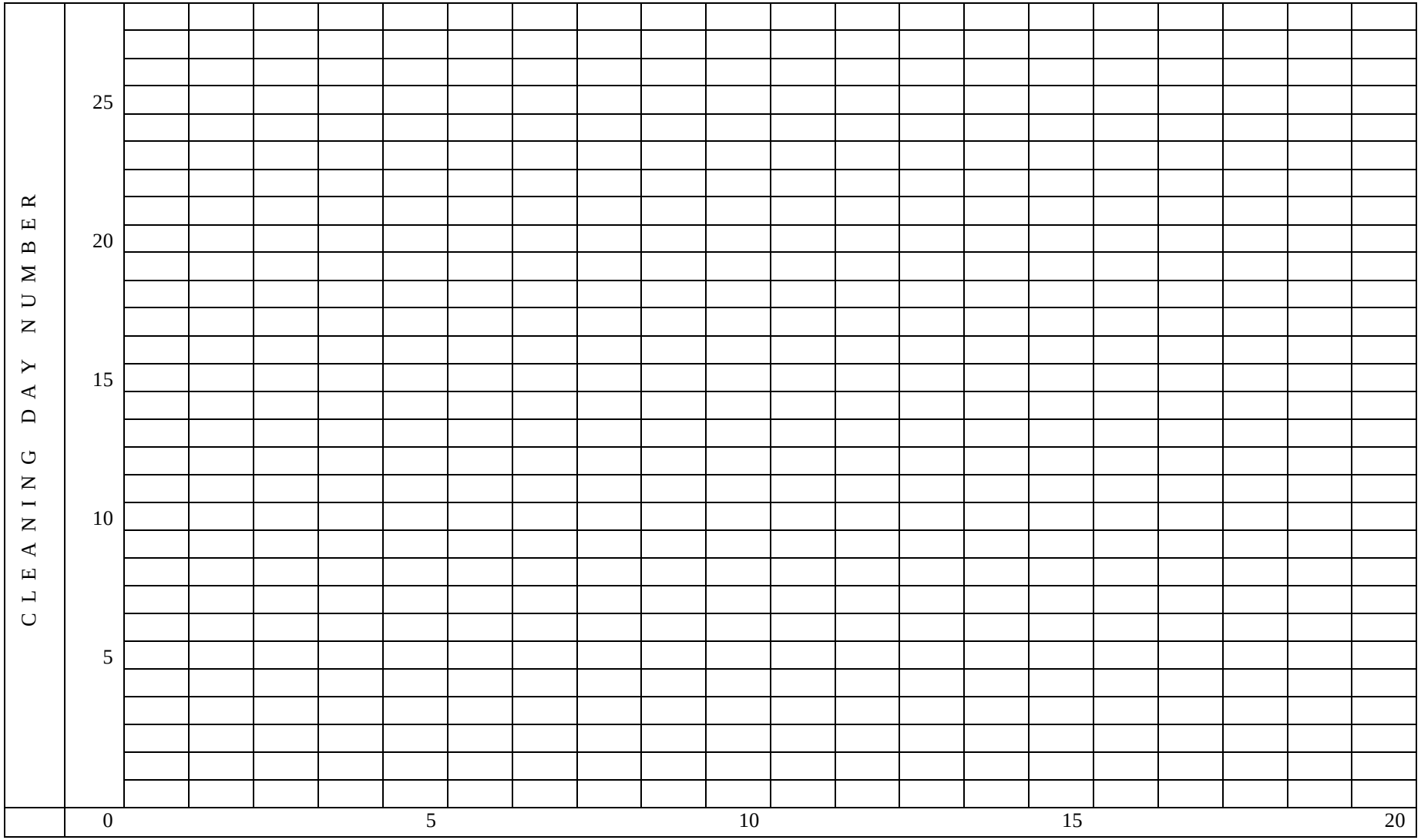


PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-1

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

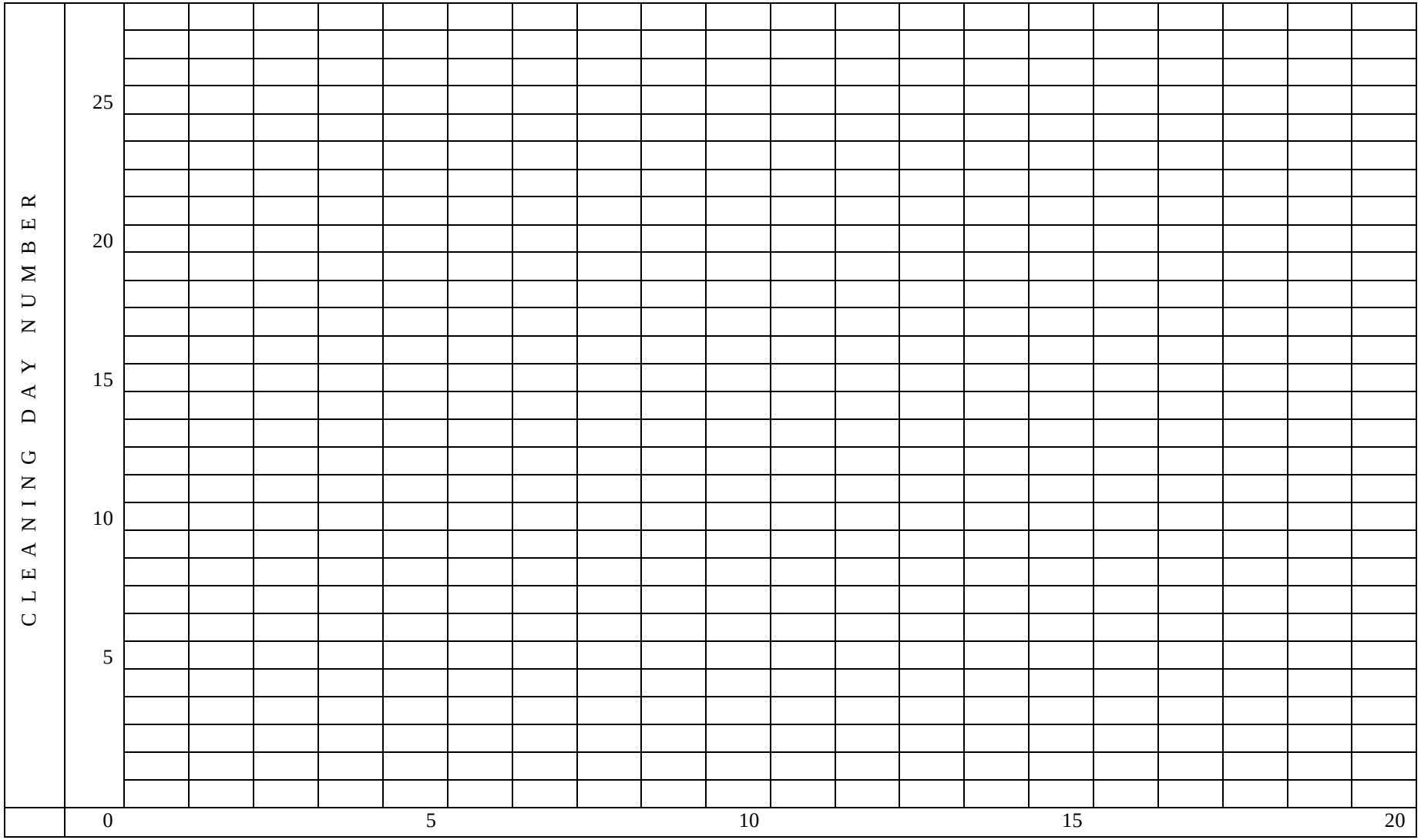


PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-2

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

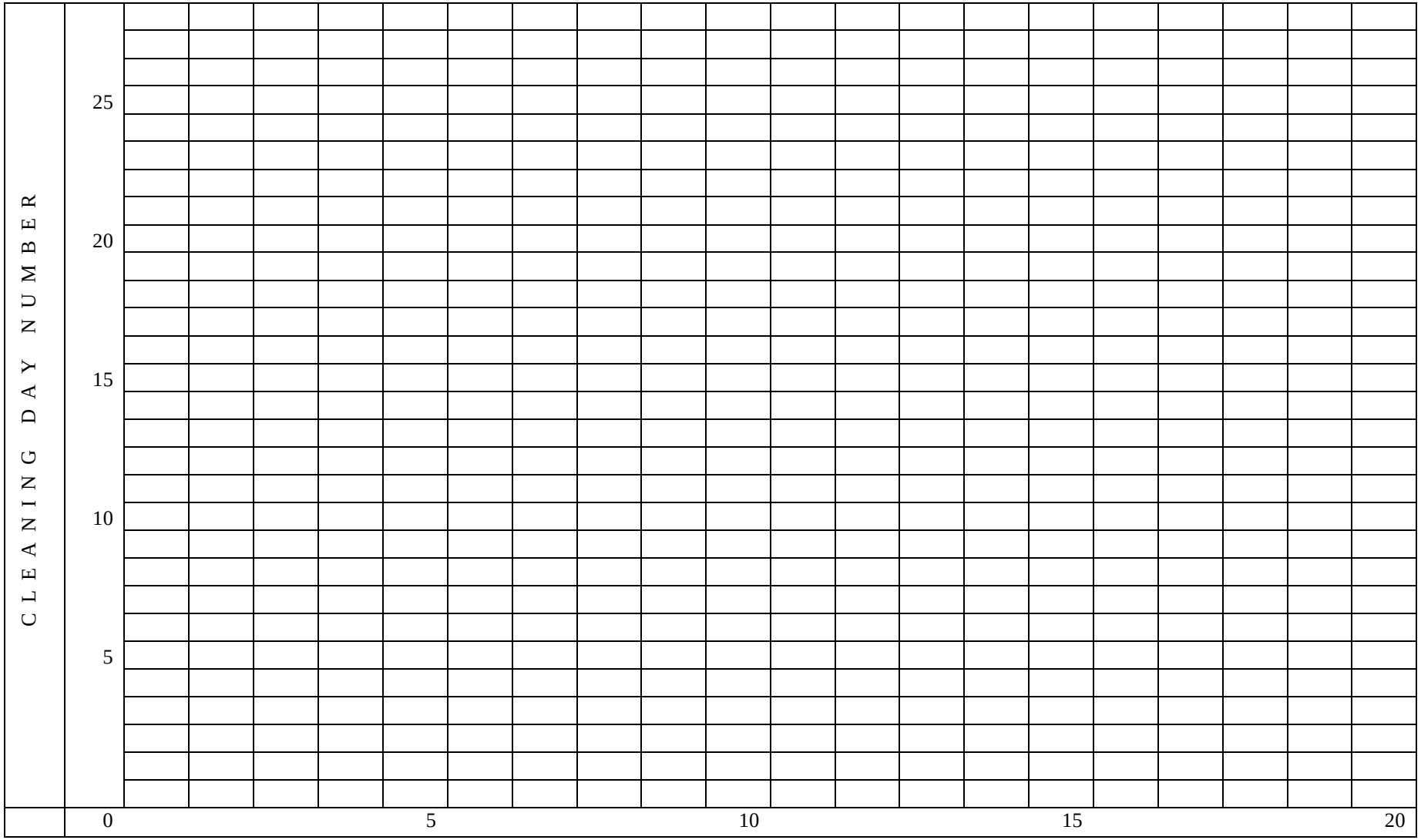


PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-3

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

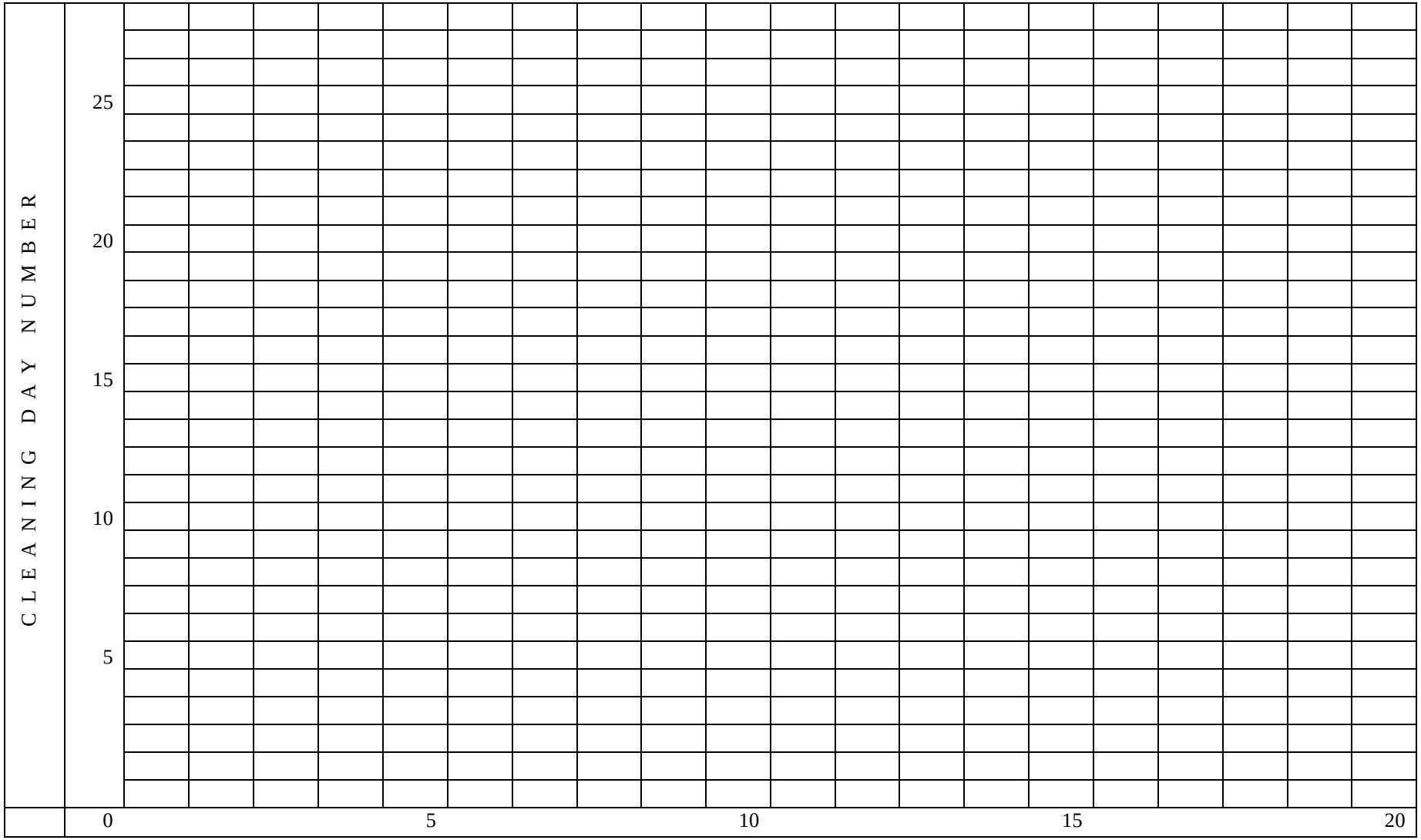


PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-4

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

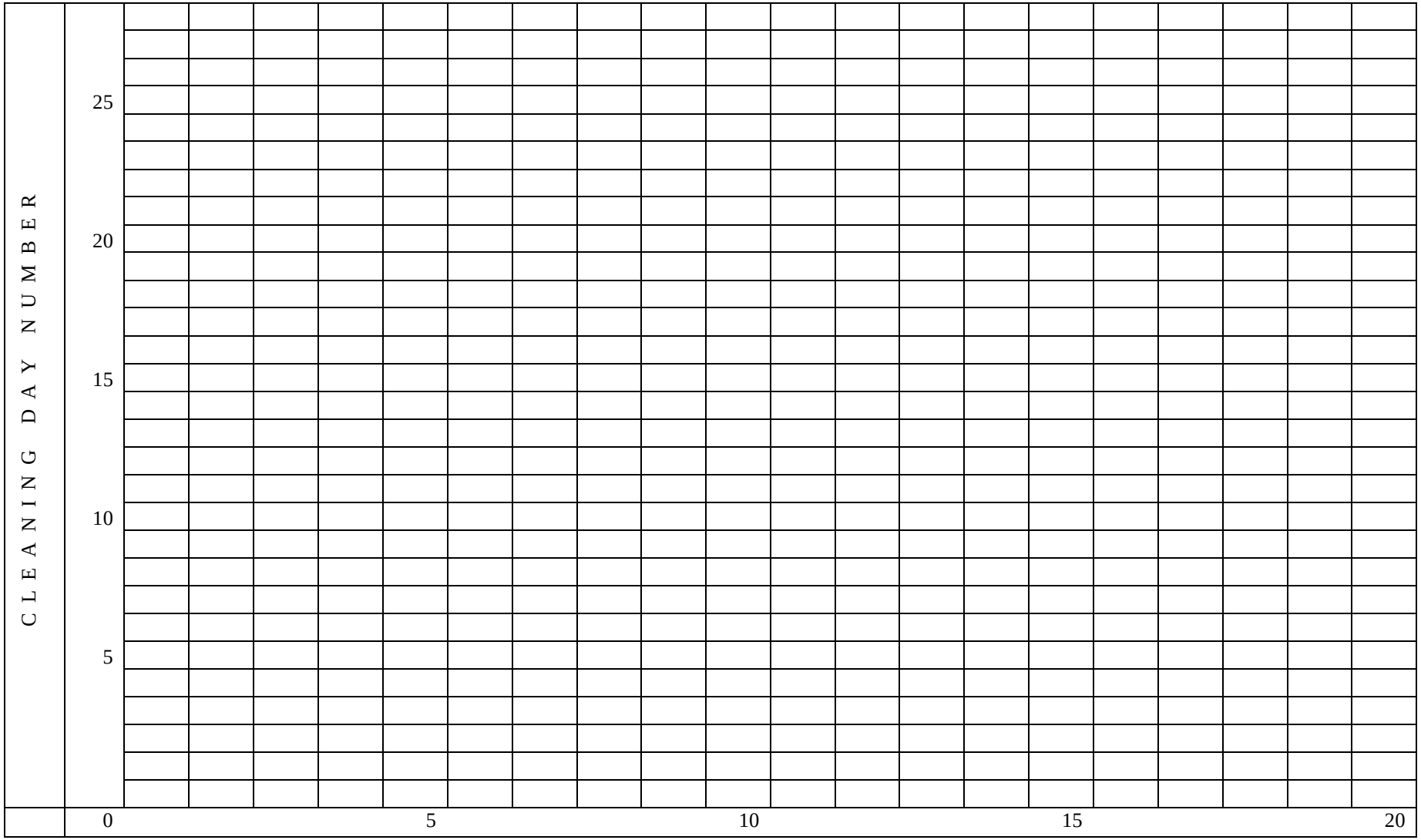


PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-5

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

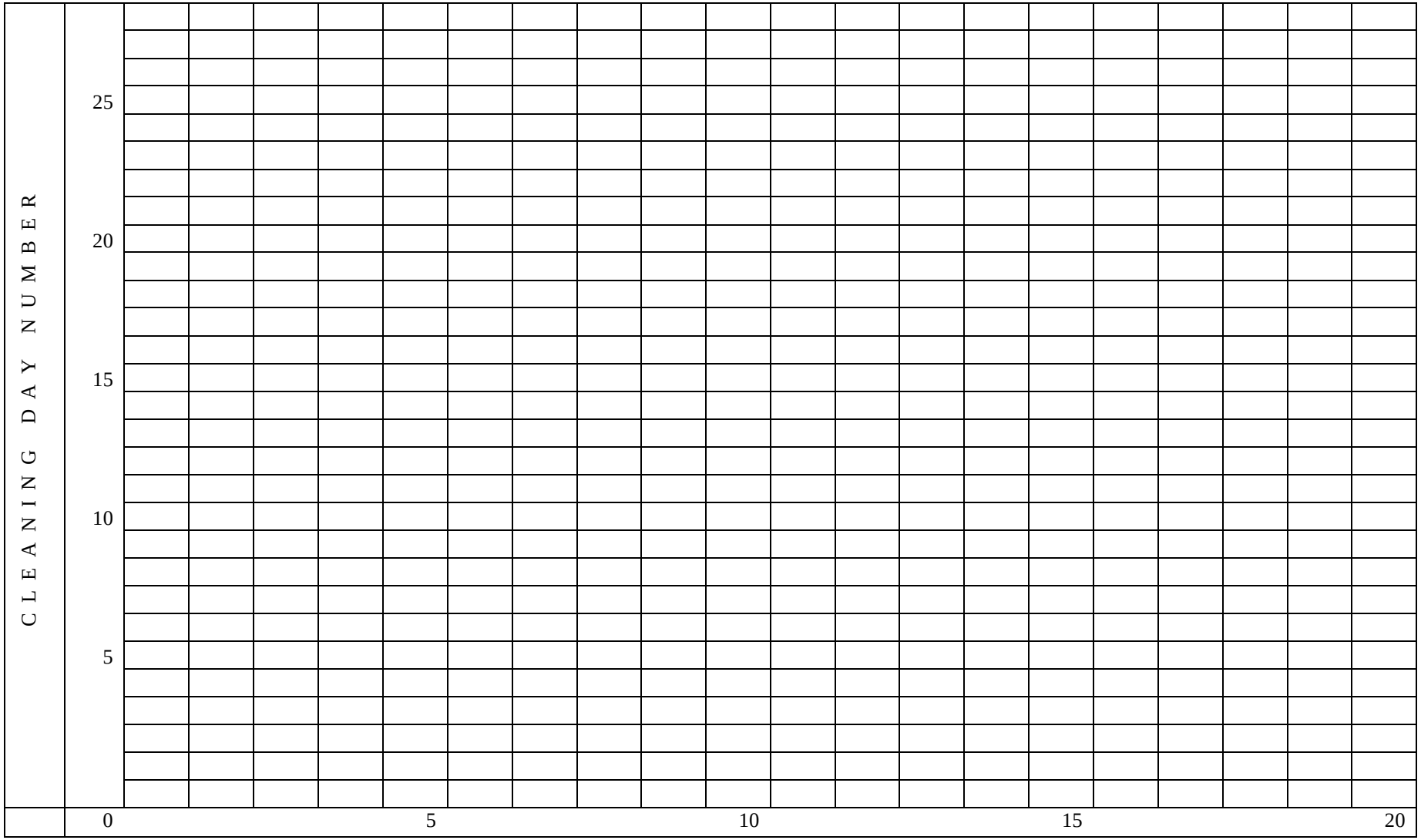


PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSR-1

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____



PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSR-2

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

SECTION 33 09 53

AVIATION FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (TYPE III)
02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.90	(2005; R 2011) Standard for Relays and Relay Systems Associated With Electric Power Apparatus

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2022) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code

UL SOLUTIONS (UL)

UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 1012	(2010; Reprint Apr 2016; Rev Mar 2021) UL Standard for Safety Power Units Other than Class 2

1.2 DEFINITIONS

Subject Matter Expert (SME) is defined as Service Headquarters Subject Matter Experts. SME for this project is Air Force - The Air Force Fuels Facilities Subject Matter Expert (HQ AFCEC/COS).

1.3 ADMINISTRATIVE REQUIREMENTS

a. This specification is provided so that a new North Apron Emergency Power Down System (EPDS) Cabinet will be provided. This cabinet will tie into the already existing Pump Control Panel and associated EPDS. This specification identifies the equipment for the EPDS cabinet as well as the testing and commissioning of the new cabinet with the existing system. Installation must be in accordance with NFPA 70

(1) The North Apron EPDS Cabinet must be furnished by a single supplier. The control system supplier must be responsible for providing a fully functional EPDS cabinet that interfaces with the existing Pump Control System and existing EPDS in accordance with the drawings and specifications.

b. The following describes the existing hydrant fueling system.

(1) Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section, with the additions and modifications specified herein. The Hydrant Fueling System consists of fueling pumps that pump fuel to a Hydrant Hose Truck Check-out Pad, Truck Fill Stands, and fuel pits located on the airfield apron. Automatic pump starts and stops are based on system pressure and flow.

(2) Programmable Logic Controllers (PLCs) receive information from pressure transmitters and other devices to control the pumps and control valves. There are two PLCs that are connected in a redundant configuration, to assure continued operation of the Hydrant fueling System even if either PLC (but not both) fails. The Hydrant Fueling System also includes above ground fuel storage tanks and a product recovery tank.

(3) The pump control panel, personal computer, and annunciator are located in the Control Room of the Pumphouse.

c. Submit six copies of Operation and Maintenance Manuals, within 7 calendar days following the completion of factory tests. Installation, Operation, and Maintenance manuals for all equipment supplied must be furnished following the completion of shop tests and must include:

(1) EPDS Cabinet including interior and exterior equipment layout. Complete guide outlining step-by-step procedures for system startup and operation.

(2) All documents previously submitted and approved with all comments and field changes annotated. Complete description of the sequence of operation including that described in PART 3 and any subsystems not controlled by the PLC (e.g. annunciator panel, EPDS, etc.).

(3) Complete listing of all programming changes of the PLCs(if any).

(4) Complete relay ladder logic diagram for the EPDS cabinet. Complete input/output diagrams of the PLC including existing and new connections. Power distribution diagrams for the EPDS cabinet.

(5) Complete troubleshooting guide, which lists possible operational problems and corrective action to be taken, including all as-built conditions.

d. Submit documents demonstrating the accuracy and completeness of the list of material and components, that items proposed comply fully with contract requirements, and are otherwise suitable for the application indicated. Documents must consist of all data or drawings published by the manufacturer of individual items listed including manufacturer's descriptive and technical literature, performance data, catalog cuts, and installation instructions. Submit additional material if the listed items are not adequate to identify intent or conformance to technical requirements. Provide typed and electronic copies of these lists for approval. Any delays associated with resubmittals of incomplete or ambiguous initial submittals will be the Contractor's responsibility.

e. For hard copy submittals, documents must be bound in a suitable binder adequately marked or identified on the spine and front cover. A table of contents page must be included and marked with pertinent contract information and contents of the manual. Provide tabs to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets must be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawing; G.

SD-03 Product Data

EPDS Cabinet and Components; G

Programmable Logical Controller (PLC) Hardware and Software; G.

Control Wiring Data Lists; G

Tools and Spare Parts

SD-06 Test Reports

Certified EPDS Cabinet Shop Test Report

Record of Test

SD-07 Certificates

Experience and Qualifications; G

Training Plan for Instructing Personnel; G

Testing Plan; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

1.5 TOOLS AND SPARE PARTS

Provide the following:

a. Any special tools necessary for operation and maintenance of the equipment providing supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked.

b. One spare set of fuses of each type and size

c. Recommended manufacturer list of spare parts, including part number, current unit price, and source of supply.

d. One spare power supply module

e. One spare I/O module for discrete devices

f. Minimum of 10 spare lamps of each type of non-LED lamps used on the EPDS cabinet

1.6 EXPERIENCE AND QUALIFICATIONS

Submit the following data for approval:

a. Certification stating that the manufacturer has manufactured, installed, and successfully completed at least five PLC-based systems for automatic cycling of pumps based upon varying dispensing demands ranging from 0 to 2400 GPM utilizing multiple pumps. At least two of the five PLC-based systems must be for dispensing jet fuel into a pressurized, constant pressure, flow demand aircraft hydrant system.

b. Certification that the control systems have successfully operated over the last 2 years and are currently in service.

c. Project names, locations, and system description of these installations. Include user point-of-contact and current telephone numbers.

1.7 WARRANTY

The EPDS cabinet and modified PCP System including devices, hardware and software must be warranted for a period of one year from the date of acceptance of the system by the Government. This warranty service must include parts and labor service for equipment supplied under this specification. Upon notification by the Government of system or component failure, respond at the site with necessary parts within 48 hours of notification.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 EPDS Cabinet and Components

NEMA ICS 1, NEMA ICS 6, NEMA 250, and UL 508. The EPDS cabinet must be a freestanding NEMA Type 12, smooth, gasketed enclosure constructed of 12

gauge steel. All seams must be continuously welded. All drilled holes or knockouts must be performed after delivery to the job site. The cabinet dimensions must be a maximum of 90 inches high, maximum 72 inches wide, and a maximum of 24 inches deep and must have removable lifting eyes. The interior surfaces of the panel must be properly cleaned, primed, and spray painted with white high-gloss enamel. Exterior surfaces must have standard factory finish. Access for the cabinet must be front only and must consist of hinged doors having 3-point latching mechanisms. The doors must open approximately 120 degrees. Rack mounting angles, swing-out panels and other component mounting hardware must be installed such that servicing of one component must not require removal or disconnection of other components. No clearance must be required between the back of the panel and the room walls. Terminal facilities must be arranged for entrance of external conductors from the top or bottom of the enclosure.

2.1.1.1 Ventilation System

Provide two supply fans, single phase, 115 volt. Each fan must supply a minimum of 100 CFM. The supply and exhaust grill must contain a filter that is easily removed from the exterior of the enclosure. Also provide three thermostats with an adjustable set point range of 70 degrees F to 140 degrees F. Locate the thermostats near the top in the interior of the PCP.

2.1.1.2 Ground Bar

The cabinet must have a tin plated copper equipment ground bar. The bar must have a minimum of twenty grounding screws.

2.1.1.3 Standard Indicator Lights

NEMA ICS 1, NEMA ICS 2, and UL 508. Lights must be heavy duty, NEMA 13, 1 inch mounting hole, round indicating lights operating at 120 volts ac/dc or 24 volts ac/dc. Long life bulbs must be used. Indicator lights must have a legend plate with words as shown on drawings. Lens color as indicated on the drawings. Lights must be "push to test (lamp)" type. LED type lamps of comparable size and color may be substituted for standard indicator lights.

2.1.1.4 Selector Switches

NEMA ICS 1, NEMA ICS 2, and UL 508. Non-illuminated lever operated selector switches must be heavy duty, NEMA 13, round, and utilize a 7/8 inches mounting hole. They must have the number of positions as indicated on the drawings. Switches must be rated 600 volt, 10 amperes continuous. Legend plates must be provided with each switch with words as indicated on the drawings.

2.1.1.5 Pushbuttons

NEMA ICS 1, NEMA ICS 2, and UL 508. Non-illuminated pushbuttons must be heavy duty, NEMA 13, round, utilize a 7/8 inch mounting hole, and have the number and type of contacts as indicated on the drawings or elsewhere in the specifications. The emergency stop switch must be a red mushroom head, 1.5 inch diameter, momentary contact type. Pushbuttons must be rated 600 volt, 10 amperes continuous. Legend plates must be provided with each switch with words as indicated on the drawings.

2.1.1.6 Relays

IEEE C37.90, NEMA ICS 2, UL 508.

2.1.1.7 Nameplates

Nameplates must be made of laminated plastic with black outer layers and a white core. Edges must be chamfered. Nameplates must be fastened with black-finished round-head drive screws or approved nonadhesive metal fasteners.

2.1.1.8 Terminal Blocks

NEMA ICS 4. Terminal blocks for conductors exiting the cabinet must be two-way type with double terminals, one for internal wiring connections and the other for external wiring connections. Terminal blocks must be made of bakelite or other suitable insulating material with full deep barriers between each pair of terminals. A terminal identification strip must form part of the terminal block and each terminal must be identified by a number in accordance with the numbering scheme on the approved wiring diagrams.

2.1.1.9 Circuit Breakers

UL 508. Individual, appropriately sized, terminal block mounted, circuit breakers must be provided for all 120 volt cabinet mounted equipment and for the 120 volt terminal boards shown on the drawings.

2.1.1.10 Miscellaneous Power Supplies

UL 1012. Certain field devices may require power other than 120 VAC (i.e. 24 VDC). The power supplies must be convection cooled, have fully isolated independent outputs, have constant voltage, have short circuit and overvoltage protection, and have automatic current limiting.

2.2 PROGRAMMABLE LOGICAL CONTROLLER (PLC) HARDWARE AND SOFTWARE

2.2.1 Input/Output (I/O) Modules

a. Provide all required I/O modules (discrete input) to manipulate the types of inputs as shown on the drawings and to comply with the sequence of operations.

b. I/O modules must be a self-contained unit housed within an enclosure to facilitate easy replacement. All user wiring to I/O modules must be through a heavy-duty terminal strip. Pressure-type screw terminals must be used to provide fast, secure wire connections. The terminal block must be removable so it is possible to replace any input or output module without disturbing field wiring.

c. During normal operation, a malfunction in any remote input/output channel must affect the operation of only that channel and not the operation of the CPU or any other channel.

d. Isolation must be used between all internal logic and external power circuits. This isolation must meet the minimum specification of 1500 VRMS. Provide optically isolated I/O components which are compatible with field devices.

e. Each I/O module must contain visual indicators to display ON/OFF status of individual input or output points.

f. Discrete output modules must be provided with self-contained fuses for overload and short circuit protection of the module.

g. All input/output modules must be color coded and titled with a distinctive label.

PART 3 EXECUTION

3.1 EPDS CABINET AND COMPONENTS

3.1.1 General

a. Where two or more pieces of equipment performing the same function are required, they must be exact duplicates produced by the same manufacturer. All display instruments of each type must represent the same outward appearance, having the same physical size and shape, and the same size and style of numbers, characters, pointers, and lamp lenses.

b. It is intended that process controlling devices except field devices, and motor controllers be attached to or mounted within the cabinet enclosure and all interconnecting wiring installed prior to shipment to the job site. This is to allow shop testing of the system and to decrease field labor requirements.

c. The cabinet must be shipped fully assembled in one piece after the completion of the shop tests and all defects corrected.

3.1.2 Wiring

Wiring methods and practices must be in conformance with NEMA ICS 1, NEMA ICS 2, NEMA ICS 4, and NEMA ICS 6 recommendations as applicable. All wiring to instruments and control devices must be made with stranded wire, and wiring must be permanently labeled with conductor/wire numbers within 1 inch of termination points. Labels must be tubular heat-shrinkable wire markers that remain legible after exposure to industrial fluids and abrasion. Position markers so that wire numbers can be read without disturbing or disconnecting wiring. Use of individual character-markers placed side-by-side is not acceptable. Numbers must match approved shop drawings. All wiring must be neatly laced from point of entry into enclosures to termination points with nylon lacing cord or plastic lacing ties. Lacing within wiring channels is not required. Provide typed Control Wiring Data Lists within each terminal cabinet and the PCP. The data lists must include: conductor identification number, wire gauge, wire insulation type, "FROM" terminal identification, "TO" terminal identification, and remarks. The preliminary lists generated by the Contractor will be submitted for approval to the Contracting Officer and will be updated to As-Built conditions by the Contractor. The As-Built data lists must be placed in a document holder within each enclosure for both hard copy and electronic submittal.

3.1.3 Certified EPDS Cabinet Shop Test Report

The manufacturer must shop test the cabinet. The procedure must include simulation of field components and must provide for fully testing the pump control system as a unit before delivery to the project site. The test

must, reveal system defects, including, but not limited to, functional deficiencies, operating program deficiencies, algorithm errors, timing problems, wiring errors, loose connections, short circuits, failed components and misapplication of components. The test must be performed prior to shipment to the site and problems detected must be corrected. The final testing and correction sequence must be repeated until no problems are revealed and then two additional successful tests must be performed. Submit certified test report within 15 days after completion of the test. The report must include a statement that the cabinet performs as specified. Notify the Contracting Officer and the SME 30 days prior to the final shop testing date. The Contracting Officer may require a Government witness at the final test before the cabinet is shipped to the site.

3.1.4 Ventilation System

Thermostat T-1, must control fan F-1 and thermostat T-2 must control fan F-2. T-1 and T-2 must be set at 80 degrees F to maintain interior air temperature to 20 degrees F above ambient.

3.1.5 Grounding

The cabinet ground bar must be connected to the building counterpoise via a #10 AWG conductor. Within the enclosure all power supplies, etc. must be grounded to meet the manufacturer's specifications.

3.1.6 Indicator Lights, Switches, and Pushbuttons

Indicator lights, switches, and pushbuttons must be mounted through the enclosure and must be arranged to allow easy vision and operation of each device. Each device must have a nameplate and/or legend plate as indicated on the drawings. Nameplate wordings must be as indicated on the drawings.

3.1.7 Terminal Blocks

As a minimum, any cabinet device that connects to a field device (devices not located in the cabinet) must be connected to a terminal block. A connection diagram similar to the drawings must be provided to the field Contractor for field connections to the cabinet.

3.1.8 Circuit Breakers

As a minimum, any 120 volt device i.e. (fans, lights, power receptacles, 24 VDC power supplies) must be provided with an individual circuit breaker. Additionally 120 volt terminal boards connecting to field devices (devices not located in the cabinet) must be protected by a 120 volt circuit breaker.

3.1.9 Power Supplies

Provide and install all 120 VAC and 24 VDC power supply. Interconnecting wiring must be completely installed prior to shipment to the job site.

3.2 PROGRAMMABLE LOGICAL CONTROLLER (PLC) HARDWARE AND SOFTWARE

3.2.1 Programs

a. Provide two copies of all working programs (i.e. PLC logic) on read only optical discs as well as a printed program listing.

b. Provide rung comments (documentation) in the ladder logic program. Each device, on the ladder, must be identified as to the type of device, i.e. limit switch XX, flow indicator XX, motor starter XX, etc. Rung comments must be provided for input and output rungs. The programmer must also provide a comment describing the function of each rung or group of rungs that accomplish a specific function.

3.3 INSTALLATION

Installation must conform to the manufacturer's drawings, written recommendations and directions.

3.3.1 Shop Drawing

The shop drawing must be clear and readable and preferably drawn using a computer aided drafting package. At the conclusion of the project the diagram drawings must be redrafted to include all as-built conditions. These updated drawings must be included in the O&M Manuals and appropriate section of the drawings placed in a data pocket located in each of the enclosures. The shop drawing at a minimum must show:

a. Overall dimensions, front, side and interior elevation views of the cabinet showing size, location and labeling of each device.

b. Power ladder diagram indicating power connections between TVSS, power conditioners, PLCs, power supplies and field and panel devices. Any terminal block connection numbers used must be indicated.

c. Control ladder diagram indicating control connections between field and devices and PLC I/O modules. Terminal block connection numbers and PLC terminal numbers must be indicated.

d. Bill of materials.

e. Written control sequence covering all inputs, outputs, and control scheme.

3.3.2 System Start-Up and Testing

a. At EPDS cabinet start-up and testing provide personnel, onsite, to provide technical assistance, program fine tuning, and to start-up and test the system. Start-up and testing must be coordinated with the overall fueling system start-up test specified in Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START-UP. Prior to this test, all connections must have been made between the PCP, the personal computer, the motor control center, and all field devices. In addition, wiring must have been checked for continuity and short circuits. Adjust set point values, timing values, and program logic as required to provide a functional hydrant fuel control system. Once the system has been fine tuned and passed the system test, the new system default values, must be loaded into the PLC EEPROM and the personal computer screens adjusted to indicate the new values.

b. A step-by-step Testing Plan of the EPDS cabinet must be submitted. The test must be designed to show that every device (lights, switches, display screens, alarms, etc.) on the EPDS cabinet and existing PCP is in working order and that the PLC program controls the system per specifications. The test must be performed in conjunction with Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START-UP. The plan must

include a place for the Contractor and government representative to initial each step of the plan after satisfactory completion and acceptance of each step. The complete initialed Record of Test must be certified by the Contractor and then submitted.

3.3.3 Training Plan for Instructing Personnel

a. Upon completion of the system start-up a competent technician regularly employed by the cabinet manufacturer must hold a training class for the instruction of Government personnel in the operation and maintenance of the system. Provide both classroom type theory instruction and hands-on instruction using operating equipment provided. The period of instruction must be a minimum of one 2-hour class. The training must be designed to accommodate 8 operators, 4 maintenance personnel, and 2 programmers. The Contracting Officer must receive written notice a minimum of 14 days prior to the date of the scheduled classes.

b. Furnish a written lesson plan and training schedule for Government approval at least 60 days prior to instructing operating, maintenance and programming personnel. Concurrently submit above to the SME for their input into the review process. Approval of lesson plan will be based on both Government and SME concurrence. This plan must be tailored to suit the requirements of the Government. The training must be tailored to three groups. The groups are: 1) Operators, those that will use the control system on a day to day basis; 2) Maintenance personnel, those that will perform routine and non-routine maintenance and trouble shooting of the control system; 3) Programmers, those that will make changes to and trouble shoot the PLC and personal computer programs. The training program must provide:

(1) a detailed overview of the control system.

(2) a general overview of programmable logic controllers

(3) the maintenance of equipment installed

(4) overview of any additional or modified programming

(5) trouble shooting of the system

c. Complete approved Operation and Maintenance manuals for Specification 33 09 53AVIATION PUMP CONTROL AND ANNUNCIATION SYSTEM (TYPE III) must be used for instructing operating personnel. Training must include both classroom and hands-on field instruction. The class must be recorded in DVD format.

d. Provide training courses in DVD format covering system overview, operation, maintenance, trouble shooting, and programming. These DVDs must be produced onsite by the Contractor using the EPDS cabinet and existing PCP as the teaching aid, or commercially produced DVDs by the manufacturer or third party who specializes in training on PLC and relay logic systems. Along with the DVDs, provide workbooks, which follow along with the DVDs.

3.4 PLC CONTROL SYSTEM SEQUENCE OF OPERATION

The following describes general functions of the fueling system components.

3.4.1 Abbreviations

a. SYS-1: components of System #1 including UPS#1, power supplies, CPU-1, I/O-1, and system #1 input and outputs.

b. SYS-2: components of System #2 including UPS#2, power supplies, CPU-2, I/O-2, and system #2 input and outputs.

c. CPU-1: SYS-1 PLC CPU.

d. CPU-2: SYS-2 PLC CPU.

e. I/O-1: SYS-1 PLC input/output modules.

f. I/O-2: SYS-2 PLC input/output modules.

g. PCP: Pump Control Panel.

h. PC: Personal Computer.

i. UPS: Uninterruptible Power Supply.

3.4.2 Safety Circuit

3.4.2.1 Emergency Stop Status

EPDS system response:

The following new system response is to occur:
When an EPDS station is activated at P-012 Apron the existing PCP (PLC) is to receive this status "P-012 Apron EPDS activated" on input.

The following existing system responses are to occur when either an existing EPDS station or new P-012 EPDS station is activated. This is per 2005 record drawing, E32, of Pump House 3 PCP wiring. If existing system responses do not occur as described, submit findings to SME and EOR. Note that the P=-12 project is not to remove any existing functionality that is programmed as a response to an EPDS activation:

a. Close valves CV-1, CV-2, CV-3, CV-4, and CV-5

b. PCP (PLC) is to receive this existing EPDS status on input.

3.4.2.2 P-012 EPDS Cabinet Power Status

The safety circuit power status relay (ER3) N.O. contact must be connected to I/O-1, I/O-2. When the relay is closed the EPDS Cabinet emergency circuit power on light illuminates.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING
08/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2022) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2021) Ductile-Iron and Gray-Iron Fittings
AWWA C111/A21.11	(2023) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C153/A21.53	(2019) Ductile-Iron Compact Fittings for Water Service
AWWA C219	(2023) Bolted Sleeve-Type Couplings for Plain-End Pipe
AWWA C500	(2019) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(2024) Dry-Barrel Fire Hydrants
AWWA C503	(2021) Wet-Barrel Fire Hydrants
AWWA C509	(2023) Resilient-Seated Gate Valves for Water Supply Service
AWWA C512	(2015) Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
AWWA C515	(2020) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C550	(2024) Protective Interior Coatings for Valves and Hydrants
AWWA C600	(2023) Installation of Ductile-Iron Mains and Their Appurtenances

AWWA C605	(2021) Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA C651	(2023) Standard for Disinfecting Water Mains
AWWA C655	(2018) Field Dechlorination
AWWA C800	(2021) Underground Service Line Valves and Fittings
AWWA C900	(2022) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)
AWWA C909	(2022) Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. (100 mm) and Larger
AWWA M9	(2008; Errata 2013) Manual: Concrete Pressure Pipe
AWWA M23	(2020) Manual: PVC Pipe - Design and Installation - Third Edition

ASTM INTERNATIONAL (ASTM)

ASTM A307	(2023) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A536	(2024) Standard Specification for Ductile Iron Castings
ASTM A563/A563M	(2024) Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)
ASTM C94/C94M	(2025) Standard Specification for Ready-Mixed Concrete
ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2774	(2021a) Standard Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D3139	(2019) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F402	(2018) Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

ASTM F477	(2014; R 2021) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F1483	(2023) Standard Specification for Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR Manual	(10th Edition) Manual of Cross-Connection Control

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8678	(1998) Cup Head Square Neck Bolts with Small Head and Short Neck-Product Grade B

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2025) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 1961	(2020) Standard on Fire Hose

NSF INTERNATIONAL (NSF)

NSF/ANSI/CAN 61	(2024) Drinking Water System Components - Health Effects

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 6, 2021) Fire Protection Engineering for Facilities

UL SOLUTIONS (UL)

UL 246	(2011; Reprint Jul 2020) UL Standard for Safety Hydrants for Fire-Protection Service
UL 262	(2004; Reprint Jul 2023) Gate Valves for Fire-Protection Service

1.2 DEFINITIONS

1.2.1 Water Transmission Mains

Water transmission mains include water piping having diameters greater than 14 inch, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.2 Water Mains

Water mains include water piping having diameters 4 through 14 inch, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.3 Additional Definitions

For additional definitions refer to the definitions in the applicable referenced standard.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Connections; G

SD-03 Product Data

Pipe, Fittings, Joints and Couplings; G

Valves; G

Valve Boxes; G

Fire Hydrants; G

Pipe Restraint; G

Tapping Sleeves; G

Disinfection Procedures; G

SD-06 Test Reports

Backflow Preventer Tests; G

Bacteriological Samples; G

Hydrostatic Sewer Test

Leakage Test

Hydrostatic Test

SD-07 Certificates

Pipe, Fittings, Joints and Couplings

Lining for Fittings

Valves

Fire Hydrants

SD-08 Manufacturer's Instructions

PVC Piping

PVCO Piping

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

Use NSF/ANSI/CAN 61 materials for potable water systems to comply with lead free content requirements as defined by the U.S. Safe Drinking Water Act effective January 2014 and January 2022.

Comply with NFPA 24 for materials, installation, and testing of fire main piping and components.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to site for required pipe markings and damage. Unload and store with minimum handling and in accordance with manufacturer's instructions to prevent cuts, scratches and other damage. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, fire hydrants, and other accessories free of dirt and debris or other contaminates.

1.5.2 Handling

Handle pipe, fittings, valves, fire hydrants, and other accessories in accordance with applicable AWWA standard, manufacturer's instructions and in a manner to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place other material, hooks, or pipe inside a pipe or fitting after the coating has been applied. Inspect the pipe for defects before installation. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. Clean the interior of pipe and accessories of foreign matter before being lowered into the trench and keep them clean during laying operations by plugging. Replace defective material without additional expense to the Government. Store rubber gaskets, not immediately installed, under cover or out of direct sunlight.

Handle PVC and PVCO pipe, fittings, and accessories in accordance with AWWA C605.

PART 2 PRODUCTS

2.1 MATERIALS

All materials are intended for potable water use unless otherwise indicated.

Provide all materials in accordance with AWWA C800 and as indicated herein. Provide valves and fittings with pressure ratings equivalent to the pressure ratings of the pipe.

2.1.1 Pipe, Fittings, Joints And Couplings

Submit manufacturer's standard drawings or catalog cuts, except submit

both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

2.1.1.1 Plastic Piping

2.1.1.1.1 PVC and PVCO Piping

2.1.1.1.1.1 PVC Piping

AWWA C900 plain end or gasket bell end pipe meeting or exceeding ASTM D1784 cell class 12454, with a minimum Pressure Class 165 (DR25), with ductile iron outside diameter (DIOD).

2.1.1.1.1.2 PVCO Piping

AWWA C909, ASTM F1483 plain end or gasket bell end pipe meeting or exceeding ASTM D1784 cell class 12454, Pressure Class 165 PVCO pressure pipe, with ductile iron outside diameter (DIOD).

2.1.1.1.1.3 Fittings for PVC and PVCO Pipe

Ductile iron fittings, AWWA C110/A21.10 or compact fittings in accordance with AWWA C153/A21.53, with cement-mortar lining for fittings, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends are to conform to the same requirements as fittings with mechanical-joint ends, except for the factory modified bell design compatible for use with PVC pipe as specified.

2.1.1.1.1.4 Joints and Jointing Material for PVC and PVCO Piping

a. Push-on joints: Use jointing material in accordance with ASTM D3139 and AWWA C111/A21.11 between pipes, pipes and metal fittings, valves, and other accessories or compression-type joints/mechanical joints. Provide each joint connection with an elastomeric gasket compatible for the bell or coupling used. Gaskets for push-on joints for pipe, ASTM F477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints.

b. Mechanical Joint: Use mechanically coupled joints having a sleeve-type mechanical coupling, as specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS, as an optional jointing method for plain-end PVC pipe, subject to the limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling as specified for compression-type joints in ASTM D3139. Provide jointing material in accordance with AWWA C111/A21.11 between pipe and sleeve-type mechanical couplings.

2.1.2 Valves

Provide a protective interior coating in accordance with AWWA C550.

2.1.2.1 Gate Valves 3 Inch Size and Larger on Buried Piping

AWWA C500, AWWA C509, AWWA C515, or UL 262 and:

a. AWWA C500: nonrising stem type with double-disc gate and mechanical-joint ends or push-on joint ends compatible for the

adjoining pipe.

b. AWWA C509 or AWWA C515: nonrising stem type with mechanical-joint ends

c. UL 262: inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined.

Match materials for UL 262 gate valves to the reference standards specified in AWWA C500. Gate valves open by counterclockwise rotation of the valve stem. Stuffing boxes have 0-ring stem seals. Stuffing boxes are bolted and constructed so as to permit easy removal of parts for repair. Use gate valves with special ends for connection to sleeve-type mechanical coupling in lieu of mechanical-joint ends and push-on joint ends. Provide valve ends and gaskets for connection to sleeve-type mechanical couplings that conform to the requirements specified for the joint or coupling. Provide AWWA C500 6 inch, 8 inch and 12 inch gate valves with gearing. Provide all valves from one manufacturer.

2.1.2.2 Air Release, Air/Vacuum, and Combination Air Valves

Provide AWWA C512 air release and combination air valves that release air and prevent the formation of a vacuum. Provide valves with an iron body, lead-free bronze trim and stainless steel float that automatically releases air when the lines are being filled with water and admits air into the line when water is being withdrawn in excess of the inflow.

2.1.2.3 Valve Boxes

Provide a valve box for each gate valve on buried piping. Construct adjustable valve boxes manufactured from cast iron of a size compatible for the valve on which it is used. Cast the word "WATER" on the lid. The minimum diameter of the shaft of the box is shown on plans.

2.1.2.4 Valve Pits

Construct the valve pits at locations indicated or as required above and in accordance with the details shown.

2.1.3 Fire Hydrants and Hose Houses

2.1.3.1 Fire Hydrants

Provide fire hydrants where indicated. Paint fire hydrants with at least one coat of primer and two coats of enamel paint. Paint barrel and bonnet colors in accordance with UFC 3-600-01. Stencil fire hydrant number and main size on the fire hydrant barrel using black stencil paint.

2.1.3.1.1 Wet-Barrel Type Fire Hydrants

Provide Dry-barrel type fire hydrants, AWWA C502 or UL 246, "Wet Barrel" with 6 inch inlet, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Individually valve pumper connection and hose connections with independent nozzle gate valves.

Provide mechanical-joint or push-on joint end, except where flanged end is indicated; with end matching requirements as specified in AWWA C503 or UL 246 for size and shape of operating nut, cap nuts, and threads on hose

and pumper connections.

2.1.3.2 Fire Hydrant Hose Houses

Provide hose houses matching the requirements of NFPA 24 at each fire hydrant indicated on the drawings to have a fire hydrant hose house.

2.1.3.2.1 Additional Equipment

Provide the following equipment, in addition to that listed in NFPA 24, Hose Houses and Equipment, with each hose house:

a. 200 feet of 2-1/2 inch woven jacketed, rubber lined hose matching the requirements of NFPA 1961 with a minimum service test pressure of 300 psi; 100 feet of 1-1/2 inch woven jacketed, rubber lined hose matching the requirements of NFPA 1961 with a minimum service test pressure of 300 psi;

b. One gated 2-1/2 by 1-1/2 by 1-1/2 inch wye;

c. One playpipe for 2-1/2 inch hose with 1 inch shutoff nozzle tip;

d. One playpipe for 1-1/2 inch hose with 1/2 inch shutoff nozzle or combination nozzle;

e. Two adapter fittings, 2-1/2 to 1-1/2 inch;

f. Two spanners for 1-1/2 inch hose.

2.2 ACCESSORIES

2.2.1 Pipe Restraint

2.2.1.1 Thrust Blocks

Use ASTM C94/C94M concrete having a minimum compressive strength of 2,500 psi at 28 days.

2.2.2 Tapping Sleeves

Provide cast gray, ductile, malleable iron or stainless steel, split-sleeve type tapping sleeves of the sizes indicated for connection to existing main with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Utilize similar metals for bolts, nuts, and washers to minimize the possibility of galvanic corrosion. Provide dielectric gaskets where dissimilar metals adjoin. Provide a tapping sleeve assembly with a maximum working pressure of 150 psi. Provide bolts with square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, utilize an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pre-torqued to 50 foot-pound.

2.2.3 Sleeve-Type Mechanical Couplings

Use AWWA C219 couplings to join plain-end piping by compression of a ring

gasket at each end of the adjoining pipe sections. The coupling consists of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. Provide true circular middle ring and the follower rings sections free from irregularities, flat spots, and surface defects; provide for confinement and compression of the gaskets. For PVC pipe, use ASTM A536 ductile iron. Use gaskets for resistance to set after installation and to meet the requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Provide track-head type bolts ASTM A307, Grade A, with ASTM A563/A563M, Grade A nuts or round-head square-neck type ISO 8678 bolts with ASME B18.2.2 hex nuts. Provide 5/8 inch diameter bolts. Minimum number of bolts for each coupling is 3 for 3 inch pipe, 5 for 6 inch pipe, and 6 for 8 inch pipe. Shape bolt holes in follower rings to hold fast to the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Provide a tight flexible joint with mechanical couplings under reasonable conditions, such as pipe movements caused by expansion, contraction, slight settling or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Match coupling strength to that of the adjoining pipeline.

2.2.4 Insulating Joints

Provide a rubber-gasketed insulating joint or dielectric coupling between pipe of dissimilar metals which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.5 Dielectric Fittings

Install dielectric fittings between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains to prevent metal-to-metal contact of dissimilar metallic piping elements and compatible with the indicated working pressure.

2.2.6 Tracer Wire for Nonmetallic Piping

Provide a continuous bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length over each separate run of nonmetallic pipe.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Connections to Existing System

Perform all connections to the existing water system in the presence of the Contracting Officer.

3.1.2 Operation of Existing Valves

Do not operate valves within or directly connected to the existing water system unless expressly directed to do so by the Contracting Officer.

3.1.3 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK.

3.2 INSTALLATION

Install all materials in accordance with the applicable reference standard, manufacturers instructions and as indicated herein.

3.2.1 Piping

3.2.1.1 General Requirements

Install pipe, fittings, joints and couplings in accordance with the applicable referenced standard, the manufacturer's instructions and as specified herein.

3.2.1.1.1 Termination of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated.

Do not lay water lines in the same trench with gas lines, fuel lines, electric wiring, or any other utility. Do not install copper tubing in the same trench with ferrous piping materials. Where nonferrous metallic pipe (i.e., copper tubing) crosses any ferrous piping, provide a minimum vertical separation of 12 inches between pipes.

3.2.1.1.2 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances is it permissible to drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe cleanly, squarely, and accurately to the length established at the site and work into place without springing or forcing. Inspect pipe and fittings prior to backfilling and repair as required. Replace a pipe or fitting that does not allow sufficient space for installation of jointing material. Blocking or wedging between bells and spigots is not permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at the design elevation and grade. Secure firm, uniform support. Wood support blocking is not permitted. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports for fastening work into place. Make provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been assembled. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Provide a minimum of 3 feet depth of cover over top of pipe.

3.2.1.1.3 Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.2.1.1.4 Connections to Existing Water Lines

Make connections to existing water lines after coordination with the facility and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped and as indicated.

3.2.1.1.5 Sewer Manholes

No water piping is to pass through or come in contact with any part of a sewer manhole.

3.2.1.1.6 Water Piping Parallel With Sewer Piping

a. Normal Conditions: Lay water piping at least 10 feet horizontally from sewer or sewer manhole whenever possible. Measure the distance from outside edge to outside edge of pipe or outside edge of manhole. When local conditions prevent horizontal separation install water piping in a separate trench with the bottom of the water piping at least 18 inchesabove the top of the sewer piping.

b. Unusual Conditions: When local conditions prevent vertical separation, construct sewer piping of AWWA compliant ductile iron water piping and perform hydrostatic sewer test, without leakage, prior to backfilling. When local conditions prevent vertical separation, test the sewer manhole in place to ensure watertight construction.

3.2.1.1.7 Water Piping Crossing Sewer Piping

a. Normal Conditions: Provide a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping in cases where water piping crosses above sewer piping.

b. Unusual Conditions: When local conditions prevent a vertical separation described above, construct sewer piping passing over or under water piping of AWWA compliant ductile iron water piping and perform hydrostatic sewer test, without leakage, prior to backfilling. Construct sewer crossing with a minimum 20 feet length of the AWWA compliant ductile iron water piping, centered at the point of the crossing so that joints are equidistant and as far as possible from the water piping. Protect water piping passing under sewer piping by providing a vertical separation of at least 18 inches between the bottom of the sewer piping and the top of the water piping; adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on or damage to the water piping.

3.2.1.1.8 Penetrations

Provide ductile-iron or Schedule 40 steel wall sleeves for pipe passing through walls of valve pits and structures. Fill annular space between walls and sleeves with rich cement mortar. Fill annular space between pipe and sleeves with mastic.

3.2.1.2 PVC and PVCO Water Main Pipe

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the requirements of AWWA C605

for laying of pipe, joining PVC pipe to fittings and accessories, setting of fire hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation in Trenches and Embankments."

a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use a lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA C605 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation in Trenches and Embankments," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

b. Joint Offset: Construct joint offset in accordance AWWA C605. Do not exceed the minimum longitudinal bending as indicated by AWWA C605.

c. Fittings: Install in accordance with AWWA C605.

3.2.1.3 Plastic Service Piping

Install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the applicable requirements of ASTM D2774, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F402.

3.2.1.3.1 Jointing

Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.2.1.3.2 Plastic Pipe Connections to Appurtenances

Connect plastic service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.2.2 Disinfection

Prior to disinfection, provide disinfection procedures, proposed neutralization and disposal methods of waste water from disinfection as part of the disinfection submittal. Disinfect new water piping and

existing water piping affected by Contractor's operations in accordance with AWWA C651. Ensure a free chlorine residual of not less than 10 parts per million after 24 hour holding period and prior to performing bacteriological tests.

3.2.3 Flushing

Perform bacteriological tests prior to flushing. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 parts per million, the residual chlorine content of the distribution system, or acceptable for domestic use. Use AWWA C655 neutralizing chemicals.

3.2.4 Pipe Restraint

3.2.4.1 Concrete Thrust Blocks

Install concrete thrust blocks where indicated.

3.2.5 Valves

3.2.5.1 Gate Valves

Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509 or AWWA C515, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509 or AWWA C515. Install gate valves on PVC and PVCO water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.5.2 Air Release, Air/Vacuum, and Combination Air Valves

Install pressure vacuum assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to the requirements of plumbing and health department and authorities having jurisdiction. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.2.6 Blowoff Valve Assemblies

Install blowoff valve assemblies as indicated on the drawings or in accordance with the manufactures recommendations. Install discharge fitting on the end of riser pipe to direct the flow of water so as to minimize damage to surrounding areas.

3.2.7 Fire Hydrants

Install fire hydrants in accordance with AWWA C600 for fire hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install fire hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, install fire hydrants with the 4 1/2 inch connection facing the paved surface where the connecting main is located.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Notify the Contracting Officer a minimum of five days in advance of hydrostatic testing. Coordinate the proposed method for disposal of waste water from hydrostatic testing. Perform field tests, and provide labor, equipment, and incidentals required for testing, except that water needed for field tests will be furnished as set forth in paragraph AVAILABILITY AND USE OF UTILITY SERVICES in Section 01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS. Provide documentation that all items of work have been constructed in accordance with the Contract documents.

3.3.1.1 Hydrostatic Test

Test the water system in accordance with the applicable AWWA standard specified below.Test PVC and PVCO plastic water systems made with PVC pipe in accordance with the requirements of AWWA C605 for pressure and leakage tests. The amount of leakage on pipelines made of PVC water main pipe is not to exceed the amounts given in AWWA C605, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. Test concrete water mains in accordance with the recommendations in AWWA M9, "Hydrostatic Testing and Disinfection of Mains." The amount of leakage on concrete pipelines is not to exceed 20 gallons per 24 hours per inch of pipe diameter per mile of pipeline. Do not backfill utility trench or begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 7 days after placing of the concrete.

3.3.1.2 Hydrostatic Sewer Test

The hydrostatic pressure sewer test will be performed in accordance with the applicable AWWA standard for the piping material or AWWA C600.

3.3.1.3 Leakage Test

For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3.1.4 Bacteriological Testing

Perform bacteriological tests in accordance with AWWA C651 Option A. Analyze samples by a certified laboratory, and submit the results of the bacteriological samples.

3.3.1.5 Backflow Preventer Tests

After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

3.3.1.6 Special Testing Requirements for Fire Service

Test water mains and water service lines providing fire service or water and fire service in accordance with NFPA 24. The additional water added to the system must not exceed the limits given in NFPA 24

3.3.1.7 Tracer Wire Continuity Test

Test tracer wire for continuity after service connections have been completed and prior to final pavement or restoration. Verify that tracer wire is locatable with electronic utility locating equipment. Repair breaks or separations and re-test for continuity.

3.4 SYSTEM STARTUP

Water mains and appurtenances must be completely installed, disinfected, flushed, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Obtain approval by the Contracting Officer prior to the new water piping being placed into service.

3.5 CLEANUP

Upon completion of the installation of water lines and appurtenances, remove all debris and surplus materials resulting from the work.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 40 00

STORMWATER UTILITIES
11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A48/A48M	(2022) Standard Specification for Gray Iron Castings
ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A536	(2024) Standard Specification for Ductile Iron Castings
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C76	(2022a) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C231/C231M	(2024) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C270	(2025) Standard Specification for Mortar for Unit Masonry
ASTM C443	(2021) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C443M	(2021) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
ASTM C478/C478M	(2022) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C655	(2019a) Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C923/C923M	(2020) Standard Specification for Resilient Connectors Between Reinforced

	Concrete Manhole Structures, Pipes and Laterals
ASTM C990	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C990M	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)
ASTM C1103	(2022) Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C1103M	(2019) Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2321	(2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Oil Resistant Gasket

Leakage Test

Hydrostatic Test on Watertight Joints

Determination of Density

Frame and Cover or Gratings

Post-Installation Inspection Report

SD-08 Manufacturer's Instructions

Placing Pipe

SD-11 Closeout Submittals

LID Verification Report; G

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Inspect materials delivered to site for damage and unload and store materials with minimumal handling. Do not store materials directly on the ground. Keep the inside of pipes and fittings free of dirt and debris. Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe in accordance with the manufacturer's recommendations and discard if the storage period exceeds the recommended shelf life. Discard solvents in use when the recommended pot life is exceeded.

1.3.2 Handling

Handle materials in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe sizes for culverts and storm drains are indicated on the drawings.

2.1.1 Concrete Pipe

2.1.1.1 Reinforced Culvert and Storm Drain Pipe

Manufactured in accordance with and conforming to ASTM C76, Class IV, Wall B or ASTM C655.

2.2 PIPE JOINTS

2.2.1 Concrete Pipe

2.2.1.1 Rubber Gasket Joints

Provide rubber gasket joints of a design and physical requirements conforming to ASTM C443. Provide rubber gaskets that meet the oil resistant gasket requirements of ASTM C443M ASTM C443.

2.3 DRAINAGE STRUCTURES

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete

Unless otherwise specified, provide concrete and reinforced concrete

conforming to the requirements for 3000 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. Provide air content by volume of concrete mixture, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Determine air content in accordance with ASTM C231/C231M. Provide a minimum concrete covering over steel reinforcing of not less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. For concrete deposited directly against the ground, provide a covering thickness of at least 3 inches between steel and ground. Provide expansion-joint filler material conforming to ASTM D1751, or ASTM D1752, or provide be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

2.4.2 Mortar

Provide mortar for pipe connections to drainage structures conforming to ASTM C270, Type M, except that the maximum placement time will be 1 hour. Provide a sufficient quantity of water in the mixture to produce a stiff workable mortar. Use water that is clean and free of harmful acids, alkalis, and organic impurities. Use the mortar within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.4.3 Precast Reinforced Concrete Manholes

Provide precast reinforced concrete manholes conforming to ASTM C478/C478M. Provide joints between precast concrete risers and tops that are full-bedded in cement mortar and smoothed to a uniform surface on both interior and exterior of the structure.

2.4.4 Frame and Cover or Gratings

Submit certification on the ability of frame and cover or gratings to carry the imposed live load. Provide frame and cover or gratings made of cast gray iron, ASTM A48/A48M, Class 35B; cast ductile iron, ASTM A536, Grade 65-45-12; or cast aluminum, ASTM B26/B26M, Alloy 356.0-T6. Stamp or cast the word "Storm Drain" into covers so that it is plainly visible.

2.4.5 Steel Ladder

Provide a steel ladder where the depth of the storm drainage structure exceeds 12 feet. Provide ladders not less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. Provide two stringers that are a minimum 3/8 inch thick and 2-1/2 inches wide. Galvanize ladders and inserts after fabrication in conformance with ASTM A123/A123M.

2.4.6 Resilient Connectors

Provide flexible, watertight connectors conforming to ASTM C923/C923M for connecting pipe to manholes and inlets.

2.5 TESTS, INSPECTIONS, AND VERIFICATIONS

2.5.1 Hydrostatic Test on Watertight Joints

Perform a hydrostatic test on the watertight joint types as proposed. This test will be conducted at the plant or by an independent laboratory.

Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested.

2.5.1.1 Concrete Pipe

Provide joints in reinforced concrete pipe meeting the performance requirements in ASTM C990M ASTM C990 or ASTM C443M ASTM C443.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavate trenches, excavate for appurtenances and backfill for culverts and storm drains, in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.1.1 Trenching

Excavate trenches to the width indicated on the drawings or as specified herein. Trench width should permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Place sheeting and bracing, where required, within the trench width as specified, without any overexcavation.

3.1.2 Removal of Rock

Replace rock in either ledge or boulder formation with suitable materials to provide a compacted earth cushion. Provide a compacted earth cushion between unremoved rock and the pipe with a thickness of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Maintain the cushion under the bell as well as under the straight portion of the pipe where bell-and-spigot pipe is used. Excavate rock as specified and defined in Section 31 00 00 EARTHWORK.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, remove such material to the depth required and replace with select granular material to the proper grade. Compact select granular material as specified in paragraph FINAL BACKFILL. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, perform such removal and replacement at no additional cost to the Government.

3.2 BEDDING AND INITIAL BACKFILL

Provide a firm bedding foundation of uniform density throughout the entire length of the pipe or box culvert.

3.2.1 Concrete Pipe

Use select granular material conforming to Section 31 00 00 EARTHWORK for haunch and bedding material. Compact haunch and outer bedding to at least 95 percent laboratory maximum density and place in layers not exceeding 6 inch loose thickness for compaction by hand-operated compactors and 200 mm

8 inches for other than hand-operated machines. Loosely place middle bedding and do not compact. After the pipe has been properly bedded, place haunch material, at a moisture content that will facilitate compaction, evenly along both sides of the pipe and thoroughly compact each layer with mechanical tampers or rammers to the springline of the pipe. Thoroughly compact the haunch material under the haunches of the pipe. For bell and spigot pipe, form a depression in bedding material for bells so entire barrel of pipe is uniformly supported. Minimize the length, depth, and width of bell depressions to that required for properly making the particular type of joint.

3.2.1.1 Trenches

After the pipe has been properly bedded and haunch material placed to the midpoint (springline) of the pipe, backfill and compact the remainder of the trench by spreading and rolling or compacting by mechanical rammers or tampers in layers not exceeding 6 inches. Test for density as necessary to ensure conformance to the compaction requirements specified below. Leave untreated sheeting in place beneath structures or pavements.

3.2.1.2 Fill Sections

For pipe placed in fill sections, uniformly spread fill material longitudinally on both sides of the pipe in layers not exceeding 6 inches in compacted depth, and compact by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe must extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, place and thoroughly compact the remainder of the fill in layers not exceeding 8 inches.

3.2.2 Plastic Pipe

Provide bedding for PVC, PE, SRPE and PP pipe meeting the requirements of ASTM D2321. Use Class IB or II material for PVC, PE, SRPE pipe bedding, haunching, and initial backfill. Use Class I, II, or III material for PP pipe bedding, haunching and initial backfill.

3.3 PLACING PIPE

Submit printed copies of the pipe manufacturer's recommended pipe installation procedures prior to installation. Thoroughly examine each section of pipe before being laid; do not use defective or damaged pipe. Protect plastic pipe, excluding SRPE pipe, from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Lay pipelines to the grades and alignment indicated. Provide proper facilities for lowering sections of pipe into trenches. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work. Divert drainage or dewater trenches during construction as necessary. Deflection of installed flexible pipe must not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (percent)
Plastic (PVC, HDPE, SRPE, and PP)	5

Post installation requirements of paragraph DEFLECTION TESTING in PART 3 of this specification for all pipe products including deflection testing requirements for flexible pipe.

3.3.1 Concrete, PVC, Pipe

Lay pipe proceeding upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe must be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

Follow the recommendation of the particular manufacturer in regard to sealing compound special installation requirements. When lubricants, primers, or adhesives are used, only apply on surfaces that are dry and clean. Affix sealing compounds to the pipe not more than 3 hours prior to installation of the pipe. Protect sealing compounds from the sun, blowing dust, and other deleterious agents at all times. Inspect sealing compounds before installation of the pipe, and remove and replace any loose or improperly affixed sealing compound. Align the pipe with the previously installed pipe, and pull the joint together.

3.4.1.2 Flexible Watertight Joints

Use lubricants, cements, adhesives, and other special installation requirements for gaskets and jointing materials as recommended by the manufacturer. When lubricants, cements, or adhesives are used, only apply on surfaces that are clean and dry. Affix gaskets and jointing materials to the pipe not more than 24 hours prior to the installation of the pipe, and protect from the sun, blowing dust, and other deleterious agents at all times. Inspect gaskets and jointing materials before installing the pipe; remove and replace any loose or improperly affixed gaskets and jointing materials. Align the pipe with the previously installed pipe, and push the joint home. If the gasket becomes visibly dislocated when joining sections of pipe, remove the pipe and remake the joint.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construct manholes of precast reinforced concrete. Construct inlets of precast or cast in place reinforced concrete. Provide manholes and inlets complete with frames and covers or gratings; and with fixed galvanized

steel ladders as indicated. The wall along the line where steel ladders are installed must be vertical for its entire length. Adequately anchor ladders to the wall by means of steel inserts spaced not more than 6 feet vertically, and install to provide at least 6 inches of space between the wall and the rungs. Make pipe connections to concrete manholes and inlets with flexible, watertight connectors.

3.5.2 Walls and Headwalls

Construct headwalls as indicated.

3.6 INSTALLATION OF TRACER WIRE AND WARNING TAPE

Install a continous length of tracer wire for the full length of each run of nonmetallic pipe in accordance with Section 31 00 00 EARTHWORK. Attach wire to top of pipe in such a manner that it will not be displaced during construction operations. Install warning tape above all storm drain pipe in accordance with Section 31 00 00 EARTHWORK.

3.7 FINAL BACKFILL

Backfill trenches with satisfactory material deposited in layers of a maximum of 8 inches loose thickness and compacted to 90 percent of maximum density for cohesive soils and 95 percent of maximum density for cohesionless soils in accordance with Section 31 00 00 EARTHWORK. Testing is the responsibility of the Contractor and will be performed at no additional cost to the Government. Unless otherwise specified, determine field in-place density of final backfill at a frequency of one test per 50 linear feet, or fraction thereof, of each lift of backfill. Submit test results in accordance with Section 31 00 00 EARTHWORK. Do not displace or damage pipe when compacting final backfill by rolling or operating heavy equipment parallel with the pipe. Movement of construction machinery over a culvert or storm drain at any stage of construction will be at the Contractor's risk. Repair or replace any damaged pipe. Protect concrete pipes with a minimum of 3 feet of cover prior to permitting heavy construction equipment to pass over them during construction. Provide minimum cover for construction loads over plastic pipes as specified in ASTM D2321.

3.8 FIELD QUALITY CONTROL

3.8.1 Tests

Testing is the responsibility of the Contractor. Perform all testing and retesting at no additional cost to the Government.

3.8.1.1 Leakage Test

Test pipe lines for leakage prior to completing backfill by performing either an exfiltration test, low pressure air pipeline test or by individual pipe joint testing. Submit leakage test results to the Contracting Officer.

3.8.1.1.1 Individual Pipe Joint Testing

Testing of individual joints for leakage by low pressure air or water must conform to ASTM C1103M ASTM C1103.

3.8.1.2 Tracer Wire Continuity

Test tracer wire for continuity after initial and final backfilling of pipes. Verify that tracer wire is locatable with electronic utility location equipement. Repair breaks or separations and re-test for continuity.

3.8.2 Inspection

3.8.2.1 Post-Installation Inspection

Inspect each segment of pipe for alignment, settlement, joint separations, soil migration through the joint, cracks, buckling, bulging and deflection. An engineer must evaluate all defects to determine if any remediation or repair is required.

3.8.2.1.1 Concrete Pipe

An engineer must evaluate all pipes with cracks with a width greater than 0.01 inches, but less than 0.10 inches to determine if any remediation or repair is required.

3.8.2.1.2 Post-Installation Inspection Report

The deflection results and final post installation inspection report must include: pipe location identification, equipment used for inspection, inspector name, deviation from design, grade, deviation from line, deflection and deformation of flexible pipe, inspector notes, condition of joints, condition of pipe wall (e.g. distress, cracking, wall damage dents, bulges, creases, tears, holes, etc.).

3.8.2.2 Low Impact Development Inspection

Inspect Low Impact Development (LID) features indicated on the design portion of the LID Verification Report. Certify LID features were constructed according to plans and specifications or by submitting as-built drawings in accordance with UFGS 01 78 00 Closeout Submittals. When as-built drawings show deviations to the LID features, document the deviations on the LID Verification Report.

3.8.3 Repair of Defects

3.8.3.1 Leakage Test

When leakage exceeds the maximum amount specified, correct source of excess leakage by replacing damaged pipe and gaskets and retest.

3.8.3.2 Deflection Testing

When deflection readings are in excess of the allowable deflection of average inside diamater of pipe are obtained, remove pipe which has excessive deflection and replace with new pipe. Retest 30 days after completing backfill, leakage testing and compaction testing.

3.8.3.3 Inspection

Replace pipe or repair defects indicated in the Post-Installation Inspection Report.

3.8.3.3.1 Concrete Pipe

Replace pipes having cracks with a width greater than 0.1 inches.

3.8.3.3.2 Flexible Pipe

Replace pipes having cracks or splits.

3.9 PROTECTION

Protect storm drainage piping and adjacent areas from superimposed and external loads during construction.

3.10 WARRANTY PERIOD

Pipe segments found to have defects during the warranty period must be replaced with new pipe and retested.

-- End of Section --

SECTION 33 46 16

SUBDRAINAGE PIPING
05/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D3034	(2016) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F758	(2014; R 2023) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F949	(2020) Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Geotextile

Pipe and Pipe Fittings

SD-07 Certificates

Geotextile

Pipe and Pipe Fittings

Cleanout Risers

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Inspect materials delivered to site for damage; unload, and store with minimum handling. Do not store materials directly on the ground. Keep the inside of pipes and fittings sfree of dirt and debris. Keep, during shipment and storage, geotextile wrapped in burlap or similar heavy duty protective covering. Protect the geotextile from mud, soil, dust, and

debris. Do not store geotextile materials in direct sunlight. Install plastic pipe within 6 months from the date of manufacture unless otherwise approved.

1.3.2 Handling

Handle materials in such a manner as to ensure delivery to the trench in sound undamaged condition. Carry pipe to the trench.

PART 2 PRODUCTS

2.1 PIPE FOR SUBDRAINS

Submit samples of pipe and pipe fittings, before starting the work. Provide type and sizes of subdrain pipe indicated. Submit certifications from the manufacturers attesting that materials meet specification requirements. Certificates are required for drain pipe and fittings.

2.1.1 Plastic

Provide plastic pipe containing ultraviolet inhibitor to provide protection from exposure to direct sunlight. Provide pipe with with bell and spigot or solvent cement joints. Provide manufacturer's standard type fittings conforming to the indicated specification.

2.1.1.1 Polyvinyl Chloride (PVC) and Fittings

ASTM D3034, ASTM F949 or ASTM F758, Type PS 46.

2.1.1.2 Pipe Perforations

Provide pipe perforations with a minimum water inlet area of 0.5 square inch per linear foot and as specified below.

2.1.1.2.1 Circular Perforations in Plastic Pipe

Cleanly cut circular holes not more than 3/8 inch or less than 3/16 inch in diameter and arrange in rows parallel to the longitudinal axis of the pipe. Provide pipe with perforations spaced uniformly along rows. Unless otherwise recommended by the pipe manufacturer, provide pipe with rows approximately 1-1/2 inches apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. Space the rows over not more than 155 degrees of circumference. Provide pipe that is not perforated for a length equal to the depth of the socket at the spigot or tongue end and provide perforations that continue at uniform spacing over the entire length of the pipe.

2.2 GEOTEXTILE

Provide geotextile meeting the requirements in Section 31 32 19.16 GEOTEXTILE SOIL STABILIZATION.

Submit samples of geotextile and certifications from the manufacturers attesting that geotextile meets specification requirements.

2.3 SUBDRAIN FILTER AND BEDDING MATERIAL

Provide drainage layer material meeting the requirements in Section 32 11 23.23 BASE COURSE DRAINAGE LAYERS

PART 3 EXECUTION

3.1 EXCAVATION AND BEDDING FOR SUBDRAIN SYSTEMS

Excavate trenches, including the removal of rock and unstable material, in accordance with Section 31 00 00 EARTHWORK. Place bedding material in the trench as indicated or as required as replacement materials used in those areas where unstable materials were removed. Compact bedding material as specified for cohesionless material in Section 31 00 00 EARTHWORK.

3.2 CLEANOUT RISERS

Install flushing and observation riser pipes with frames and covers at the locations indicated. Submit certification on the ability of frame and cover to carry the imposed live load. Construct risers of non-perforated plastic pipe. Join riser pipes to the subdrain system as indicated.

3.3 INSTALLATION OF GEOTEXTILE AND PIPE FOR SUBDRAINS

3.3.1 Installation of Pipe for Subdrains

3.3.1.1 Pipelaying

Install pipe in accordance with the manufacturer's recommendations. Thoroughly examine each section of pipe before being laid; do not use defective or damaged pipe. Do not lay pipe when the trench conditions or weather is unsuitable for such work. Remove water from trenches by sump pumping or other approved methods. Lay the pipe to the grades and alignment as indicated. Bed the pipe to the established gradeline. Center perforations on the bottom of the pipe. Lay bell-and-spigot type with the bell ends upstream. Approval of all in-place pipes by the Contracting Officer is required prior to backfilling.

3.4 INSTALLATION OF DRAINAGE LAYER MATERIAL AND BACKFILLING FOR PERFORATED SUBDRAINS

After perforated pipe for subdrains has been laid, inspected, and approved, place drainage layer material around and over the pipe to the depth indicated. Place the drainage layer material in layers not to exceed 8 inches thick.

3.5 INSTALLATION OF AND BACKFILLING FOR BLIND OR FRENCH DRAINS

Place filter material as indicated and compact as specified for cohesionless materials in Section 31 00 00 EARTHWORK. Extend filter material to a suitable outlet or to an outlet through a pipeline as indicated. Place and compact overlying backfill material as specified in Section 31 00 00 EARTHWORK.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 52 23.15

POL SERVICE PIPING WELDING
05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API 570	(2016; Addendum 1 2017; Addendum 2 2018; ERTA 1 2018) Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
API RP 2009	(2002; R 2007; 7th Ed) Safe Welding, Cutting, and Hot Work Practices in Refineries, Gasoline Plants, and Petrochemical Plants
API Std 650	(2013; Errata 1 2013; Addendum 1 2014; Errata 2 2014; Addendum 2 2016; Addendum 3 2018) Welded Tanks for Oil Storage

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel
ASNT SNT-TC-1A	(2020) Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.48	(2015) Line Blanks
ASME B31.3	(2024) Process Piping
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC V	(2017) BPVC Section V-Nondestructive Examination

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding,

	Brazing and Nondestructive Examination
AWS A3.0M/A3.0	(2025) Standard Welding Terms and Definitions
AWS A5.1/A5.1M	(2025) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.4/A5.4M	(2012; R 2022) Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding
AWS A5.9/A5.9M	(2022) Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification
AWS A5.18/A5.18M	(2023) Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding
AWS A5.22/A5.22M	(2024) Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods
AWS A5.32/A5.32M	(2021) Welding Consumables-Gases and Gas Mixtures for Fusion Welding and Allied Processess
AWS C5.5/C5.5M	(2003) Recommended Practices for Gas Tungsten Arc Welding
AWS D1.1/D1.1M	(2025) Structural Welding Code - Steel
AWS D1.6/D1.6M	(2017) Structural Welding Code — Stainless Steel
AWS D10.4	(1986; R 2000) Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
AWS D10.10/D10.10M	(2021) Recommended Practices for Local Heating of Welds in Piping and Tubing
AWS D10.11M/D10.11	(2007) Guide for Root Pass Welding of Pipe Without Backing
AWS D10.12M/D10.12	(2000) Guideline for Welding Mild Steel Pipe
AWS QC1	(2016) Specification for AWS Certification of Welding Inspectors
AWS WHB-4.9	(2010) Welding Handbook, Volume 4 - Materials and Applications Part 1
AWS Z49.1	(2021) Safety in Welding, Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM E329	(2023) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E1316	(2020a) Standard Terminology for Nondestructive Examinations

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 326	(2015) Standard for Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety and Occupational Health (SOH) Requirements

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-460-01	(2019; with Change 3, 2023) Design: Petroleum Fuel Facilities

1.2 DEFINITIONS

Except as provided in this Section, definition of welding terms is in accordance with AWS A3.0M/A3.0, and definition of inspection and examination terms is in accordance with ASTM E1316.

1.2.1 Closure Weld

The final weld connecting POL service piping systems, components, or sub-assemblies which have been successfully tested in accordance with ASME B31.3. For purposes of this Section, a closure weld can include connection of new work to existing piping and is considered within the scope of ASME B31.3.

1.2.2 Complete Joint Penetration (CJP)

A weld condition in which fusion between base and filler has occurred across the entirety of surfaces intended for welding and between all weld passes.

1.2.3 Designer of Record

The professional engineer designated by the prime contractor to be in multidisciplinary responsible charge of all POL service piping design and repair.

1.2.4 Examination

As used in this Section, a process for determining weld properties, conditions, or characteristics using nondestructive techniques, technologies, and methods, and performed by qualified and certified examiner(s). Nondestructive examination (NDE) is a quality control function performed by the contractor as part of oversight organization duties.

1.2.5 Examiner

As used in this Section, specialist with responsibility to use various nondestructive techniques, technologies, and methods to inform the quality of welds. Examiner(s) is a QC Specialist pursuant to Section 01 45 00 QUALITY CONTROL and is part of the contractor quality control organization.

1.2.6 Hazardous Area

As used in this Section, any area within 100 feet of active storage tanks, areas within 100 feet of leaking section of fuel pipeline or other vapor sources, areas within 200 feet of the downwind side of potential vapor emission sources (i.e., pressure-vacuum vents, sample ports, open vents on active tanks, weeping flanges or joints).

1.2.7 Heat-Affected Zone (HAZ)

The portion of base metal whose mechanical properties or microstructure have been altered by the heat of welding, brazing, soldering, or thermal cutting.

1.2.8 Independent

Impartial third party not a part or affiliated with Contractor or subcontractor principal or subsidiary businesses.

1.2.9 In-Process Examination

A series of steps prescribed in ASME B31.3 to inspect and examine a closure weld for which a hydrostatic leak test is not possible. Can also be used on other joints. As used in this Section, in-process examination requires visual means aided by liquid penetrant examination (PT) or magnetic particle examination (MT) methods in determination of the weld condition. In this Section, the terms in-process examination and in-process inspection are used synonymously.

1.2.10 Inspection

As used in this Section, contractor oversight activity to observe work performed on materials or components to determine acceptability and control the quality of welds. Inspection is performed by qualified and certified inspector(s). In this Section, the weld inspection function is separate and distinct from inspection activities performed by an Owner's Inspector (pursuant to ASME B31.3) and from inspection activity of the Quality Control Manager (pursuant to Section 01 45 00 QUALITY CONTROL).

1.2.11 Inspector

As used in this Section, specialist with oversight responsibility to control the quality of welds. Inspector(s) is a QC Specialist pursuant to Section 01 45 00 QUALITY CONTROL and is part of the contractor quality control organization. The contractor inspector role is separate and distinct from both an Owner's Inspector (pursuant to ASME B31.3), and separate and distinct from the Quality Control Manager role (pursuant to Section 01 45 00 QUALITY CONTROL).

1.2.12 Hot Work

For work covered by this Section, drilling, boring, flame heating, welding, torch cutting, brazing, carbon arc gouging, grinding, abrasive blasting, or any work which produces heat, by any means, of 400 degrees F or more; or in the presence of flammable material or flammable atmosphere, other ignition sources such as spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, nonexplosion-proof lights, fixtures, motors or equipment.

1.2.13 Marine Chemist

The holder of a valid Certificate issued by the National Fire Protection Association in accordance with the "Rules for Certification of Marine Chemists" establishing the individual as a Qualified Person pursuant to NFPA 326.

1.2.14 Owner's Inspector

Technical representative(s) of the Contracting Officer responsible for assuring that contractor performance meets requirements and contractor quality control organization is effective. In this Section, the Owner's Inspector role (pursuant to ASME B31.3) is separate and distinct from Inspector, Examiner, and Quality Control Manager roles.

1.2.15 Piping Engineer

One or more licensed professional engineers, or an engineering firm, acceptable to the Contracting Officer who are knowledgeable and experienced in the engineering disciplines associated with evaluating hydraulic, mechanical, and material characteristics which affect integrity and reliability of POL service piping systems. The piping engineer is the piping or pipeline subject matter expert. More than one individual can serve in the role as long as one is designated to be in responsible charge.

1.2.16 POL Service Piping

Pipe, piping, pipeline, fittings, components, assemblies, and appurtenances used for petroleum, oil, or lubricant (POL) conveyance service under pressure or force of gravity, including modifications to existing systems.

1.2.17 Weld Map

Drawing(s) containing sketches and tables which correlate design, weld plan, shop drawings, welder identification, weld inspection, nondestructive examination, and physical locations.

1.2.18 Timely

As used in this Section, receipt of reporting records by the Contracting Officer no more than 10 days after installation of weld.

1.2.19 Weld Slag

Crystalline residue remaining on a weld surface.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welding Procedure Specification; G

Procedure Qualification Record; G

Welder Performance Qualification; G

Weld Plan; G

SD-02 Shop Drawings

POL Service Piping; G

Pigging Plan; G

SD-06 Test Reports

Weld Log; G

Examinations, Inspections and Tests; G

SD-07 Certificates

Weld Inspector Certificate; G

Independent Test Organization; G

In-Process Weld Inspector Certificates; G

Weld Examiner Certificate; G

1.4 SAFETY

Safety precautions must conform to Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, EM 385-1-1, API 570, API RP 2009, and AWS Z49.1.

1.4.1 Control of Hazardous Energy

Prior to welding, provide proper lockout and tagout (LOTO) of the piping or pipeline and appurtenances to completely isolate work from fuel, vapors, and sources of energy. Isolate using physical means such as blind flange compliant with ASME B16.5 or solid-plate line blank compliant with ASME B16.48 to prevent fuel or vapor transfer into the workspace. Use isolation means of sufficient strength to withstand pressure which might be exerted by liquid, gas, or vapor in an active pipeline, piping, or tank. Use gaskets on both sides if a line blank is inserted between two flanges. Do not use a valve as sole means of isolation. If LOTO isolates a segment of active fuel piping from thermal relief, install temporary relief capability.

Execute in accordance with accepted Accident Prevention Plan, Section

01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, and EM 385-1-1. Coordinate LOTO installation, maintenance, inspection, and removal with facility fuel system operator.

1.4.2 Preparation for Welding

Develop written procedures in accordance with EM 385-1-1, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, and AWS Z49.1. Test piping for hydrocarbons and purge as necessary. Do not start grinding or welding until vapor-free certification is received from the Marine Chemist and requirements of EM 385-1-1 have been met.

1.4.3 Gas-Free Condition

Degass piping until requirements of Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, the accepted Accident Prevention Plan, and the certified Marine Chemist are met. Obtain gas-free certification from the Marine Chemist. Maintain the gas-free environment. Display the Marine Chemist certificate on-site and available for review at all times during welding work.

1.5 PERFORMANCE

Establish and maintain a system integral with the quality control program for inspection and examination of design and construction. Perform inspection and examination to ensure contract work conforms to requirements. Maintain complete records and make them available to the Government.

Contractor is responsible for the quality of all design, joint preparation, welding, inspection, examination, testing, records maintenance, and reporting. All materials used in welding operations must be clearly identified and recorded. Inspection, examination, and testing defined in this Section are minimum requirements. Provide additional inspection, examination, and testing when necessary to achieve the required quality of work.

1.6 GENERAL REQUIREMENTS

This section covers welding of POL service piping systems. Contractor must oversee the quality of design, joint preparation, welding, inspection, and examination. Deviation from applicable codes, approved procedures, and approved drawings is not permitted without prior written approval by the Contracting Officer. Materials or components with welds made offsite are not accepted if the welding does not conform to requirements of this Section, unless otherwise specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Unless otherwise specified, the choice of weld process is responsibility of the Contractor. See paragraph DESIGN REQUIREMENTS for limitations on use of closure welds.

The Contracting Officer or Owner's Inspector may conduct inspection, test, or oversight work. Government inspection or testing are for the sole benefit of the Government. They do not:

a. Relieve Contractor of responsibility for providing adequate quality control measures

b. Relieve Contractor of responsibility for damage to or loss of the

material before acceptance

c. Constitute or imply acceptance

1.6.1 Procedures

Develop procedures for welding all metals included in the work. Procedures for making transition welds between different P-number materials or between plates or pipes of different thickness must be qualified.

1.6.2 Weld Inspection

This Section contains requirements to inspect all welds. Ensure full compliance with requests of the weld inspector(s) to correct deficiencies in materials and workmanship. It provides minimum requirements to qualify personnel, procedures, and equipment, and contains acceptance criteria. Correct all deficiencies in materials and workmanship in accordance with requirements of this Section.

1.6.3 Nondestructive Examination

This Section contains requirements to examine welds with nondestructive means to detect the presence of defects. It provides minimum requirements to qualify personnel, procedures, and equipment, and contains acceptance criteria. Correct all deficiencies in materials and workmanship in accordance with requirements of this Section.

1.6.4 Records Retention

Maintain current records of test results obtained in weld procedure qualification. Maintain current records of performance test results obtained to qualify welders and welding operators. Maintain welder continuity records. Maintain all records of weld inspection and NDE at the site and readily available for review by the Contracting Officer. Produce all records as part of Statement of Work (SOW) or Project Program completion report requirements.

1.6.5 Timely Reporting

Timely reporting of weld inspection and examination progress is required. A weld is not finished until its associated Weld Log record with affirmative inspection and examination results has been received and is found complete and accurate. Do not submit a request for progress payment for unfinished welding work.

1.6.6 Protect in Place

Protect in place tanks, piping, components, flanges, gaskets, motors, valves, pumps, impellers, risers, coating, finishes, gauges, alarms, conduit, and conductors. Employ measures to protect people, equipment, and surfaces from exposure to and damage from sparks, heat, radiant energy, and light emission. See paragraph MAINTAINING CLEANLINESS OF PIPING for more requirements.

1.7 DESIGN REQUIREMENTS

Consult with experts experienced in fuel piping or pipeline welding. Provide subject matter professional engineering expertise to design

welding. Validate site conditions to fully inform procedures, specifications,sketches and shop drawings. Produce work plans, procedures, specifications, sketches, and shop drawings which are complete and usable. Provide means to minimize heat distortion. Identify work which requires special methods such as preheat or postweld heat treatment, dissimilar metal joints or thickness, in-process weld examination, or closure welds. Establish fit-up and edge preparation tolerances.

Products to be conveyed in the piping is MIL-DTL-83133 JP-8. Unless noted otherwise in SOW or Project Program, Fluid Service Category is Normal per ASME B31.3.

1.7.1 Code and Criteria Basis

UFC 3-460-01, API 570, and ASME B31.3 are relevant design codes and criteria. ASME B31.3 incorporates by reference other requirements of ASME BPVC SEC V, ASME BPVC SEC IX, and American Welding Society (AWS). For applicable processes, provide design and plans consistent with standards and guides AWS D10.4, AWS D10.10/D10.10M, AWS D10.11M/D10.11, AWS D10.12M/D10.12, and AWS C5.5/C5.5M.

1.7.2 Closure Welds

Restrict use of closure welds, as defined in this Section, to the minimum. Design work to maximize use of hydrostatic test(s) as means of compliance with leak test requirements of ASME B31.3 paragraph 345. Refer to Section 33 52 43.13 AVIATION FUEL PIPING for hydrostatic test requirements. Designate on drawings or sketches the location of each closure weld and provide notes which state in-process examination requirements in accordance with this Section, API 570, and ASME B31.3. Ad-hoc, field-determined, or unnecessary closure weld designations are not allowed.

Closure welds in the work are only acceptable under the following circumstances.

a. A closure weld is the only means by which the pipe or assembly can be installed into the system due to a physical constraint

b. The closure weld cannot be leak-tested in accordance with ASME B31.3, either in-situ or offsite

1.7.3 Structural Welds

In accordance with AWS D1.1/D1.1M Structural Welding Code, and AWS D1.6/D1.6M Structural Welding Code (stainless steel). Do not weld attachment studs to any surface of the pressure-containing boundary. A weld which connects a support to the pressure-containing boundary is considered a piping or pipeline weld.

1.7.4 Piping or Pipeline Welds

In accordance with API 570, ASME B31.3 Process Piping Code, and this Section. Restrict process for root pass to gas tungsten arc. Butt joint or groove welds must have CJP. Branch connection welds must be no closer than two times the run piping thickness from an adjacent weld.

1.7.5 Weld Plan

Provide a weld plan which addresses all aspects of welding operations, inspection, and examination to meet requirements of this Section. Include specification and qualifying record for each procedure along with a summary table which lists all qualified welding personnel and the Welding Procedure Specification (WPS) under which they are qualified. For each welding operation, identify a sequence to minimize heat distortion both in-situ and offsite. Provide a process for machine welding if used. Describe how the quality of welding operations will be controlled. Submit Weld Plan in accordance with paragraph SUBMITTALS.

1.8 QUALITY ASSURANCE

Provide welding procedure specifications, procedure qualification records, and welder performance qualification records for each procedure and welder. Provide means and methods to control the quality of welding operations. If used, provide a method to track and control the quality of multiple welders on the same weld.

1.8.1 Data Management

Organize repair data in a non-proprietary management system such as a database or spreadsheet. Establish a piping location identification scheme which uniquely identifies each piping weld, its location, its orientation, and its relative position to other piping features. Provide secure, auditable, and organized data. Ensure the system has the capability to track the provenance of each weld. Cloud-based systems are not acceptable. Limit access to the management system to ensure data integrity.

1.8.2 Weld Log

Produce, populate, and maintain a Weld Log capable of uniquely tracking the specific location of every weld in the work. Follow the established location identification scheme. Weld identification on shop drawings must match weld tracking log and weld marking. The log must include the following minimum contents.

a. Weld map depicting physical location, location on the piping, clock position, and orientation

b. Type of weld including temporary and tack welds

c. Applicable WPS

d. Name or identification number of welding personnel

e. Date and time of completion of welding or tacking

f. Date and type of weld inspection, inspector name, acceptance criteria; acceptance determination

g. Date and type of nondestructive examination, examiner name, acceptance criteria, acceptance determination

h. Date, name, description of defects found, reason for noncompliance

i. Corrective action planned or taken, including all steps above leading

to an acceptance determination

j. Date and time of the QCM inspection for each determination that a specific weld (welding, inspection, and examination) is complete, meets requirements, and is acceptable

1.8.2.1 Progress Reporting

Update and populate the log as work progresses. Submit to the Contracting Officer on a regular basis as part of progress documentation. Provide a progress submittal weld log (including records for in-process inspection and examination) for oversight in a timely manner and indicating the QCM determination that a weld is complete, meets requirements, and is acceptable. Notify the Contracting Officer if weld log submittal lags by more than 10 work days.

1.8.3 Weld Symbology

Provide weld symbology in accordance with AWS A2.4.

1.8.4 Weld Marking

Neatly mark on the work with a marker or paint pen sufficient information for Government QA of the work. Use block letters approximately 2 inches in height and in legible color contrasting with the work surface. The QCM is responsible to manage and oversee all marking, timeliness, and content. In the event marking cannot be made on the piping itself, use an all weather placard attached to the work at the location of each weld. Minimum information is listed below. Should weld rework be required, neatly place a single line through obsolete marking and provide new marking.

a. Unique weld identifier (correlated to the design)

b. Welder identification

c. Inspector identification, date, and result

d. Examiner identification, date, and result

e. QCM determination, date, and result

1.8.5 Shop Drawings

Prepare and submit detail CAD drawings showing location, length, clock position, and type of welds. Indicate preweld and postweld heat treatment, inspection, and NDE. The drawings must identify the WPS to be used at each weld location. Indicate locations of closure welds and in-process examination per the design.

1.8.6 Inspection Procedures

Provide weld inspection procedures compliant with API 570, ASME B31.3, and paragraph PROCEDURE STANDARDS. The weld inspector(s) is considered a QC Specialist and must report results directly to the QC Manager, as specified in Section 01 45 00 QUALITY CONTROL.

1.8.7 Examination Procedures

Provide examination procedures compliant with API 570, ASME B31.3, and paragraph PROCEDURE STANDARDS. The weld examiner(s) is considered a QC Specialist and must report results directly to the QC Manager, as specified in Section 01 45 00 QUALITY CONTROL. Identify a procedure standard for any method planned to be used which is not listed.

1.8.8 Procedure Standards

Method	Procedure Standard
Ultrasonic Examination (UT)	ASME BPVC SEC V Article 4
PT	ASME BPVC SEC V Article 6
MT	ASME BPVC SEC V Article 7
Radiographic Examination (RT)	ASME BPVC SEC V Article 2
Visual Examination (VT)	ASME BPVC SEC V Article 9

1.8.9 Inspection and Examination Reporting

Provide timely reports in accordance with paragraphs SUBMITTALS and weld log PROGRESS REPORTING. At minimum, reports must consist of the following.

a. Records made by the AWS certified inspector for all duties performed per paragraph 4.2 of AWS QC1 using the unique identifier for each weld inspected.

b. All NDE examiner reports using the unique identifier for each weld examined.

c. Weld map location of each weld, weld procedure, welder identification, results of visual inspection, results of NDE.

d. Up-to-date Weld Log.

e. Records made by the AWS certified inspector for in-process weld inspection, including visual method report as required in ASME B31.3.

1.9 QUALIFICATIONS AND CERTIFICATIONS

Before assigning welders or welding operators to the work, provide the Contracting Officer with names and certification that each individual is performance-qualified as specified. The certification must state the type of welding and positions for which each is qualified, the code and welding procedure specification under which each is qualified, date qualified, and the firm and individual who certified the qualification tests. Provide a summary table showing all welders and the WPS for which they are qualified to weld.

Do not start welding until qualified weld procedures, welders, and welding operators have been provided. Qualify procedures for making transition welds between different materials or between metal of different wall

thickness. Qualification testing must be performed by an approved independent test laboratory, or by the Contractor if approved by the Contracting Officer. Cost of such testing must be borne by the Contractor. Notify the Contracting Officer at least one week in advance of the time and place of tests. If the Contracting Officer elects to witness the tests, the qualification tests must be performed at or near the worksite and at the notified time and place.

1.9.1 Welding Procedure Specification

Qualify the WPS for every proposed welding procedure. Qualification must conform to the requirements of ASME B31.3 and this Section. Specify back purge gas requirements and end preparation for joints to include cleaning, alignment, and root opening tolerances. Include procedures for weld repairs. Specify interpass temperature control and any weld special treatment requirements as required by the design. Identify weld procedures uniquely and reference on the Weld Tracking Log and shop drawings.

Submit copies of the WPS for each type of welding required in accordance with paragraph SUBMITTALS. Approval of any procedure does not relieve the Contractor of the sole responsibility to produce acceptable welds.

1.9.2 Procedure Qualification Record

Perform tests, qualify all procedures including weld repair, and document the results in detail on procedure qualification records. Qualify each proposed welding procedure. Qualify procedures in compliance with ASME B31.3, ASME BPVC SEC IX, and this Section. Use the PQR format QW-483 in ASME BPVC SEC IX. Submit each PQR together with its associated WPS, and in accordance with paragraph SUBMITTALS.

1.9.3 Welding Personnel

Conduct tests using qualified procedures to determine welding personnel are capable of producing the minimum requirements of an acceptable weldment. Test all welding personnel for each welding process to be used. Tests conducted by a different employer are not acceptable. Test in accordance with ASME B31.3 and ASME BPVC SEC IX.

1.9.3.1 Welder Performance Qualification

A welder or welding operator may be qualified by volumetric NDE or by bend tests on a test coupon. Qualification by initial production welding is not allowed. Before assigning welding personnel to the work, provide WPQ records which certify the individual is performance-qualified for the procedure in accordance with ASME B31.3. The certification must state the type of welding and positions for which each is qualified, the code and welding procedure specification under which each is qualified, date qualified, and the firm and individual certifying the qualification tests. Use the WPQ format in ASME BPVC SEC IX QW-484A for welders and QW-484B for welding operators. All welder qualification records must be signed and stamped by a certified welding inspector (CWI) as defined in AWS QC1. Submit each WPQ in accordance with paragraph SUBMITTALS.

1.9.3.2 Renewal of Welder Qualification

Requalification of a welder or welding operator is required under any of the following conditions:

a. When a welder or welding operator has not used the specific welding procedure for a period of 3 months; the period may be extended to 6 months if the welder or welding operator has been employed on another welding procedure.

b. When a welder or welding operator has not welded with any procedure during a period of 3 months, all the personal qualifications are considered expired, including any extension by virtue of a. above.

c. There is specific reason to question the person's ability to make welds that will meet requirements of the specifications.

d. The welder or welding operator was qualified by an employer, other than firms performing work under this contract, and a qualification test has not been taken within the preceding 12 months.

e. Renewal of qualification for a specific welding procedure under conditions a., b., and d., above, needs to be made on only a single test joint or pipe of a thickness, position, or material required by the welding procedure specifications to reestablish the welder or welding operator qualification for the previous qualification.

1.9.4 Previously Qualified Procedures and Personnel

Welding procedure specifications, welders, and welding operators previously qualified by test may be accepted for the work without requalification, provided that all of the following conditions are fulfilled.

a. Copies of each WPS, procedure qualification record (PQR), and welder performance qualification (WPQ) are submitted and approved in accordance with paragraph SUBMITTALS.

b. Testing was performed by an approved test laboratory, approved technical consultant, or by the Contractor's approved quality control organization.

c. The welding procedures, welders, and welding operators were qualified in accordance with API 570 and ASME B31.3, and base materials, filler materials, electrodes, equipment, and processes conformed to the applicable requirements of the design and this Section.

d. The requirements of paragraph RENEWAL OF WELDER QUALIFICATION are met and records showing name of employer and period of employment using the process for which qualified are submitted as evidence of conformance.

1.9.5 Independent Test Organization

The independent test organization can be a testing laboratory, technical consultant, or NDE testing firm, and must meet principles of ASTM E329. The principal business of the testing organization, testing laboratory, technical consultant, or firm must be NDE, inspection, and testing, and must have no involvement in project procurement, fabrication, construction or installation. The test organization, testing laboratory, technical consultant or NDE testing firm must be a first tier subcontractor. Submit current Independent Test Organization certification which demonstrates compliance with this Section in accordance with paragraph SUBMITTALS.

1.9.6 Inspection and Examination Personnel

Provide a commercially independent organization for all weld examinations. Submit qualifications of all inspection and examination personnel for approval by the Contracting Officer. All inspection and NDE personnel must be qualified in accordance with the following requirements.

1.9.6.1 Prohibited Practices

a. The contractor quality control manager cannot be the weld inspector or the weld examiner.

b. Should a weld inspector also be a welder, that individual is disqualified from inspecting or examining a weld or any portion thereof of the inspector's own work.

c. Should a weld examiner also be a welder, that individual is disqualified from inspecting or examining a weld or any portion thereof of the examiner's own work.

1.9.6.2 Weld Inspector

a. Qualification: Weld inspector must be qualified in accordance with ASME B31.3 and API 570, and have minimum 5 years of experience inspecting process pipe or pipeline welding on military or commercial fuel systems. The weld inspector(s) is considered a QC Specialist. All inspectors must be independent and must not represent nor be an employee of the prime construction contractor, welding subcontractor, fabricator, erector, or manufacturer.

b. Certification: Welding inspectors must be certified as CWI or senior certified welding inspector (SCWI) as defined in AWS QC1 with a ASME BPVC SEC IX endorsement. Provide AWS Weld Inspector Certificate in accordance with paragraph SUBMITTALS. Provide one SCWI in responsible charge of weld inspection duties to oversee CWI inspection and review all weld inspection reports.

1.9.6.3 In-Process Weld Inspector

a. Qualification: In-process weld inspector must be qualified in accordance with ASME B31.3 and API 570, and have minimum 5 years of experience inspecting process pipe or pipeline welding on military or commercial fuel systems. The in-process weld inspector(s) is considered a QC Specialist. All inspectors must be independent and must not represent nor be an employee of the prime construction contractor, welding subcontractor, fabricator, erector, or manufacturer.

b. Certification: In-process weld inspector must be certified as CWI or senior certified welding inspector (SCWI) as defined in AWS QC1 with a ASME BPVC SEC IX endorsement, and must be certified as a Level II in visual method compliant with ASNT SNT-TC-1A. Provide both AWS and ASNT In-Process Weld Inspector Certificates in accordance with paragraph SUBMITTALS.

1.9.6.4 Nondestructive Examiner

a. Qualification: Examiners must be qualified to perform NDE in

accordance with ASME B31.3 and API 570. Examiners must meet minimum requirements for qualification in ANSI/ASNT CP-189. Qualified examiners must have minimum 5 years verifiable experience performing nondestructive examination of fuel pipeline or piping. Experience is defined as work activity performing a specific NDE method under the direction of qualified supervision but does not include time spent in training programs. Examiners performing PAUT must be qualified in accordance with ASME BPVC SEC V Mandatory Appendix VII, and API Std 650 Annex U Personnel Qualifications and Training, with Level III Review. Personnel performing nondestructive examination must not represent nor be an employee of the prime construction contractor, welding subcontractor, fabricator, erector, or manufacturer, and must be employed by an independent test organization.

b. Certification: Provide examiners certified compliant with ANSI/ASNT CP-189 pursuant to the table EXAMINER CERTIFICATION STANDARDS for the applicable method. Level II Limited certification does not meet the Level II requirement. Provide Weld Examiner Certificate in accordance with paragraph SUBMITTALS.

1.9.6.5 Examiner Certification Standards

Method	Standard
UT	Level II or III
PT	Level II or III
MT	Level II or III
RT	Level III
VT	Level II

1.9.7 Piping Engineer of Record

Professional engineer in responsible charge of the POL service piping design.

a. Qualification: 5 years of experience in POL facilities engineering, including design, inspection, and construction of pipelines or process piping systems.

b. Certification: Bachelor of Science degree in Civil or Mechanical Engineering; Licensed as a professional civil or mechanical engineer.

1.10 DELIVERY, STORAGE, AND HANDLING

All filler metals, electrodes, and other welding materials must be delivered to the site in manufacturer original package and stored in a dry space until used. Packages must be properly labeled and designed to give maximum protection from moisture, prevent contamination, and to ensure safe handling.

1.10.1 Material Control

Store materials in a controlled access and clean, dry area that is weathertight and is maintained at a temperature recommended by the manufacturer. Materials must not be in contact with the ground or floor, and must be stored on wooden pallets or cribbing.

1.10.2 Partial Issue

When a container of covered electrodes is opened and only a portion of the content is issued, the remaining portion must, within the limits established by AWS D1.1/D1.1M be placed and kept in a storage oven until use.

1.10.3 Damaged Container

Low-hydrogen steel electrodes must be stored in their sealed shipping container. If the seal is damaged during shipment or storage, and the damage is not immediately detected, the covered electrodes in that container must be rebaked in accordance with the manufacturer's instructions prior to issuance, or they must be discarded. If a container is damaged in storage and the damage is witnessed, the electrodes from that container must be immediately placed in a storage oven. The storage oven temperature must be as recommended by the manufacturer or the welding material specification.

1.10.4 Damaged Material

Materials which are damaged must be discarded. Do not use covered electrodes which are oil or water-soaked, dirty, or on which the flux has separated from the wire.

PART 2 PRODUCTS

2.1 WELDING MATERIALS

Welding materials for carbon steel, stainless steel and aluminum must comply with AWS WHB-4.9. Welding equipment, electrodes, welding wire, shielding and backing gas, and fluxes must be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures. All field girth root pass welds must be made with non-covered electrodes or welding wire. All root passes must be made with shielding and backing gas. External welds on the pipe such as attaching pipe supports may be made with covered electrodes or welding wire. Electrodes, welding wire or fluxes must be in accordance with Table 1.

TABLE I

AWS	Process	Alloy	Consumable	Use
			(Examples) (1)	
AWS A5.1/A5.1M	SMAW	Low Carbon	E7018	Fill
AWS A5.4/A5.4M	SMAW	Stainless	E308L, E309L	Fill

TABLE I

AWS	Process	Alloy	Consumable	Use
			(Examples) (1)	
AWS A5.9/A5.9M	GTAW	Stainless	ER308L,ER309L	Root and Fill
AWS A5.18/A5.18M	GTAW	Low Carbon	E70S-3,E70S-6	Root and Fill
AWS A5.22/A5.22M	GTAW	Stainless	E308LT1-1	Root (Backing and Shielding Gas Required)
AWS A5.32/A5.32M	GTAW	All		Shielding Gas

Note(1): The consumable material designations shown are examples only and are not intended to limit the Contractor's selection of consumable materials.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

Perform welding in accordance with the Weld Plan and qualified procedures using qualified personnel. Do not weld when the quality of the completed weld could be impaired by prevailing working or weather conditions. The Contracting Officer must determine when weather or working conditions are unsuitable for welding.

For applicable processes, provide operations consistent with standards and guides AWS D10.4, AWS D10.10/D10.10M, AWS D10.11M/D10.11, AWS D10.12M/D10.12, and AWS C5.5/C5.5M.

a. The root pass on stainless steel, and carbon steel pipe must be by the GTAW process.

b. All joints unless indicated otherwise, in carbon steel, aluminum and stainless steel piping systems must be welded.

c. Unless otherwise approved, all girth welds must be CJP groove welds made in accordance with qualified welding procedures.

d. Weld preparation must comply with the requirements of ASME B31.3 and the qualified Welding Procedure Specification. The use of "rice paper" as purge blocks is not permitted. Contractor must submit alternate method for approval.

e. Backing Rings. The use of backing rings for making or repairing welds will not be permitted.

3.1.1 Identification

Assign each welder or welding operator weld a unique identification mark (number, letter, or symbol). Place identification mark on the work and the weld map. Ensure each identification is neat and legible, traceable to a welder, and associated with a performance qualification record.

Apply the unique identification mark adjacent to each weld with permanent weatherproof means using a rubber stamp, felt-tipped marker, paint pen, or other method approved by the Contracting Officer. Do not use fluorescent paint or any method which deforms the metal. Identification by die stamps or electric etcher is not allowed.

3.1.2 Base Metal Preparation

Use mechanical grinding of thermal cut ends to remove the HAZ, or to dress metal for proper fit-up. This practice is limited to the HAZ or a maximum 1/8 inch length of removal. Do not use oxy-fuel cutting on austenitic stainless steel or nonferrous materials. Do not reduce pipe thickness outside of a weld. See paragraph GRINDING for requirements in the event pipe thickness is reduced from nominal.

3.1.3 Weld Joint Fit-up

Provide fabrication, assembly, erection, preparation, and fit-up in accordance with API 570 and ASME B31.3. Use bars, jacks, clamps, or other mechanical fixtures to fit, align, and retain joints in position during the welding operation. Align and prepare end joints prior to welding in accordance with Chapter V of ASME B31.3. For socket-welded joints, implement a program to ensure gaps are properly measured and documented to be in conformance with ASME B31.3. Branch connection welds must be no closer than 2 times the run piping thickness from an adjacent weld.

Do not use welded temporary attachments except when it is impractical to use mechanical fixtures. When temporary attachments are used, they must be the same material as the base metal and must be completely removed by careful cutting or grinding after the weld operation is completed. Cut the attachment no closer than 1/4 inch from the member and remove remaining material by careful grinding. Do not grind into base metal. After the temporary attachment has been removed, inspect the area using VT. For any area with grinding that could reduce metal or pipe wall thickness below nominal, refer to and follow requirements in paragraph GRINDING.

3.1.4 Butt Weld Joint Spacing

Butt weld joints must be spaced a minimum of 6 inches apart with measurement taken from the toe of the first weld to the toe of the second weld. Measure at the closest point between the welds when visually inspected. If spacing is not possible due to existing conditions, a reduction in spacing to not less than 2 inches may be made.

3.1.5 Preheat and Interpass Temperatures

Meet the requirements specified by ASME B31.3 for preheat temperatures. However, in no case can the preheat be below 50 degrees F for ferritic steel or austenitic stainless steel, or 32 degrees F for nonferrous alloys. Maximum interpass temperatures must not exceed 300 degrees F for austenitic stainless steels, nickel alloys, and copper alloys; and 500 degrees F for carbon steels. Preheat techniques must be such as to ensure the full thickness of weld joint preparation and adjacent base material, at least 3 inches in all directions, is at the specified temperature. Preheating by induction or resistance methods is preferred. When flame heating, only use a neutral flame. Do not use oxy-fuel heating on austenitic stainless steel. However, air-fuel heating is acceptable if controlled to ensure that the surface temperature does not exceed 150

degrees F. Interpass temperatures must be checked on the surface of the component within 1 inch of the weld groove and at the starting location of the next weld pass, and for a distance of 6 inches ahead of the weld, but not on the area to be welded.

3.1.6 Production Welding Instructions

a. Welding must not be done when ambient temperature is lower than 0 degrees F.

b. Welding is not permitted on surfaces that are wet or covered with ice, when snow or rain is falling on the surfaces to be welded. During periods of high winds welding is not permitted unless the welders and the work are properly protected.

c. Gases for purging and shielding must be welding grade and must have a dew point of minus 40 degrees F or lower.

d. Back purges are required for austenitic stainless steels and nonferrous alloys welded from one side and must be set up such that the flow of gas from the inlet to the outlet orifice passes across the area to be welded. The oxygen content of the gas exiting from the purge vent must be less than 2 percent prior to welding. The flow rate must be that required by the approved weld procedure specification.

e. The purge on groove welds must be maintained for at least two passes or 3/16 inch whichever is greater.

f. Removable purge dam materials must be made of expandable or flexible plugs, such as plexiglass or dry and clean plywood. Wood dams must be kiln-dried quality. Do not use purge dams made of polyvinyl alcohol.

g. Any welding process which requires the use of external gas shielding cannot be done in a draft or wind unless the weld area is protected by a shelter. This shelter must be of material and shape appropriate to reduce wind velocity in the vicinity of the weld to a maximum of 5 mph (440 fpm).

h. Tack welds to be incorporated in the final welds must have their ends tapered by grinding or welding technique. Remove tack welds that are cracked or defective and retack the groove prior to welding. Temporary tack welds must be removed, the surface ground smooth, and visually inspected. For low-alloy and hardenable high-alloy steels, the area must be examined by MT.

i. Grinding of completed welds is to be performed only to the extent required for inspection or NDE, including in-process examination, and to provide weld reinforcement within the requirements of ASME B31.3. If the surface of the weld requires grinding, reducing the weld or base material below the minimum required thickness is not allowed. See paragraph CORRECTION AND REWORK. Minimum weld external reinforcement must be flush between external surfaces.

j. Each qualified welder must be assigned unique identification. All welds must be permanently annotated with the mark or symbol of the individual who made the weld.

k. Direct welded connection of carbon steel and stainless steel must not

be made.

3.1.7 Postweld Heat Treatment

a. When required, perform postweld heat treatment in accordance with ASME B31.3. Temperatures for local postweld heat treatment must be measured continuously by thermocouples in contact with the weldment.

b. Postweld heat treatment of low-alloy steels, when required, must be performed immediately upon completion of welding and prior to the temperature of the weld falling below the preheat temperature. However, postweld heat treatment may be postponed after the completion of the weld, if, immediately after the weld is completed, it is maintained at a minimum temperature of 300 degrees F or the preheat temperature, whichever is greater, for 2-hours per 1 inch of weld thickness.

3.2 EXAMINATIONS, INSPECTIONS AND TESTS

Provide the services of a qualified inspection, testing, or examination organization meeting requirements of paragraph QUALIFICATIONS AND CERTIFICATIONS and approved by the Contracting Officer. Radiographic, Liquid penetrant, Magnetic particle examination is required pursuant to this Section. Perform inspection, examination, and testing as required by the SOW or Project Program, this Section, the piping engineer, API 570, ASME B31.3, and in accordance with written procedures.

a. When in-process weld examination is required, perform in accordance with paragraph IN-PROCESS WELD INSPECTION.

b. Hydrostatic test requirements are found in the SOW or Project Program and Section 33 52 43.13 AVIATION FUEL PIPING.

c. When examination, inspection, and testing indicate a defect in a weld joint, the weld must be repaired by a qualified welder in accordance with paragraph CORRECTION AND REWORK.

d. When inspection, examination, and tests substantiate defects in a weld, rework the weld with a qualified welder in accordance with paragraph CORRECTION AND REWORK. Perform all inspection, examination, and tests on rework until acceptable results are achieved.

e. Submit all weld inspection, examination, and test reports to the Contracting Officer.

3.2.1 Quality Control of Welding

a. Verify base materials and consumable welding materials conform to the specifications, and that welding filler metals used are as specified for each base material.

b. Verify welding equipment to be used for the work is appropriate for use with the welding procedure specification and has the capability to meet requirements of the welding procedure.

c. Verify only approved or qualified welding procedures are used for the work.

d. Verify that edge preparation and joint geometry meet requirements of

the welding procedure and drawings.

e. Verify specified filler metals are used and that filler metals are maintained in proper condition, per requirements and as recommended by the manufacturer.

f. Verify work conforms to requirements of the applicable code, standards, drawings, design, or other documents.

g. Verify the approved WPS pre-heat and post heat procedures are being used.

h. Prepare clear and concise reports and verify that records of the results of weld inspection and examinations are maintained.

3.2.2 Weld Inspection

Perform weld inspection to detect surface and subsurface discontinuities in completed welds. Visually inspect all welds in accordance with requirements of ASME B31.3, ASME BPVC SEC V, and AWS D1.1/D1.1M. Aid the VT by using PT or MT as-needed to determine the condition of a weld.

a. Provide inspector personnel qualified and certified in accordance with paragraph INSPECTION AND EXAMINATION PERSONNEL.

b. Visually inspect all tack welds and completed welds.

c. Submit weld inspection reports to the Contracting Officer within 10 work days of performance.

d. Provide inspection in accordance with paragraph EXAMINATION AND INSPECTION FREQUENCY.

e. Weld personnel found making defective welds must be removed from the work or must be required to be requalified in accordance with ASME B31.3 by the Quality Control Manager.

f. For each method used, provide a qualified procedure in accordance with paragraph INSPECTION PROCEDURES.

3.2.2.1 Weld Inspection Duties

a. Verify the technique and performance of each welder, welding operator, and tack welder are as specified.

b. Verify the work inspected is identified and documented in accordance with SOW or Project Program requirements and this Section.

c. Prepare clear and concise reports and verify that records of the results of weld inspection and examinations are maintained.

d. Review requirements in paragraph QUALITY CONTROL OF WELDING and determine whether the quality control program is effective.

e. Perform VT inspection of all welds.

3.2.3 In-Process Weld Inspection

For closure welds or welds designated for in-process inspection or

examination, inspect in accordance with requirements of ASME B31.3, ASME BPVC SEC V, API 570, and AWS D1.1/D1.1M. Aid visual inspection with PT or MT in accordance with API 570 if needed to determine the condition of a weld. Perform in-process inspection in accordance with paragraph WELD INSPECTION and the following.

a. Provide in-process inspection in accordance with paragraph EXAMINATION AND INSPECTION FREQUENCY.

b. Before welding: Inspect for compliance with requirements for joint preparation, cleanliness, preheating, fit-up, joint clearance, and internal alignment in accordance with ASME B31.3. Assess compliance with variables specified in the WPS including filler material, position, and electrode.

c. During welding: After cleaning, inspect root pass for cracks, slag, and conformance to approved welding procedure. Assess weld condition between passes. When it is accessible, perform visual inspection of the interior side of the root pass by remote means allowed in ASME BPVC SEC V Article 9.

d. After welding: Inspect for defects, contour and finish, bead reinforcement, undercutting, overlap, weld slag on the interior of the pipe, appearance, and weld size in accordance with ASME B31.3 and AWS D1.1/D1.1M. Perform visual inspection of the interior by remote means allowed in ASME BPVC SEC V Article 9 when it is accessible.

e. Prepare and provide inspection record of in-process weld inspection including visual method report. Submit in-process weld inspection records and reports to the Contracting Officer within 10 work days of performance.

3.2.4 Nondestructive Examination

Perform NDE as required by API 570, ASME B31.3, SOW or Project Program, this Section, the design, and in accordance with written procedures. Procedures must conform to paragraph EXAMINATION PROCEDURES. Each approved procedure must be demonstrated to the satisfaction of the Contracting Officer. In addition to essential variables required in paragraph EXAMINATION PROCEDURES, the written procedures must include proper timing of NDE in relation to welding operations, weld inspection, and safety precautions.

Provide non-destructive examination in accordance with paragraph EXAMINATION AND INSPECTION FREQUENCY. Service organization must meet requirements of paragraph INDEPENDENT TEST ORGANIZATION and must be approved by the Contracting Officer.

Provide services of a commercially independent qualified testing agency approved by the Contracting Officer for examination and testing of piping welds. The cost of examination and testing, including re-examination and re-test of repaired welds, must be borne by the Contractor. Weld ripples or surface irregularities that might mask or be confused with the radiographic image of any objectionable defect must be removed by grinding or other suitable mechanical means. The weld surface must be merged smoothly with the base metal surface.

3.2.5 Examination, Inspection, and Tests by the Government

Welding is subject to inspection and tests in the mill, shop, and field. When materials or workmanship do not conform to SOW or Project Program, or requirements of this Section, the work may be rejected at any time before final acceptance of the system containing the weldment. If defective work is identified, provide a corrective action plan and initiate rework procedures. Perform rework, repair, inspection, examination, and testing compliant with SOW or Project Program requirements and this Section. The rework, repair, inspection, examination, and testing, except as noted below, is at no additional cost to the Government.

3.2.5.1 Supplemental NDE, Inspection, and Tests

In addition to requirements of the SOW or Project Program and this Section, the Government Owner's Inspector may perform supplemental nondestructive examination, inspection, or tests as deemed necessary. The cost of supplemental NDE, inspection, or tests will be borne by the Government. Coordinate safe access to the work for the NDE, inspection, and test personnel and equipment. If defective work is identified, provide a corrective action plan and initiate rework procedures.

3.2.5.2 Destructive Tests

In addition to requirements of the SOW or Project Program and this Section, the Contracting Officer or Owner's Inspector may order destructive tests to be performed by the Contractor. If destructive test results indicate that materials or workmanship do not conform to contract requirements, the cost of destructive tests, corrective action, and repair must be borne by the Contractor. When destructive tests are made, repairs must be made by qualified welders or welding operators using qualified welding procedures which will develop the full strength of the member.

3.3 EXAMINATION AND INSPECTION FREQUENCY

Conduct NDE and inspection of all welding, including high point vent and low point drain piping. Determine and report conformance to the paragraph ACCEPTANCE STANDARDS. Provide frequency of NDE and inspection in accordance with the below requirements and paragraph EXAMINATION AND INSPECTION SCHEDULE.

a. Provide 100 percent RT for welds on underground, below ground (piping within vaults and pits), or inaccessible piping.

b. Provide 100 percent RT for welds on severe cyclic piping to include aviation hydrant systems and truck fillstands.

c. Examine each socket weld or socket welded branch connection with either magnetic particle or liquid penetrant methods.

d. For aboveground welds examined by radiography at frequency less than 100 percent, provide random RT in accordance with ASME B31.3 on no less than 20 percent of welds. Random testing must include representation of welds made by each welding operator or welder and must include representation of each weld type present in the work. The progressive sampling requirements of ASME B31.3 apply.

e. Where RT is infeasible, notify and provide justification to the Contracting Officer. Justification must be substantive and not be

based on convenience. Upon approval by the Contracting Officer, perform UT in lieu of RT in accordance with this Section and API Std 650 Annex U and ASME BPVC SEC V.

f. Provide select RT in accordance with ASME B31.3 for all aboveground piping welds. The inspection must include an examination of welds made by each welding operator or welder. Not less than 20 percent of total welds must be examined. If the testing reveals that a weld fails to meet minimum quality requirements, an additional percent of the welds in that same group must be inspected in accordance with ASME B31.3. If all of the additional welds inspected meet quality requirements, the entire group of welds represented is accepted and the defective welds must be repaired. If any of the additional welds inspected fail to meet quality requirements, the entire group of welds represented is rejected. Rejected welds must be removed and rewelded.

3.3.1 Examination And Inspection Schedule

Weld Type	Joint Type or Configuration	Frequency	Method
CJP groove	Butt	Each pass	VT
CJP groove	Butt	Final pass	VT, RT
Closure	Root pass	Each	VT, PT or MT; Note 1
Closure	Cover pass	Final	VT, RT; Note 1
Fillet		Final	VT, MT
Structural attachment	Installation or removal	Final pass or after removal	VT, PT or MT
	Cutline	Each	VT; Note 2
Repair		Note 3	Note 3
	Pipe interior	Root or final pass, when accessible	VT
Insert	Branch connection	Final pass	VT, RT
Non radiographicable	Branch Connection	Final pass	VT, PT or MT
CJP groove	Butt; inaccessible	Final pass	VT, RT
Socket		Final pass	VT, PT or MT

Note 1. In-process weld examination IAW API 570, ASME B31.3 and this Section.

Note 2. Examine the cutline for laminations, scale, burrs before welding.

Note 3. Examination and inspection requirement for a weld repair is pursuant to that of the original weld and must be repeated until no defect

exists.

3.4 ACCEPTANCE STANDARDS

Inspection and examination acceptance standards must be in accordance with ASME B31.3. Acceptance criteria are in paragraph ACCEPTANCE CRITERIA and notes. For hydrant systems and stainless steel systems, use severe cyclic conditions. Interpretation of results and limitations on imperfections in welds must comply with the requirements of 100 percent radiography as defined in ASME B31.3.

3.4.1 Acceptance Criteria

Method	Criterion	Note
VT	ASME B31.3 Table 341.3.2	1
RT	ASME B31.3 Table 341.3.2	-
MT	ASME B31.3 344.3	2
PT	ASME B31.3 344.4	3
UT	ASME B31.3 344.6	-

Note 1. In addition to paragraph ACCEPTANCE CRITERIA, requirements of paragraph VISUAL also apply.

Note 2. In addition to paragraph ACCEPTANCE CRITERIA, requirements of paragraph MAGNETIC PARTICLE also apply.

Note 3. In addition to paragraph ACCEPTANCE CRITERIA, requirements of paragraph LIQUID PENETRANT also apply.

3.4.2 Visual

The following indications are unacceptable.

a. Weld slag on the interior of the pipe.

3.4.3 Magnetic Particle

The following relevant indications are unacceptable.

a. Any linear indication.

b. Rounded indication with any dimension greater than 3/16 inch.

c. Four or more rounded indications in a line separated by 1/16 inch or less edge-to-edge.

d. Ten or more rounded indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches (linear dimension), and with the area calculated in the most unfavorable location relative to the indications being evaluated.

3.4.4 Liquid Penetrant

Indications with a major dimension greater than 1/16 of an inch must be considered relevant. The following relevant indications are unacceptable.

a. Any crack or linear indication.

b. Rounded indication with any dimension greater than 3/16 inch.

c. Four or more rounded indications in a line separated by 1/16 inch or less edge-to-edge.

d. Ten or more rounded indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches (linear dimension), and with the area calculated in the most unfavorable location relative to the indications being evaluated.

3.5 Final Tie-in Weld Examination

For final tie-in welds that are not subject to hydrostatic testing, final radiography of the welds and in-process welding examination in accordance with ASME B31.3, paragraph 344.7 must be performed. In addition, careful observation of the system piping put under operating pressure with fuel before joints are covered will satisfy the requirement for this testing. In-process welding examination must be confirmed by a certified welding inspector to verify that the following in-process examination requirements have been adequately met.

a. Joint preparation and cleanliness.

b. Preheating.

c. Fit-up, joint clearance, and internal alignment prior to joining.

d. Variables specified by the joining procedure, including filler material, position, and electrode.

e. Condition of the root pass after cleaning – aided by magnetic particle examination.

f. Slag removal and weld condition between passes.

g. Appearance of the finished joint.

3.6 CORRECTION AND REWORK

Disqualifying or rejectable inspection findings or examination indications must be completely removed and repaired as specified in ASME B31.3, unless specified otherwise in this Section. Defects discovered between weld passes must be completely removed and repaired before additional weld passes are made. After defect removal is complete and before rewelding, the area must be inspected and examined by the same method(s) which first revealed the defect to ensure the defect has been eliminated. After rewelding, the repaired area must again be inspected and examined by the same method(s) originally used for that area. Any indication of a defect must be regarded as a defect unless reevaluation by NDE or by surface conditioning shows that no defects are present.

3.6.1 Defect Removal

Defective or unsound weld joints must be corrected by removing and replacing the entire weld joint, or for the following defects, corrections must be made as follows.

a. Excessive Convexity and Overlap: Reduce by careful removal of excess metal.

b. Excessive Concavity of Weld, Undersized Welds, Undercutting: Clean and deposit additional weld metal.

c. Excessive Weld Porosity, Inclusions, Lack of Fusion, Incomplete Penetration: Remove defective portions including sound weld metal for a distance of twice the thickness of the base metal or 2 inches, whichever is less, and reweld.

d. Cracks or linear indications in weld or base metal: Remove crack or linear indication throughout its length, extending removal into sound weld metal for a distance of twice the thickness of the base metal or 2 in, whichever is less, beyond each end of a crack or linear indication. Confirm complete removal by MT for carbon steel or PT for stainless steel. Once removal is inspected and examined, then rework can commence.

e. Poor Fit-Up: Cut apart improperly fitted parts, re-fit, and reweld.

3.6.1.1 Methods of Defect Removal

Remove weld metal or portions of base metal by chipping, grinding, sawing, machining, or other mechanical means. It is less preferable but defects also can be removed by thermal cutting techniques. If thermal cutting techniques are used, clean and smooth the cut surfaces by mechanical means to remove the HAZ. In addition, a maximum of 1/8 inch of metal must be removed by mechanical means from the cut surfaces of stainless steel.

Wherever a defect is removed, and repair by welding is not required, the affected area must be blended into the surrounding surface eliminating sharp notches, crevices, or corners.

3.6.1.2 Grinding

For surfaces which require grinding, exercise caution to avoid reducing wall thickness. After all grinding operations are complete, measure with UT and record remaining metal thickness on areas which were ground. Perform thickness measurements, compare to nominal, and analyze results in accordance with API 570. Report results to the Contracting Officer.

3.6.1.3 Rewelding

Make repair welds using an electrode or filler wire smaller than that used in making the original weld. Rewelding must be done using qualified welding procedures. The surface must be cleaned before rewelding. Repair welds must meet all requirements of this Section.

3.6.1.4 Peening or Caulking

The use of force (peening) or foreign materials to mask, fill, seal, or disguise any welding defect is prohibited.

3.7 MAINTAINING CLEANLINESS OF PIPING

Keep the interior and ends of all new pipe and piping affected by work thoroughly cleaned of foreign matter and water before, during, and after installation. Keep piping systems clean during installation by means of plugs, covers, or other effective methods. When work is not in progress, secure ends of piping, components, and fittings so no water, debris, or foreign substance can enter. Inspect piping before placing into position. Clean the interior of each length of pipe after welding. Use a swab with a leather or canvas belt disc to fit the inside diameter of pipe and pull through each length of pipe after welding in place. It is the Contractor's responsibility to ensure the interior of piping is free of dirt, debris, water, and foreign matter, including weld slag, when it is connected into the system.

3.7.1 Pigging Plan

The pigging plan must be submitted for approval by the Contracting Officer. The pigging plan must provide a minimum of two runs through the system with each set of pigs. There must be a minimum of two types of pigs, polyurethane and foam. More types of pigs (brushes, scrapers) or runs may be required depending on the type of debris found in the system. The pigging plan must be submitted to the Contracting Officer for approval. See Section 33 52 43.13 AVIATION FUEL PIPING.

3.8 QUALITY CONTROL DETERMINATION

Perform quality control oversight of the welding, inspection, testing, and NDE work. Provide a determination by the QCM that each weld is complete, has been inspected by the inspector, has been examined by the examiner(s), and meets contract requirements. Mandatory elements of the determination are below. See paragraphs WELD MARKING and WELD LOG.

a. Review of the weld

b. Welder, inspector, and NDE examiner markings are complete, accurate, and up to date

c. Weld inspection and results

d. Weld examination and results

e. Weld Log is complete, accurate, and up to date

f. Reporting to the Contracting Officer is complete, accurate, and up to date

3.9 COMMISSIONING

For commissioning of POL service piping systems see Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START-UP.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 52 43.11

AVIATION FUEL MECHANICAL EQUIPMENT
08/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Std 607	(2016) Fire Test for Quarter-turn Valves and Valves Equipped with Non-metallic Seats

ASTM INTERNATIONAL (ASTM)

ASTM C827/C827M	(2023) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM D1655	(2018a) Standard Specification for Aviation Turbine Fuels

ENERGY INSTITUTE (EI)

EI 1584	(2017; 4th Ed) Four-Inch Hydrant System Components and Arrangements

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3275	(2009; Rev C) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-130	(2007; Rev N; Change 1 2012) Identification Marking of U.S. Military Property
MIL-STD-161	(2025; Rev J) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

1.2 ADMINISTRATIVE REQUIREMENTS

Submit detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and systems. Provide the drawings as one package with the design analysis. Shop fabrication drawings must include type of material, configuration, thickness, and necessary details of construction of the steel tank and vault. Shop drawings must also show the steel grating and supports.

Submit Manufacturer's Catalog Data and Certificates of Compliance. Operation and maintenance information must be submitted for the equipment items or systems listed in PART 2. Automatic pump controls must include step-by-step procedures required for system startup, operation, and shutdown. Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted for various types of equipment and systems.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hydrant Outlet Pits; G

Hydrant Valve; G

Hydrant Isolation Valve; G

High Point Vent Pits; G

SD-03 Product Data

Hydrant Valve; G

Hydrant Isolation Valve; G

SD-07 Certificates

System Supplier; G

SD-10 Operation and Maintenance Data

Hydrant Valve; G

Hydrant Isolation Valve; G

Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted for various types of aviation fueling equipment and systems.

1.4 QUALITY ASSURANCE

Submit the following data for approval:

a. Certification stating that the system supplier has provided and installed at least five PLC-based pump control systems in the last five years, for automatic cycling of pumps based upon varying dispensing demands, utilizing multiple pumps. These systems must be for dispensing jet fuel.

b. Certification that six systems have been successfully operated over the last three years and are currently in service.

c. Project names, locations, system description, and items provided at

these installations. Include user point-of-contact and current telephone numbers.

PART 2 PRODUCTS

2.1 MATERIALS

Materials of construction must be stainless steel, aluminum or nonferrous material except meter case may be steel with electroless nickel plated internals coated to 3 mil thickness. No ferrous or zinc-coated material bronze, brass or other copper bearing alloys must be used in contact with the fuel.

2.1.1 Types of Fuel Handled

2.1.1.1 Properties of F-24 Turbine Fuel

Jet Fuel system components must be suitable for use with F-24 turbine fuel (Jet A with additives FSII, CI/LI, and SDA); specific gravity of 0.81 at 60 degrees F; Reid vapor pressure less than 0.05 psi; flash point of 100 degrees F; viscosity 1.62 cSt at 60 degrees F; ASTM D1655.

2.1.2 Components

Components to be ANSI Class 150 (275 PSIG at 100 degrees F.) unless noted otherwise. Components to be suitable for outside, unsheltered location, and to function normally in ambient temperatures between 20 degrees F and 100 degrees F.

2.1.3 Composition of Materials

Materials in contact with the fuel must be noncorrosive. No zinc-coated metals, brass, bronze, iron, lead or lead alloys, copper or copper alloys, or other light metal alloys containing more than 4 percent copper must be used in contact with the fuel.

2.1.4 Gaskets

Gaskets must be in accordance with Section 33 52 43.13 AVIATION FUELING PIPING.

2.1.5 Bolts and Nuts

Bolts and nuts must be in accordance with Section 33 52 43.13 AVIATION FUELING PIPING.

2.2 EQUIPMENT AND MATERIAL

2.2.1 General

All items of equipment and material must be new and of the best quality used for the purpose in commercial practice and must be products of reputable manufacturers. Each major component of equipment must have the manufacturer's name, address and catalog number on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent only will not be acceptable. The gears, couplings, projecting set screws, keys and other rotating parts located so that any person may come in close proximity thereto must be fully enclosed or properly guarded. Equipment, assemblies and parts must be marked for identification in accordance with

MIL-STD-130 and MIL-STD-161. Identification (ID) tags made of brass, stainless steel, or engraved anodized aluminum, indicating valve number and normally open (NO) or normally closed (NC) must be installed on valves. Tags must be 1-3/8 inch minimum diameter, and marking must be stamped or engraved. Indentations must be black, for reading clarity. Tags must be attached to valves with No 12 AWG, copper wire, stainless or aluminum hanging wires, or chrome-plated beaded chain designed for that purpose.

2.2.2 Supplier

Since the pump control system, including but not limited to pump control panel, venturi tubes, transmitters, flow switches, fueling system pumps, all field instrumentation, tightness monitoring system, and control valves with all hardware and software, is an integrated system it must be furnished by a single systems supplier regularly engaged in the supplying of this equipment. System Supplier must be a company whose regular, normal, and primary business is representing manufacturers in the distribution and start-up of aviation fueling facilities, and have no affiliation with the Contractor other than as a seller to the Contractor. Supplier must provide all equipment and appurtenances regardless of manufacture, be a factory authorized certified representative, and be responsible to the Contractor for satisfactory operation of the entire system, and must oversee the installation of the equipment. Substitutions of functions specified will not be acceptable. The Contractor and the System Supplier must be present at the system commissioning, and must coordinate and schedule the work during construction, testing, calibration, and acceptance of the system. The System Supplier must be on-site with their mechanical and control personnel to supervise and assist the Contractor during pre-commissioning check-out of the mechanical systems and control systems, initial fuel receipt, initial filling, hydrostatic testing, pigging, flushing, cleaning, Equipment Tests, Performance Testing, and training all for the owner's representatives. The System Supplier must be responsible to the Contractor for scheduling all Contractor, Sub-contractor, and manufacturer's service personnel during system start-up, Equipment Tests, Performance Testing, and training.

2.3 ELECTRICAL EQUIPMENT

Motors, manual or automatic motor control equipment except where installed in motor control centers, and protective or signal devices required for the operation specified herein must be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Any wiring required for the operation specified herein, but not shown on the electrical plans, must be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.4 HYDRANT VALVE

Hydrant valve must be 4-inch cast ductile-iron body with Class 150 ASME inlet flange, and outlet adapter must conform to EI 1584, 4th Edition. Hydrant valve must have an air-operated pilot valve, to open and close valve.

2.5 UNDER HYDRANT ISOLATION VALVE

Hydrant valves must include Under Hydrant isolation valves having Class 150 inlet and outlet flanges. Under Hydrant isolation valves must conform to API Std 607. Valve must be provided with an integral stone guard

strainer. Under Hydrant isolation valves must be furnished with a minimum of ten t-bar remote operating handles. The valve must be manually operated by use of an externally mounted gear box with position indicator allowing the servicing and removal of the hydrant valve when closed. The isolation valve must be full port with stainless steel ball. As an alternative, if exercised and approved by the Government, a full port ball valve with a conical strainer at the inlet is acceptable in lieu of the under hydrant isolation valve. The Contractor may submit to the Contracting Officer a change request for use of a full port ball valve with a conical strainer at the inlet, in lieu of the under hydrant isolation valve at no additional cost to the Government.

2.6 PRESSURE CONTROL COUPLER

Pressure control couplers must be 4-inch, of high strength aluminum and stainless steel construction, and conform to EI 1584, 4th edition. Four pressure control couplers must be procured by Contractor and provided to PACAF/A4R & 36 WG/LRS. The couplers must be retrofitted into four R-12 hydrant dispenser trucks by PACAF/A4R & 36 WG/LRS. The coupler must facilitate connecting the truck to a hydrant valve to allow pressurized fuel to flow from hydrant loop into receiving aircraft. The coupler must include a deadman operated pressure regulator that protects receiving aircraft from excess pressure and from pressure surge damage.

2.7 HYDRANT OUTLET PITS

Use this paragraph for On-shoulder and On-apron installation. Hydrant hose truck hydrant outlet pits must be prefabricated units that are the standard products of a firm regularly engaged in the manufacture of such products and must essentially duplicate items that have been in satisfactory use for at least (3) years prior to bid opening. The basic pit must consist of a 0.50-inch thick fiberglass walls and floor with main body dimensions as shown on the drawings. The pit must contain twelve (minimum) integral concrete anchors or two integral anchors that run continuous on three sides of pit. The integral fiberglass top flange must require no exposed corrosive material, weldments, or strongbacks within the pit to support the aluminum cover assembly. The manufacturer must have had a minimum of three years successful experience in the production and usage of their fiberglass service pits and must supply proof of experience at time of submittals.

2.7.1 Pit Cover, General Requirements

The pit cover must include a removable outer ring frame and an interior 18-inch diameter (clear opening) hinged lid that opens 160 degrees. The pit must have a tamperproof cover. The removable outer ring must have anchors to provide for means to secure the manhole and its moveable cover and lid to the "concrete" fiberglass containment. The inner hinged lid must have a means of being locked. Each cover lid must move smoothly through its entire range of motion and must require a maximum opening force of 35 pound-force to be applied at a single lifting handle. Each handle must provide a comfortable, secure grip for an average adult male's full gloved hand. Tools must not be required to engage the lifting handle. Projections of the lid's hinges or handles above the plane of the lid, whether temporary or permanent, must not be allowed. The pit service must be integrally cast in raised letters on the top surface of each lid. The lettering must be a minimum of 1-inch high and 0.0625-inch deep. The weight bearing flanges of the fiberglass pit liner and the aluminum cover frame (and lid) must be machined to assure uniform weight distribution.

2.7.2 Pit Cover Materials, Design, and Testing

The cover frames and lids must be designed and manufactured by a qualified company having a minimum of five years successful experience in the production of similar airport apron slab fixtures. All cover lids and frames must be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 200,000-pound test-load applied perpendicular to a 200-square-inch contact area(10 by 20 inches) of the cover's top surface. The aluminum alloy material selected for design must be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers must be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects must not be allowed. Minor cosmetic welding is acceptable. The cover must be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations must be considered as failure. Actual load-tests must be performed on a minimum of 10 percent of all the covers supplied. Load-tested units must be randomly selected. Load-test conditions must model field-installed conditions as nearly as practicable. The 200 Kip test-load must be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load must not exceed 1/180th of the interior diameter of the fiberglass pit body. Maximum deflection of the cover lids, remaining after removal of the test load must be + 0.010-inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame must be carefully examined for cracks or localized areas of permanent deformation. All results must be submitted for review and approval. A single failure to meet any of the stated criteria must be considered sufficient grounds for the testing of 50 percent of the units.

2.7.3 Pipe Seal

The pipe penetrations through the pit wall must be sealed by means of a Buna-N boot. The boot must be secured to the pipe and to a steel sleeve bonded to the pit wall at the pit penetration by stainless steel clamps. Buna-N (Nitrile Butadiene) material must be in accordance with SAE AMS3275.
Closure of space between the pipe and the pipe sleeve must be by means of a mechanically adjustable segmented elastomeric seal. The seal must be installed so as to be flush.

2.8 HIGH POINT VENT PITS

Use for On-Shoulder and On-Apron installations.

2.8.1 Pit Assembly

Each pit must incorporate the following items built into a self-contained assembly.

2.8.2 Pit

The basic pit must consist of 0.25-inch wall fiberglass liner with a main body approximately 23-inches in diameter and a minimum of 37-inches deep. The pit must contain two integral concrete anchors. The fiberglass top flange must require no exposed corrosive material, weldments, or strongbacks within the pit to support the cast aluminum ring and cover assembly. The pits must be the standard products of a firm regularly

engaged in the manufacture of such product and must essentially duplicate items that have been in satisfactory use for at least three (3) years prior to bid opening. Proof of experience will be submitted.

2.8.3 Pit Cover, General Requirements

The pit cover must include a removable outer ring frame and an interior 18-inch diameter (clear opening) hinged lid that opens 160 degrees. The pit must have a tamperproof cover. The removable outer ring must have anchors to provide for means to secure the manhole and its moveable cover and lid to the "concrete" fiberglass containment. The inner hinged lid must have a means of being locked. Each cover lid must move smoothly through its entire range of motion and must require a maximum opening force of 35 pound-force to be applied at a single lifting handle. Each handle must provide a comfortable, secure grip for an average adult male's full gloved hand. Tools must not be required to engage the lifting handle. Projections of the lid's hinges or handles above the plane of the lid, whether temporary or permanent, must not be allowed. The pit service must be integrally cast in raised letters on the top surface of each lid. The lettering must be a minimum of 1-inch high and 0.0625-inch deep. The weight bearing flanges of the fiberglass pit liner and the aluminum cover frame (and lid) must be machined to assure uniform weight distribution.

2.8.4 Pit Cover Materials, Design, and Testing

The cover frames and lids must be designed and manufactured by a qualified company having a minimum of five years successful experience in the production of similar airport apron slab fixtures. All cover lids and frames must be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 200,000-pound test-load applied perpendicular to a 200-square-inch contact area(10 by 20 inches) of the cover's top surface. The aluminum alloy material selected for design must be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers must be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects must not be allowed. Minor cosmetic welding is acceptable. The cover must be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations must be considered as failure. Actual load-tests must be performed on a minimum of 10 percent of all the covers supplied. Load-tested units must be randomly selected. Load-test conditions must model field-installed conditions as nearly as practicable. The 200 Kip test-load must be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load must not exceed 1/180th of the interior diameter of the fiberglass pit body. Maximum deflection of the cover lids, remaining after removal of the test load must be + 0.010-inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame must be carefully examined for cracks or localized areas of permanent deformation. All results must be submitted for review and approval. A single failure to meet any of the stated criteria must be considered sufficient grounds for the testing of 50 percent of the units.

2.8.5 Pipe Riser Seal

The riser pipe penetration through the pit floor must be sealed by means of a Buna-N boot. The boot must be secured to a metal collar welded to the pipe riser and to a flange at the floor opening by stainless steel

clamps. Collar must be fabricated from the same material as the pipe. Closure of space between the pipe and the collar must be by means of a mechanically adjustable segmented elastomeric seal. The seal must be installed so as to be flush.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

Install equipment and components in position, true to line, level and plumb, and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearances between equipment components. Equipment, apparatus, and accessories requiring normal servicing or maintenance to be accessible.

3.1.2 Anchoring

Anchor equipment in place. Check alignment of anchor bolts before installing equipment and clean-out associated sleeves. Do not cut bolts because of misalignment. Notify Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads. Where anchor bolts or like devices have not been installed, provide appropriate self-drilling type anchors for construction condition.

3.1.3 Grouting

Equipment which is anchored to a pad is to be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, and coatings which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide necessary formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project site. Grouting must be in accordance with ASTM C827/C827M. Perform all grouting in accordance with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.1.4 Leveling and Aligning

Level and align equipment in accordance with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shim to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.1.5 Precautions

Special care must be taken to ensure that equipment and materials are stored properly to prevent damage and maintain cleanliness, and that the completed system is free of rocks, sand, dirt, and foreign objects. Take the following steps to insure these conditions.

a. Equipment brought to the site and not stored inside, must be stored on blocks or horses at least 18 inches above ground.

b. Visual inspection must be made of each piece of equipment to ensure that it is clean prior to installation.

c. The open ends of equipment must be closed when work with that piece of equipment is not in progress.

3.2 INSTALLATION OF FIBERGLASS PITS

Submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover. These procedures must indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, must be provided. Follow these recommendations and apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner must be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Reference the Contract drawings for additional installation requirements.

3.3 POSTED OPERATING INSTRUCTIONS

For each designated system or equipment item, provide instructions for guidance of operating and maintenance personnel. Following approval of content, prepare these instructions in a form and scale that will be readily legible when displayed in appropriate locations, to be designated by the Contracting Officer and meet the following requirements:

3.3.1 Each System

For each system, include diagrams of equipment, piping, wiring and control. Define control sequences.

3.3.2 Each Item

For each equipment item, include starting, adjustment, operation, lubrication, safety precautions and shut-down procedures. Identify procedures to be performed in event of equipment failure. Provide other instructions recommended by the manufacturer.

3.3.3 Volume of Fuel

Provide a certified system inventory of fuel in the pipe. The piping will show length of pipe, size of pipe, gal/foot, and total gal. Verify during initial fill.

-- End of Section --

SECTION 33 52 43.13

AVIATION FUEL PIPING
08/18, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1110	(2013; R 2018) Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide
API STD 608	(2012) Metal Ball Valves - Flanged, Threaded, And Welding End
API Spec 6D	(June 2018, 4th Ed; Errata 1 July 2018; Errata 2 August 2018) Specification for Pipeline and Piping Valves
API Std 607	(2016) Fire Test for Quarter-turn Valves and Valves Equipped with Non-metallic Seats

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(2024) Unified Inch Screw Threads (UN, UNR, and UNJ Thread Form)
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2022) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	(2012; R 2021) Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B31.3	(2024) Process Piping
ASME BPVC SEC VIII D1	(2023) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

AMERICAN WELDING SOCIETY (AWS)

AWS A5.9/A5.9M	(2022) Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification

ASTM INTERNATIONAL (ASTM)

ASTM A182/A182M	(2024) Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/A193M	(2024a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2024) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A269/A269M	(2024) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312/A312M	(2022a) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A358/A358M	(2024) Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature Service and General Applications
ASTM A403/A403M	(2022b) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A961/A961M	(2024) Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications
ASTM D229	(2019) Standard Test Methods for Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM D1655	(2018a) Standard Specification for Aviation Turbine Fuels

ASTM F436 (2011) Hardened Steel Washers

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58 (2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (2024) Flammable and Combustible Liquids Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J514 (2012) Hydraulic Tube Fittings

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101 (2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders

MIL-STD-161 (2025; Rev J) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

1.2 ADMINISTRATIVE REQUIREMENTS

Design conditions must be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT. Submit Operation and Maintenance Manuals for the equipment items or systems listed below. Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted for various type of equipment and systems.

Manual Valves
Strainers
Protective Coatings
Isolating Gasket Kits
Gaskets

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Qualifications; G

SD-03 Product Data

Stainless Steel Piping; G

Protective Coatings for Buried Stainless Steel Piping; G

Fittings; G

Isolating Gasket Kits; G

Flange Protectors; G

Lightning Surge Arrester; G

Nuts and Bolts; G

Gaskets; G.

Ball Valves; G.

Plug (Double Block and Bleed) Valves; G

Thermal Relief Valves; G

Strainers; G

Pigging Accessories; G

SD-05 Design Data

Pipeline Inventory; G

SD-06 Test Reports

Pneumatic Test

Hydrostatic Test

SD-07 Certificates

Stainless Steel Piping

Protective Coatings for Buried Stainless Steel Piping

Fittings

Isolating Gasket Kits

Lightning Surge Arrester

Nuts and Bolts

Gaskets

Ball Valves

Plug (Double Block and Bleed) Valves

Thermal Relief Valves

Strainers

Pigging Accessories

Survey Final Elevations

Pipeline Pigging Verification; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

Ball Valves; G

Plug (Double Block and Bleed) Valves; G

Strainers; G

Isolating Gasket Kits; G

Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted for various types of aviation fueling equipment and systems.

1.4 QUALITY ASSURANCE

1.4.1 Design Data

1.4.1.1 Pipeline Inventory

Fuel system volume must be calculated using as constructed pipe lengths, internal diameters, fittings, and components.

1.4.2 Contractor Qualifications

Each installation Contractor must have successfully completed at least 3 projects of the similar scope and the same size or larger within the last 6 years. Each installation Contractor must demonstrate specific installation experience in regard to the specific system installation to be performed. Each installation Contractor must have taken, if applicable, manufacturer's training courses on the installation of piping and must meet the licensing requirements in the state. Submit a letter listing prior projects, the date of construction, a point of contact for each prior project, the scope of work of each prior project, and a detailed list of work performed. Provide in the letter evidence of prior manufacturer's training and state licensing.

PART 2 PRODUCTS

2.1 TYPES OF FUEL HANDLED

2.1.1 Properties of F-24 Turbine Fuel

Jet Fuel system components must be suitable for use with F-24 turbine fuel (Jet A with additives FSII, CI/LI, and SDA); specific gravity of 0.81 at 60 degrees F; Reid vapor pressure less than 0.05 psi; flash point of 100 degrees F; viscosity 1.62 cSt at 60 degrees F; ASTM D1655.

2.2 MATERIALS AND EQUIPMENT

Pipe and fittings in contact with fuel must be stainless steel, interior epoxy coated carbon steel, or carbon steel as indicated on the drawings. No zinc coated metals, brass, bronze or other copper bearing alloys must be used in contact with the fuel. Identification of piping must be in accordance with MIL-STD-161 and as detailed on the drawings, unless specified otherwise. Flow arrows, at a minimum, must be provided adjacent each product labeling location. Flow arrows must be sized based on the requirements of MIL-STD-101. Material for manual valves must be as specified hereinafter.

2.2.1 Stainless Steel Piping

a. Piping 2-1/2-Inches and Larger:

(1) ASTM A358/A358M, Grade 304L, Class 1 or Class 3 with supplementary requirements of S1, S2 and S3, or ASTM A312/A312M Type 304L, seamless (only). Any agreements between the purchaser and the manufacturer or supplier as referenced in the applicable ASTM must include the Contracting Officer as a party to the agreement. All piping welds will receive 100 percent radiographic inspection, 100 percent liquid penetrant inspection, 100 percent visual inspection and all tests as required by the applicable ASTM Standard. Piping must be provided with a nominal wall thickness as shown in Table A for ASTM A358/A358M with the deviation from the nominal wall thickness less than 0.01-inch. ASTM A312/A312M seamless piping must be provided with a minimum schedule 10S wall thickness.

TABLE A

Nominal Pipe Size	Nominal (Average) Pipe O.D.	Wall Thickness(tn)
16 inches	16.000 inches	0.312 inch
14 inches	14.000 inches	0.312 inch
12 inches	12.750 inches	0.250 inch
10 inches	10.750 inches	0.250 inch
8 inches	8.625 inches	0.250 inch
6 inches	6.625 inches	0.219 inch
4 inches	4.500 inches	0.219 inch
2.5 inches	2.875 inches	0.156 inch

(2) Pipe Ends: All Piping must be provided with beveled ends per Chapter V, ASME B31.3, and must be shipped with the ends capped.

(3) Factory Testing and Inspection Records: Per Table K341.3.2 of Chapter IX of ASME B31.3, visual, radiographic and liquid penetrant tests must be performed for each section of piping provided as all sections are subjected to cyclic conditions. All

testing and inspections records must be submitted to the Contracting Officer and must indicate the pipe mark and installed location of each piping section on the project site. Observation by the Contracting Officer of the manufacturers and the fields testing and inspection procedures must be allowed under this contract. Pipe certification along with pipe markings must be submitted before the pipe arrives on the job site.

(4) Provide a qualified inspector in accordance with Chapter VI of ASME B31.3. to act as the owner's inspector (for the Government) at the pipe manufacturer's facility in addition to the manufacturer's inspector.

(5) Submit Quality Assurance Plan for the welding, inspecting and testing of the welded seam pipe.

b. Piping 2-inches and Smaller: Schedule 80 ASTM A312/A312M seamless Type 304L for threaded piping and schedule 40 (unless otherwise indicated) ASTM A312/A312M seamless Type 304L for welded piping.

c. Stainless Steel Control Tubing: Seamless, fully annealed tubing conforming to ASTM A269/A269M, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be 0.049-inch.

d. Welding Electrodes (Factory Fabrication): E308L conforming to AWS A5.9/A5.9M.

2.2.2 External Protective Coatings for Buried Steel Piping

2.2.2.1 Protective Coatings for Buried Stainless Steel Piping

a. New pipe and fittings must be factory coated fusion bonded epoxy (FBE) in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

b. Field joints and repairs must be fusion bonded epoxy (FBE) in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

c. Field joints and repairs in tight spots (valve pits, etc. when heaters are too big) must be liquid epoxy in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

d. Existing systems must match existing coating system and must be in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

2.2.3 Fittings

2.2.3.1 General

Welding ells, caps, tees, reducers, etc., must be of materials compatible for welding to the pipe line in which they are installed, and wall thickness, pressure and temperature ratings of the fittings must be not less than the adjoining pipe line. Unless otherwise required by the conditions of installation, all elbows must be the long radius type. Miter joints are not acceptable. Make odd angle offsets with pipe bends or elbows cut to the proper angle. Butt weld fittings must be factory-made wrought fittings manufactured by forging or shaping. Fabricated fittings will not be permitted. Welding branch fittings must

be insert type suitable for radiographic inspections specified herein, unless indicated otherwise on the drawings.

2.2.3.2 Stainless Steel Fittings

a. Fittings 2.5 Inches and Larger: Butt weld stainless steel conforming to ASTM A403/A403M, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same minimum wall thickness as the adjoining pipe. Welded fittings must be tested and inspected the same as the welded seam pipe and meet the same requirements as for the pipe. Elbows located between the pig launcher and the receiver, must have a radius 3 times the pipe diameter (3D bends). Tees with branches 6-inches and larger, must have guide bars as detailed on the drawings.

b. Fittings 2-Inches and Smaller: Forged Type 304 or 304L (socket welded or if indicated on drawings, threaded), 3,000-pound W.O.G. conforming to ASTM A182/A182M and ASME B16.11. Threaded fittings must only be used for above grade applications. Underground and in pits low point drain pipe and high point vent pipe must be butt welded.

c. Unions. Conforming to ASTM A312/A312M, Grade 304 or 316.

d. Flanges. 150 pound weld neck, forged Type 304 stainless steel flanges conforming to ASTM A182/A182M and ASME B16.5, except flanges that are to be connected to the fueling/defueling pumps must be 300-pound. For flanges 2" and smaller located in contained pumphouses, contained truck offloads, contained truck fill stands, and other visibly contained areas the fitting may be forged (socket welded), 900 kg 3,000 -pound W.O.G., conforming to ASTM A182/A182M and ASME B16.11. In pits, vaults, on PRV piping for pipeline routes, and other uncontained locations the connection must be butt welded. Flanges to be 1/16-inch raised-face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flanges must be subjected to the Supplementary Requirements S56, Liquid Penetrant Examination as outlined in ASTM A961/A961M. Detectable flaws will not be acceptable.

e. Stainless Steel Tube Fittings. Flareless, 316 stainless steel fittings conforming to SAE J514.

2.2.3.3 Isolating Gasket Kits (Insulating) for Flanges

Provide ASTM D229 electrical insulating material of 1,000 ohms minimum resistance or 500 Volts per Mil (VPM) minimum dielectric strength; material must be resistant to the effects of aviation hydrocarbon fuels. Provide full face insulating gaskets between flanges with fluoroelastomer (FKM), commonly referred to as Viton, O-ring sealing surfaces. Provide full surface 0.03-inch thick wall thickness, spiral-wound mylar insulating sleeves between the bolts and the holes in flanges; bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Provide 0.125-inch thick high-strength phenolic insulating washers next to flanges and provide flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5-inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts. Above grade flanges separated by electrically isolating gasket kits must be provided with weatherproof lightning surge arrester devices. The surge arrester must bolt across flanges separated by insulating gasket kits per detail on contract drawings. The arrestor must have the

following features:

a. Weatherproof NEMA 6P enclosure.
b. Bidirectional and bipolar protection.
c. Constructed of solid state components, no lights, fuses or relays and used without required maintenance or replacement.
d. Withstand unlimited number of surges at 50,000 Amperes.
e. Maximum clamping voltage of 700 Volts based on a IEEE C62.41 8x20 microsecond wave form at 50,000 Amperes peak measured at the device terminals (zero lead length).
f. A UL listed arrester for installation in Class 1, Division 1 or Class 1, Division 2, Group D, hazardous areas.

Install the mounting bracket and leads on the flange side of the bolt insulating sleeve and washer, and size in accordance with this schedule:

Line Size	Bolt Size
2 inch	5/8 inch
2.5 inch	5/8 inch
3 inch	5/8 inch
4 inch	5/8 inch
6 inch	3/4 inch
8 inch	3/4 inch
10 inch	7/8 inch
12 inch	7/8 inch
14 inch	1 inch
16 inch	1 inch

Note: Make allowance for the 1/32-inch thickness of the insulating sleeve around the bolts when sizing the mounting lugs.

2.2.3.4 Flange Protectors

Protectors shall protect the bolts, studs, nuts, and gaskets of a flanged end connection from corrosion or damage due to exposure to the environment. Protectors must be weather and ultraviolet (UP) resistant. Protectors must allow for quick and easy removal and re-installation by maintenance personnel. Provide grease filled bolt caps. Corrosion prevention grease shall be non-expansive and designed for the service. Provide protectors that allow for visual inspection of the flange gasket without requiring removal. Provide protectors with grease fittings which allow the injection of grease into the flange cavity. Only provide in low point drain pits, high point vent pits, and isolation valve vaults.

2.2.4 Nuts and Bolts

Bolts and nuts for pipe flanges, flanged fittings, valves and accessories must conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified. Bolts must be of sufficient length to obtain full bearing on the nuts and must project no more than three full threads beyond the nuts with the bolts tightened to the required torque. Bolts must be regular

hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A193/A193M, Class 2, Grade B8, stainless steel, when connections are made where a stainless steel flange is involved, and Grade B7, chromium molybdenum alloy, when only carbon steel flanges are involved. Bolts must be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Nuts must conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194/A194M, Grade 8, stainless steel for stainless steel bolts, and Grade 7, chromium molybdenum allow for chromium molybdenum alloy bolts. Nuts must be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Provide washers under bolt heads and nuts. Use chromium molybdenum alloy washers dimensioned to ASTM F436 flat circular for chromium molybdenum bolts. Stainless steel washer dimensioned in accordance with ASTM F436 flat circular, use material the same as the bolt. Use torque wrenches to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tight in the pattern recommended by the gasket manufacturer. Use anti-seize compound on stainless steel bolts.

2.2.5 Gaskets

ASME B16.21, composition ring, using a Buna-N, polytetrafluoroethylene (PTFE), or a protein and glycerin binder, 0.1250-inch thick. Gaskets must be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Full-face gaskets must be used for flat-face flanged joints. Ring gaskets must be used for raised-face flanged joints. Gaskets must be of one piece factory cut.

2.2.6 Relief and Drain System Piping

Pressure relief valve discharge lines and drain lines to the product recovery tank must be Schedule 40 ASTM A312/A312M seamless Type 304L Stainless Steel. See Gaskets specified herein before.

2.2.7 Relief and Drain System Protective Coating

Pipe must be factory coated as specified herein before for steel piping.

2.2.8 Stainless Steel Field Applied Protective Coatings

The field joints and fittings of all underground piping must be coated in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEMS, Para 2.2 (Field Applied External Pipe Coating).

2.2.9 Threaded Joints

Threaded joints, if indicated on the drawings, must be made tight with manufacturer recommended PTFE tape or a mixture of graphite and oil, inert filler and oil, or with a graphite compound, applied with a brush to the male threads. Not more than three threads must show on made up joints. Threaded joints, mechanical couplings and flanges will not be permitted in buried piping. Threaded joints must not get welded.

2.2.10 Welded Joints

Welded joints in steel pipe must be as specified in Part 3.

2.3 MANUAL VALVES

All portions of a valve coming in contact with fuel in stainless steel pipe lines or epoxy lined carbon steel pipe lines must be of noncorrosive material. Valves in stainless steel pipe lines or epoxy lined carbon steel pipe lines must be Type 304 or Type 316 stainless steel or carbon steel internally plated with chromium or nickel or internally electroless nickel plated. Valves in unlined carbon steel pipelines must have carbon steel body. Stem and trim must be stainless steel for all valves. Manually operated valves 6 inches and larger must be worm-gear operated and valves smaller than 6 inches must be lever operated or handwheel operated. Valves smaller than 2 inches must have lever-type handles. Handles installed more than 6 feet above finished floor must have chain operators. Valve indicators installed higher than 5 feet must have a position indicator visible from ground level. Sprocket wheel for chain operator must be aluminum. Valves in the isolation pits in fuel piping between the pig launchers and the pig receivers must be full bore, piggable, double block and bleed type. The full bore piggable valves at the launcher and the receiver must be ball type.

2.3.1 Ball Valves

Ball valves must be fire tested and qualified in accordance with the requirements of API Std 607 and API STD 608. Seal material for the fire test must be graphite, seal material for the project must be as as indicated below. Ball valves must be nonlubricated valves that operate from fully open to fully closed with 90 degree rotation of the ball. Valves 2 inches and larger must conform to applicable construction and dimension requirements of API Spec 6D, ANSI Class 150 and must have flanged ends. Valves smaller than 2 inches must be ANSI class 150 valves with flanged ends, unless noted otherwise. The balls in valves 10 inches full port and 12 inch regular port and larger must have trunnion type support bearings. Except as otherwise specified, reduced port or full port valves may be provided at the Contractor's option. All 1-inch ball valves associated with thermal relief assemblies shall be full port. Balls must be solid, not hollow cavity.

2.3.1.1 Materials

Ball must be stainless steel. Ball valves must have polytetrafluoroethylene (TFM) or fluoroelastomer (FKM), commonly referred to as Viton seats, body seals and stem seals. Valves 4 inches and smaller must have a locking mechanism.

2.3.2 Plug (Double Block and Bleed) Valves

API Spec 6D, ANSI Class 150, non-lubricated, resilient, double seated, trunnion mounted, tapered lift plug capable of two-way shutoff. Valve must have tapered plug of steel or ductile iron with chrome or nickel plating and plug supported on upper and lower trunnions. Sealing slips must be steel or ductile iron, with Viton seals which are held in place by dovetail connections. Valve design must permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Valves must operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valves must have weatherproof operators with mechanical position indicators. Indicator shaft must be stainless steel. Minimum bore size must be not less than 65 percent of the internal cross sectional area of a pipe of the same nominal diameter unless bore height of plug equals the nominal pipe diameter and manufacturer can show equal

or better flow characteristics of the reduced bore size design. Full port plug valves in distribution piping must be provided with a 1/2-inch threaded body drain. Provide full port (piggable) double block and bleed plug valves where indicated on the mechanical drawings.

2.3.2.1 Valve Operation

Rotation of the handwheel toward open must lift the plug without wiping the seals and retract the sealing slips so that during rotation of the plug clearance is maintained between the sealing slips and the valve body. Rotation of the handwheel toward closed must lower the plug after the sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, the slips must form a secondary fire-safe metal-to-metal seat on both sides of the resilient seal. Plug valves located in Isolation Valve Pits or vaults must be provided with handwheel extensions.

2.3.2.2 Relief Valves

ANSI Class 150. Provide plug valves with automatic thermal relief valves to relieve the pressure build up in the internal body cavity when the plug valve is closed. Relief valves must open at 25 psi differential pressure and must discharge to the throat of, and to the upstream side, of the plug valve.

2.3.2.3 Bleed Valves

ANSI Class 150, stainless steel body valve. Provide manually operated bleed valves that can be opened to verify that the plug valves are not leaking when in the closed position.

2.4 THERMAL RELIEF VALVES

Relief valves must be the fully enclosed, spring loaded, angle pattern, single port, hydraulically operated type with plain caps, and must be labeled in accordance with ASME BPVC SEC VIII D1 (GPM). Valve stems must be fully guided between the closed and fully opened positions. The valves must be factory-set to open at 225 psi unless otherwise indicated on the drawings. Operating pressure must be adjustable by means of an enclosed adjusting screw. The valves must have a minimum capacity of 20 GPM at 10 percent overpressure. Valves must have a replaceable seat. Relief valves that do not relieve to a zone of atmospheric pressure or tank must be a balanced (non-ASME) type relief or regulator valve.

2.4.1 Valve Materials

Valves must have carbon steel bodies (stainless steel on SS pipelines) and bonnets with stainless steel springs and trim. Valves must be Class 150 flanged end connections.

2.5 PIPING ACCESSORIES

2.5.1 Pipe Sleeves

Pipe sleeves must be installed where indicated and at all points where the piping passes through concrete construction. Such sleeves must be of sufficient inside diameter to provide a minimum clear distance between the pipe and the sleeve of 1/2-inch. Sleeves through concrete pits or slabs must be GR TP316L Schedule 40S stainless steel pipe, unless indicated

otherwise. Each sleeve must extend through the respective pit wall or slab and must be provided with a Buna-N casing seal (Viton when exposed to sunlight). Sleeves where piping passes under roads or piping indicated to be double walled must be standard weight carbon steel pipe with a protective coating as previously specified. Alignment of the sleeve and piping must be such that the pipe is accurately centered within the sleeve by a nonconductive centering element. The sleeve must be securely anchored to prevent dislocation. Closure of space between the pipe and the pipe sleeve must be by means of a mechanically adjustable segmented elastomeric seal. The seal must be installed so as to be flush.

2.5.2 Strainers

2.5.2.1 Cone Type

Strainer must be stainless steel type 304 or 316, 100 mesh screen with the ratio of net open area of strainer to the area of the connecting pipe must be not less than three to one at the pump suction, and 5/32-inch perforations and suitable for bi-directional flow at the inlet to the hydrant pit control valves.Pump suction strainer must have a 100 mesh screen with not less than 300 percent open area (ratio of the strainer open area to the cross section of pipe). Hydrant pit control valve strainer must be the basket type, have 5/32 inch perforations, suitable for bidirectional flow, and have a minimum 200 percent open area.

2.5.3 Pipe Supports

2.5.3.1 General

Pipe supports must conform to MSS SP-58. Supports must be provided at the indicated locations. Steel support structures shall be hot-dipped galvanized unless otherwise noted on the Structural drawings. A PTFE pad must be installed between the pipe and any steel structure to prevent metal to metal contact.

2.5.3.2 Adjustable Pipe Supports

Adjustable pipe supports must consist of a cast iron saddle and a threaded nipple connected to a carbon steel pipe by means of a special reducer conforming to MSS SP-58. The supports must be provided with PTFE insulation strips.

2.5.3.3 Low Friction Supports

Low friction supports must be self-lubricating antifriction element composed of reinforced PTFE. Units must be factory designed and manufactured.

2.5.3.4 Concrete and Grout

Concrete and grout for anchors and supports must comply with SECTION 03 30 00 CAST-IN-PLACE CONCRETE.

2.5.4 Pigging Accessories

2.5.4.1 Closure Door

The closure must be hinged, swing bolted closure of the same material as the pipe and for a Class 150 system. Gasket must be nitrile. Eye bolts

must be pinned to lugs on the hub.

2.5.4.2 Signaler

The pig signaler must be mechanical flag type with manual reset, and be located on the pig launcher and the pig receiver. Material in contact with the fuel must be stainless steel. Units must be suitable for removal and installation under line pressure of 275 psig. Signaler must be capable of withstanding line pressure of a Class 150 system.

PART 3 EXECUTION

3.1 VERIFICATION OF DIMENSIONS

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 CLEANING OF PIPING

Keep the interior and ends of all new piping, affected by construction operations, thoroughly cleaned of foreign matter and water before and after being installed. Piping systems must be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings must be closed so that no water or other foreign substance will enter the pipes or fittings. Piping must be inspected before placing into position. The interior of each length of pipe must be cleaned after welding insuring that the interior of the piping is free of foreign matter when it is connected into the system.

3.3 TRENCHING AND BACKFILLING

Trenching and backfilling must conform to , and the following bedding and backfill requirements. The pipe must be laid in a bed of sand 6 inches deep, compacted in accordance with Section 31 00 00 EARTHWORK, paragraph "Backfilling and Compaction". Sand must meet the requirements of Section 31 00 00 EARTHWORK, paragraph "Select Granular Material". The full length of each section of pipe without any protective covering must be excavated to permit installation of the protective covering. Pipe that has the grade or joint disturbed after laying, must be taken up and relaid. Pipe must not be laid in water or when the trench or weather conditions are unsuitable for such work. After testing and application of protective covering to joints, sand backfill must be placed and compacted around the pipe or protective coating to a depth of 1 foot above top of pipe. The remainder of the backfill must be the same as for other types of pipe.

3.4 PIPING LAYOUT REQUIREMENTS

3.4.1 Pipe Fabrication

Fabricate piping to measurements established on the project site and position into place without springing or forcing. Make provisions for absorbing expansion and contraction without undue stress in any part of the system. The use of flexible hoses in permanently mounted pump suction and discharge lines as a method of compensating for piping misalignment is not acceptable.

3.4.2 Interferences and Measurements

Provide offsets, fittings, and accessories required to eliminate interferences and to match actual equipment connection locations and arrangements. Verify measurements before commencing work. Submit discrepancies for clarification before proceeding with the installations to the Contracting Officer.

3.4.3 Space and Access

Keep piping, control tubing, which is not detailed close to structures and columns so as to take up a minimum amount of space. Ensure that access is provided for maintenance of equipment, valves and gauges.

3.4.4 Location

Do not place unions in locations that will be inaccessible after the completion of the work. Place unions on each side of equipment.

3.4.5 Piping and Equipment

Provide anchors where required to absorb or transmit thrust or eliminate vibration or pulsation. Provide hangers and supports near each change of direction. Select support components which do not restrict the movement of the pipe due to thermal expansion. Space hangers uniformly and arrange symmetrically.

3.4.6 Structural Support

Provide supplementary or intermediate steel or other structural members as required for transmission of loads to members forming part of the supporting structure. Piping must not be supported from other piping.

3.4.7 Grade

Where profiles of piping lines are shown on the drawings, grade the line uniformly between changes in slope or direction. Maintain gradient to within $\pm$ 1/4-inch over the entire length of pipe. When backfilling has been completed to the top of the pipe, the pipe must be surveyed at each joint, and logged by station number. Submit to the Contracting Officer for approval the survey final elevations before backfilling can continue.

3.4.8 Size Changes

Make changes in pipe size with reducing fittings. Do not use bushings. In lieu of welding reducing outlet tees for piping 2 inches and larger, welding branches suitable for 100 percent radiographic inspection may be used. Do not use weldolets unless specifically called out (labeled) on the drawings.

3.4.9 Direction Changes

Make changes in direction of pipes with long radius fittings. Provide special fittings when required. Do not make miter welds. Make odd-angle offsets with pipe bends or elbows cut to the proper angle.

3.5 WELDING

3.5.1 General

All joints, unless indicated otherwise, in stainless steel piping systems must be welded. Welding of fuel pipe joints must comply with Section 33 52 23.15 SERVICE PIPING WELDING.

3.6 INSTALLATION

3.6.1 Precautions

Take special care to ensure that the protective coating on buried pipe is not damaged during installation and that the completed system is free of rocks, sand, dirt, water, weld slag, and foreign objects including construction debris. Take the following steps to ensure these conditions.

a. Coated pipe must be handled only with canvas or nylon slings or padded clamps. Any coating damaged by improper handling or storage must be repaired as specified.

b. Pipe brought to the site must be stored on blocks or horses at least 18 inches above the ground and adequately supported to prevent sagging. Padded blocks or horses must be used for coated pipe. The method and height of storing coated pipe must be in accordance with the coating manufacturer's instructions. Pipe ends must be protected and capped against weather at all times, except to accommodate immediate installation.

c. Visual inspection must be made of the inside of each length of pipe to ensure that it is clear and clean prior to installation.

d. The open ends of the pipe system must be closed at the end of each day's work or when work is not in progress by use of expansion plugs and must not be opened until the work is resumed.

e. A swab, with a leather or canvas belt disc to fit the inside diameter of pipe, must be pulled through each length of pipe after welding in place.

f. Obstruction remaining in the pipe after completion of the system must be removed at the expense of the Contractor.

g. Plasma cutters and torches are not to be used to make penetrations in the pipe or to cut pipe.

h. After installation and backfill of the hydrant loop is complete and before fuel is put in the pipe, the pipe will be cleaned using foam swabs and poly coated wire brush pigs and compressed dry gas, residual humidity of not over 20 percent. Ten flights of a combination of swab and brush pigs must be run. During this, low point drains and high point vents must be blown clean.

3.6.2 Protective Coatings for Buried Stainless Steel Piping

Refer to Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

3.7 INSTALLATION OF UNDERGROUND PIPE

Underground fuel pipelines must be pitched as shown on the drawings. Where not indicated they must be pitched a minimum of 2 inches per 100 feet. Branch lines to the hydrant pits must slope up to the pit. Two-inch pipe size valved drain connections must be provided at all low points and 1-1/2-inch pipe size valved outlet vent connections must be provided at all high points. Vent and drain lines must terminate in male cam-type locking end connectors with matching female dust covers and installed in pits. The pipe must have cover as shown on the drawings. Drain lines must be installed at the slopes indicated.

3.7.1 Pipe Assembly

Pipe must be strung parallel and adjacent to or above a trench. The pipe must be supported on padded skids during welding and inspection of joints. Protective coating must be inspected and repaired prior to lowering the pipe into the trench. The pipe must be lowered using only canvas or nylon slings. The sling must be dug from underneath the pipe after placements and must not be pulled from underneath the pipe while in contact with it. Care must be taken to prevent damage to the pipe, welded joints or coating and any such damage must be repaired as directed by the Contracting Officer. Pressure testing of the pipe must be done after it has been placed in final position in the trench.

3.7.2 Warning Tapes in Earth Trenches

For the purpose of early warning and identification of buried pipes outside of building walls during future trenching or other excavation, continuous identification tapes must be provided in the trench. Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured for the purpose of early warning and identification of utilities buried below the tape. Tape must be at least 3 inches in width. Color of tape must be as standard with the manufacturer with respect to the type of utility buried below the tape. Tape must have lettering at least 1 inch high with warning and identification imprinted in bold black letters continuously over the entire tape length with not less than the following identification on the tape: BURIED JET FUEL PIPING BELOW. Tape must be installed in accordance with the printed recommendations of the tape manufacturer, as modified herein. Tapes must be buried at a depth of 6 inches from the top of the subgrade or 12 inches below the top surface of earth. Provide permanent color and printing, unaffected by moisture or soil.

3.7.3 Clearances

Install pipe to be clear of contact with other pipes, pipe sleeves, casings, reinforcing steel, conduits, cables, or other metallic structures. Where pipes cross other pipes or structures with a separation of less than 6 inches, install an insulating separator. Protect the pipe from contact with a 12-inch square by 1 inch thick bituminous-impregnated cane fiber board.

3.7.4 Protective Coating

When the protective coating on pipe is damaged, the Contracting Officer must be notified and must inspect the pipe before the coating is patched. If the damage to the pipe is deeper than 0.050-inch, the damage must be repaired by welding in accordance with paragraph "WELDING". If the pipe

is dented, out of round or damaged to the point that welding will not make it good as new, the length of pipe must be rejected.

3.8 TESTING

Piping must be tested by pneumatic and hydrostatic pressure. Testing must comply with applicable requirements of ASME B31.3, NFPA 30 and the requirements specified herein. Hydrostatic testing must be performed using fuel as the liquid. Water must not be introduced into the system for testing. Pneumatic and hydrostatic testing must be performed only after welding inspection has been completed.

3.8.1 Pneumatic Test

Piping to be installed underground must not receive field applied protective covering at the joints or be covered by backfill until the piping has passed the pneumatic test described herein. To facilitate the tests, isolate various sections of the piping system and test each one separately. Where such sections terminate at flanged valve points, the line must be closed by means of blind flanges in lieu of relying on the valve. Furnish tapped flanges that can be attached to the end of the section of line being tested, and that will permit a direct connection between the piping and the air compressor and/or pressurizing pump. No taps in the permanent line will be permitted. Furnish all necessary equipment for testing; all gauges must be subject to testing and approval of the Contracting Officer. The air used for pneumatic testing must have a dew point of no more than 41 degrees F. Provide dehumidifying equipment on the suction or discharge side of the air compressor used to provide air for testing. Pressurizing pump must not exceed 10 cfm.

3.8.1.1 Pneumatic Test Procedure

Special safety measures, including the wearing of face mask, must be taken during testing under pressure. Only authorized personnel must be permitted in the area during testing. The pneumatic test pressure must be applied in increments. A preliminary 25 psig test must be applied. Examine joints with soap solution. Leaks revealed by this test must be repaired. The full test pressure must then be applied. Unless otherwise directed by the Contracting Officer, all piping must be tested at a pressure of 50 psig for not less than 2 hours, during which time there must be no drop in pressure, only pressure rises with temperature. The pressure source must be disconnected during the final test period. Any leaks revealed by the test must be repaired and the test repeated.

3.8.1.2 Hydrostatic Test

Upon completion of pneumatic testing and after backfilling, hydrostatically test each piping system with fuel at 415 psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gauge pressure for four hours. Furnish electricity, instruments, connecting devices, and personnel for test. Fuel must be furnished by the Government. Equipment which is not rated by the manufacturer for the test pressure must be removed prior to testing. Defects in work must be corrected at the Contractor's expense, and the test repeated until the work is proven to be in compliance with the Contract requirements.

3.8.2 Performance Testing

After the system is completed (including pneumatic and hydrostatic

testing) the fuel system must be cleaned and performance tested as specified in Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START UP. All control valves, both manual and automatic, must be checked for leaks (any area wetted with fuel) and proper operation and adjusted, repaired or replaced to correct any defects.

3.9 PIPELINE PIGGING VERIFICATION

3.9.1 Pipeline Internal Inspection Operations

3.9.1.1 General

The following pigs will be propelled through the pipeline with product in order to inspect the pipeline: 5 pound density foam swab, combination poly scraper-magnetic, stainless steel wire brush, and aluminum plate gauge. Tracking devices must be used on all pigs. At a minimum, the sequence of pig runs must be as follows: 1) foam swab for proving and cleaning, 2) wire brush for cleaning, 3) scraper-magnetic for cleaning, 4) aluminum plate gauge for gauging internal anomalies, 5) scraper-magnetic for cleaning, 6) wire brush for cleaning, 7) scraper-magnetic for cleaning, 8) foam swab for cleaning, (Note: the number of pig flights of each type of cleaning pigs must be determined by the amount and type of debris removed. The conclusion of the cleaning process must be when debris recovered is only that from the pigs themselves. This determination will be determined by the project's system supplier and the Contracting Officer).

3.9.1.2 Preparatory Work

The Government will bring to the attention of the Contractor all statutes, rules and regulations relevant to the performance of the work on the site (on Government property) and will also provide the Contractor with a copy of its own site regulations (if any). Provide the pigging vendors with all-available pipeline records and drawings.

3.9.1.3 Pig Load And Launch

The pig must be loaded into the pig launcher by the Contractor. The method of loading and lodging the front pig cup into the launcher must not involve the use of uncontrolled mechanical force applied to the rear of the pig. A temporary pig launcher and receiver must be provided by the Contractor to pig the new hydrant loop.

3.9.1.4 Pipeline Operation During Pigging

All pig runs to the new hydrant loop must be made with the line packed with product. The temporary pumps will be used to propel the pig. The temporary pig traps will be used for pig launch and retrieval.

3.9.1.5 Brush and Gauging Survey

Run a brush pig at least as often as previously indicated. The brush pig must be designed and provided by the geometry/ultrasonic pig vendor. Additional runs may be required based upon the amount of debris found in the pipeline. The onsite geometry/ultrasonic pig vendor's personnel and COR must determine if additional runs are required. Immediately following the brush pig run and immediately prior to the geometry/ultrasonic survey, run, as a minimum, a single batching pig fitted with a gauge plate equal to 90 percent of the pipeline normal inside diameter. The plate is to be a segmented aluminum disk of 1/8 inch thickness. The plate gauge pig must

also include a tracker and tracking equipment. Track the pig assembly above ground during the operation.

3.9.1.6 Lost Pig

The Contractor is responsible for a lost pig, finding the pig, retrieval of the pig, and all repairs, radiographs to the pipeline system and the pig.

-- End of Section --

SECTION 33 52 80

LIQUID FUELS PIPELINE COATING SYSTEMS
08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C210	(2015) Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C213	(2022) Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings

ASTM INTERNATIONAL (ASTM)

ASTM D3276	(2015; E 2016) Standard Guide for Painting Inspectors (Metal Substrates)
ASTM D3335	(1985a; R 2020) Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy
ASTM D3718	(1985a; R 2015) Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy
ASTM D3925	(2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D4285	(1983; R 2018) Indicating Oil or Water in Compressed Air
ASTM D4417	(2021) Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8502-3	(2017) Preparation of Steel Substrates Before Application of Paints and Related Products - Tests for the Assessment of Surface Cleanliness - Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure-Sensitive Tape Method)
ISO 9001	(2015) Quality Management Systems-Requirements

NACE INTERNATIONAL (NACE)

NACE RP0402	(2002) Field-Applied Fusion-Bonded Epoxy (FBE) Pipe Coating Systems for Girth Weld Joints: Application, Performance, and Quality Control

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 1	(2015; E 2017) Mineral and Slag Abrasives
SSPC AB 2	(2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive
SSPC AB 3	(2023; R 2023) Ferrous Metallic Abrasive
SSPC Guide 6	(2021) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC Guide 12	(2023) Guide for Illumination of Industrial Painting Projects
SSPC PA 1	(2024) Shop, Field, and Maintenance Coating of Metals
SSPC PA 2	(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC QP 3	(2010) Standard Procedure for Evaluating Qualifications of Shop Painting Applicators
SSPC QP 5	(2022) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC QS 1	(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 17	(2019) Thorough Abrasive Blast Cleaning of Non-Ferrous Metals
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances

29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1926.59	Hazard Communication

1.2 SYSTEM DESCRIPTION

This section specifies the requirements for exterior coating of below ground and buried carbon steel and stainless steel liquid fuel pipelines. The exterior coating system for buried pipelines is a fusion bonded epoxy (FBE) system. Fusion bonded epoxy coating is specified for the interior of carbon steel aviation fuel pipe to protect fuel iron contamination.

1.3 DEFINITIONS

Definitions are generally provided throughout this Section in the paragraphs where used and denoted by capital letters. The following definition is used throughout this Section:

a. INDEPENDENT THIRD-PARTY - Impartial third-party not a part or affiliated with Contractor or subcontractor principal or subsidiary businesses, and not a materials supplier.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contract Errors, Omissions, and Other Discrepancies

Corrective Action Procedures

Corrective Action Request (CAR) Form

Coatings Work Plan

Inspection Report Forms

SD-03 Product Data

External Pipe Coating

Internal Pipe Coating

Field-Applied External Pipe Coating

SD-05, Design Data

Containment System

SD-06 Test Reports

Inspection Report Forms

Daily Inspection Reports

Coatings Qualification Test Reports

Non-Metallic Abrasive Qualification Test Reports

Coating Field Test Reports

Abrasive Field Test Reports

SD-07 Certificates

Contract Errors, Omissions, And Other Discrepancies

Corrective Action Procedures

Coatings Work Plan

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications of Pipe Coating Shop

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coatings Inspection Company

Qualifications of Quality Assurance Coatings Inspector

Qualifications of Coatings Contractors for Field Coating

Qualifications of Individuals Performing Abrasive Blasting for Field Coating

Qualifications of Individuals Performing Coating Application for Field Coating

Qualifications of Testing Laboratory for Coatings

Qualifications of Testing Laboratory for Abrasive

Coating Materials Certificate of Conformance

Non-Metallic Abrasive Certificate of Conformance

SD-08 Manufacturer's Instructions

Coating System Instructions

SD-11 Closeout Submittals

Disposal of Used Abrasive Shop Applied Coating

Disposal of Used Abrasive Field Applied Coating

Inspection Logbook

Corrective Action Log; G

1.5 QUALITY ASSURANCE

1.5.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents to the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies must be addressed and resolved, and the Coatings Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered must be identified at the earliest discoverable time and submitted for resolution. Schedule time (float) must be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

1.5.2 Corrective Action (CA)

CA must be included in the Contractor Quality Control Plan as outlined in Section 01 45 00 QUALITY CONTROL.

1.5.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated.

1.5.2.2 Corrective Action Request (CAR) Form

Develop Corrective Action Request (CAR) forms for initiating CA and for tracking and documenting each step. The CAR should be included with the Corrective Action Procedures. A CAR must be initiated by either the Contractor or the Contracting Officer. The Protective Coatings Specialist (PCS) must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

1.5.2.3 Corrective Action Log

When a CAR is initiated, Contractor must take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These actions must apply to non-compliance in the work, and to non-compliance in the Quality Control (QC) System. Corrective actions must be appropriate to the effects of the non-compliance encountered. The corrective action must be documented in a report that is serialized and tracked in the Corrective Action Log until project completion and its acceptance by the Contracting Officer. All corrective action reports must be retained in project records. The Corrective Action Log, showing status of each CAR, must be submitted to the Contracting Officer monthly.

1.5.3 Coatings Work Plan

This work plan must be considered as part of the Contractor Quality Control Plan as outlined in Section 01 45 00 QUALITY CONTROL.

The Coatings Work Plan must be submitted and approved by the PCS prior to mobilization. The Coatings Work Plan must explain in detail all procedures including, but not limited to, all sequential processes,

quality control for each process, quality assurance for each process, and safety considerations. Subsections must include at least the following:

a. Purpose;

b. Introduction;

c. Safety, fire, and health information;

d. Contractor and worker qualifications with certifications;

e. Project management organization and documents;

f. Timeline in a Gantt chart;

g. Project document references;

h. Reference to all applicable standards (e.g., AMPP, NACE, SSPC, ISO, and ASTM);

i. Coatings manufacturer's supporting documentation;

j. Descriptions and explanations of any exceptions from the coating manufacturer (including those specific to stainless steel piping;

k. Coating and blasting equipment, model names, and, if applicable, calibration dates;

l. Containment design and/or details;

m. Environmental testing;

n. Material delivery, storage, and handling details;

o. Surface preparation;

p. Pre-application test panel validation for field-applied external coating as outlined in SURFACE STANDARD;

q. Coating materials, mixing, application, recoat windows, and coating curing times, if applicable;

r. Coating repairs and rework;

s. Non-conformance;

t. Spent material handling and effluent discharge containment and disposal;

u. Inspection test plan (as outlined in FIELD INSPECTION, and including inspection hold points, both Quality Assurance and Coating Contractor QC Coatings Inspector's responsibilities, and daily documentation and delivery);

v. Instruments and test kits;

w. Warranty (in writing, signed by the Contractor and the coating manufacturer's representative);

x. Demobilization;

y. PCS and PM approval;

1.5.4 Design Data

1.5.4.1 Containment System for Field Coating

Submit complete design drawings and calculations for the scaffolding and containment system, including an analysis of the loads which will be added to the structure by the containment system and waste materials. A registered engineer must approve calculations and scaffold system design.

1.5.5 Test Reports

1.5.5.1 Coatings Qualification Test Reports

Submit test results from an INDEPENDENT THIRD-PARTY laboratory of representative samples of each coating material. U.S. Department of Defense laboratories are considered to be INDEPENDENT THIRD-PARTY laboratories. Samples must have been tested within the last three years. The purpose of qualification testing is to pre-qualify the coatings used on buried pipe. Provide qualification testing results for exterior coatings used for repairs or girth welds on buried pipe in conformance with NACE RP0402. Provide qualification testing results for shop applied exterior coatings for buried pipe in conformance with AWWA C213.

Qualification testing must be based on all required production verification testing required by NACE RP0402. For AWWA C213, provide test reports for production verification testing described in paragraph OPTIONAL EPOXY PERFORMANCE TESTING OF COATED PIPE of AWWA C213, including cross-section porosity, interface porosity, thermal analysis (DSC), permanent strain (bendability), and interfacial contamination. Perform production verification testing on a minimum of one pipe joint in the first half hour of production each day, and on a minimum of one pipe joint in the last half hour of production each day. Perform additional testing as required to segregate any non-compliant material.

1.5.5.2 Non-Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of SSPC AB 1. Submit test results from an INDEPENDENT THIRD-PARTY laboratory of representative samples of each abrasive to be used on the jobsite. Samples must have been tested within the last three years. Note that this testing is for the purpose of pre-qualifying the abrasive.

1.5.6 Qualifications

The qualifications specified in this Section must be met throughout the duration of this contract. Personnel and corporate entities must provide proof of active certification to all qualifications specified in this Section. Work must not be provided by personnel and corporate entities unless all specified qualifications are met.

1.5.6.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY CIH. Submit documentation that the hygienist is certified by the American Board of Industrial Hygiene in comprehensive

practice, including certification number and date of certification/recertification. The CIH must remain certified during the entire project, and the Contracting Officer must be notified of any change in certification status within 10 days of the change. If a CIH's certification expires, the hygienist will not be allowed to perform any hygienist functions, and all hygienist work must stop, until the certification is reissued or another CIH is approved. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Provide evidence of experience with hazards involved in industrial coating application work.

1.5.6.2 Qualifications of Pipe Coating Shop

Each shop that applies coatings to pipe must be certified to SSPC QP 3 prior to contract award and must remain certified while accomplishing any surface preparation or coating application. If a shop's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in the shop's certification status within 10 days of the change. If a shop's qualification expires, the shop will not be allowed to perform any coatings related functions until the qualification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply. Notify the Contracting Officer of all scheduled and unannounced on-site audits from AMPP and furnish a copy of all audit reports.

For shops located outside the United States, Guam, and Puerto Rico, the certifications for the shop (SSPC QP 3) can be substituted if the coatings Contractor meets all of the below requirements:

a. ISO 9001 certified;

b. Eight years of experience with industrial coatings;

c. Evidence of recent work that has Contractor Performance Assessment Report System (CPARS) ratings, and/or other quality/performance ratings, that are equivalent to, or exceed, "Above Average";

d. Evidence of an INDEPENDENT THIRD-PARTY audit from AMPP demonstrating equivalency to SSPC QP 3 within the last two years.

The shop must be certified to ISO 9001 prior to contract award and must remain so certified for the duration of the project. Notify the Contracting Officer of any change in the shop's certification status within 10 days of the change. If a Contractor's qualification expires, the shop will not be allowed to perform any coatings related functions until the qualification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply. Notify the Contracting Officer of all scheduled and unannounced on-site inspections from the ISO certifying organization and furnish a copy of all inspection reports.

1.5.6.3 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY PCS. Submit documentation that the PCS is certified by the Association for Materials Protection and Performance (AMPP) (formerly SSPC: The Society for Protective Coatings (SSPC)), including certification number and date of certification/recertification. If the PCS is employed by the same coatings inspection company to which the Quality Assurance Coatings Inspector is employed, this does not violate the INDEPENDENT THIRD-PARTY requirements. The PCS must be an INDEPENDENT THIRD-PARTY to the pipe coating shop. The PCS must remain certified during the entire project, and the Contracting Officer must be notified of any change in certification status within 10 days of the change. If a PCS's certification expires, the PCS will not be allowed to perform any PCS functions, and all coatings work must stop, until the certification is reissued or another PCS is approved. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. The PCS must not be the designated Quality Assurance Coatings Inspector. The PCS's responsibilities are outlined in PROTECTIVE COATINGS SPECIALIST (PCS).

1.5.6.4 Qualifications of Coatings Inspection Company

Submit documentation that the selected quality assurance coatings inspection company is accredited by AMPP to the requirements of SSPC QP 5 prior to contract award. The coatings inspection company that is submitted and approved, must remain and cannot be changed through completion of the contract. The coatings inspection company must remain SSPC QP 5 certified for the duration of the coatings work. If a coatings inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in the coatings inspection company certification status within 10 days of the change. Notify the Contracting Officer of all scheduled and unannounced on-site audits from AMPP and furnish a copy of all audit reports. The coatings inspection company must not engage in any activities that may conflict with their independence of judgment and integrity in relation to their inspection activities. In particular, they must not be engaged in the manufacture, supply, application, surface preparation, purchase, or maintenance of the applied coating in this project.

1.5.6.5 Qualifications of Quality Assurance Coatings Inspector

Submit documentation that each Quality Assurance Coatings Inspector is employed by the SSPC QP 5 company and is qualified to a minimum certification of NACE CIP Level II. Each inspector must remain employed by the coatings inspection company while performing any coatings inspection functions. The Quality Assurance Coatings Inspector's responsibilities are outlined in QUALITY ASSURANCE COATINGS INSPECTOR'S FIELD RESPONSIBILITIES. The roles of the Quality Assurance Coatings Inspector are in addition to, and distinct from, the role of the QC Coatings Inspector employed by the coatings Contractor and the Coatings Inspector for Shop Coating.

1.5.6.6 Qualifications of Coatings Contractors for Field Coating

All Contractors and Subcontractors that perform surface preparation or coatings application must be certified to SSPC QP 1 and SSPC QS 1 prior to contract award and must remain certified while accomplishing any surface preparation or coating application. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status within 10 days of the change. If a Contractor's qualification expires, the Contractor will not be allowed to perform any coatings related functions until the qualification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply. Notify the Contracting Officer of all scheduled and unannounced on-site audits from AMPP and furnish a copy of all audit reports.

For projects located outside the United States, Guam, and Puerto Rico, the certifications for the coatings Contractor (SSPC QP 1 and SSPC QS 1) can be substituted if the coatings Contractor meets all of the below requirements:

a. ISO 9001 certified;

b. Eight years of experience with industrial coatings;

c. Evidence of recent work that has Contractor Performance Assessment Report System (CPARS) ratings, and/or other quality/performance ratings, that are equivalent to, or exceed, "Above Average";

d. Evidence of an INDEPENDENT THIRD-PARTY audit from AMPP demonstrating equivalency to SSPC QP 1 and SSPC QS 1 within the last two years.

The coatings Contractors and coatings Subcontractors must be certified to ISO 9001 prior to contract award and must remain so certified for the duration of the project. Notify the Contracting Officer of any change in Contractor certification status within 10 days of the change. If a Contractor's qualification expires, the Contractor will not be allowed to perform any coatings related functions until the qualification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply. Notify the Contracting Officer of all scheduled and unannounced on-site inspections from the ISO certifying organization and furnish a copy of all inspection reports.

1.5.6.7 Qualifications of Individuals Performing Abrasive Blasting for Field Coating

Submit name, address, and telephone number of each person that will be performing abrasive blasting. All individuals performing abrasive blasting must be certified by AMPP to the SSPC C7 Dry Abrasive Blaster Qualification Program or CAS Coating Application Specialist Level 2 Certification Program (Interim Status), and must remain certified during the entire period of abrasive blasting. The Contracting Officer must be notified of any change in qualification status within 10 days of the change. If a blaster's qualification expires, the blaster will not be allowed to perform any blasting functions until the qualification is

reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply.

This requirement applies to all manual abrasive blasting performed in shop and field locations. This requirement does not apply to automated abrasive blasting performed in the shop.

1.5.6.8 Qualifications of Individuals Performing Coating Application for Field Coating

Submit name, address, telephone number, and evidence of certification of each person that will be performing coatings application by any method. All individuals performing coatings application must be certified by AMPP to the SSPC CAS Coating Application Specialist Level 2 Certification Program (Interim Status) or SSPC C12 Spray Application Program. Each applicator must remain certified during the entire period of coatings application, and the Contracting Officer must be notified of any change in qualification status within 10 days of the change. If an applicator's qualification expires, the applicator will not be allowed to perform any coatings application functions until the qualification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply.

1.5.6.9 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY laboratory or laboratories selected to perform testing of coating samples for qualification testing and for field sample testing for compliance with this Section. Submit documentation that the laboratory is regularly engaged in testing of paint samples for conformance with specifications and that the employees performing testing are qualified.

1.5.6.10 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY laboratory or laboratories selected to perform testing of abrasive for compliance with this section. Submit documentation that the laboratory has experience in testing samples of abrasive for conformance with specifications and that the employees performing testing are qualified.

1.5.6.11 Coating Materials Certificate of Conformance

Provide manufacturer's certification of conformance to NACE RP0402 for exterior coatings used for repairs or girth welds on buried pipe. Provide manufacturer's certification of conformance to AWWA C213 for shop applied exterior coatings for buried pipe.

1.5.6.12 Non-Metallic Abrasive Certificate of Conformance

Provide manufacturer's certification that the materials are currently in conformance with SSPC AB 1 and as modified in this Section, and have been tested within the last three years.

1.5.7 QA and QC Personnel

1.5.7.1 QC Manager

The QC Manager is as defined in Section 01 45 00 QUALITY CONTROL.

1.5.7.2 Protective Coatings Specialist (PCS)

The PCS must be considered a QC Specialist and must report to the QC Manager, as specified in Section 01 45 00 QUALITY CONTROL. The PCS must approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

The PCS's responsibilities include, but are not limited to, the following:

a. Obtain, review, and understand all project documentation including, but not limited to, this Section, project program, Coatings Work Plan, inspection and testing plan (ITP), and all submittals before the project starts, during the project, and all coatings related re-work;

b. Attend all pre-job coatings meetings (in-person, phone, or virtually);

c. Attend pre-final coatings walk-through (mandatory) and attend final coatings walk-through (as required).

1.5.7.3 Quality Assurance Coatings Inspector

The Quality Assurance Coatings Inspector must be considered a QC Specialist and must report to the QC Manager, as specified in Section 01 45 00 QUALITY CONTROL. The Quality Assurance Coatings Inspector must be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities. The Quality Assurance Coatings Inspector must provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The responsibilities of the Quality Assurance Coatings Inspector are defined in QUALITY ASSURANCE COATING INSPECTOR'S RESPONSIBILITIES. These responsibilities are separate and distinct from the responsibilities of the Coatings Contractor QC Coatings Inspector and Coatings Inspector for Shop Coating.

1.5.7.4 Coatings Inspector for Shop Coating

The coatings inspector must be the shop Quality Manager or appropriate designee. The coatings inspector must be considered a QC Specialist and must report to the prime Contractor's QC Manager, as specified in Section 01 45 00 QUALITY CONTROL. The coatings inspector must be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, and during all coating repair work required of the shop. The coatings inspector must provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system.

1.5.7.5 Coatings Contractor QC Coatings Inspector

The Coatings Contractor QC Coatings Inspector must stop non-compliant work. The responsibilities of the Coatings Contractor QC Coatings

Inspector are defined in COATINGS CONTRACTOR QC COATINGS INSPECTOR'S RESPONSIBILITIES. These responsibilities are separate and distinct from the responsibilities of the Quality Assurance Coatings Inspector.

1.5.8 Pre-Application Meeting for Field Coating

After approval of submittals, but prior to the initiation of coatings work, Contractor representatives, including at a minimum, project superintendent, QC manager, paint foreman, Quality Assurance Coatings Inspector, and PCS must have a pre-application coating preparatory meeting. This meeting must be in addition to the pre-construction conference. Specific items addressed must include: corrective action requirements and procedures, coatings work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

1.6 PRODUCT DATA

1.6.1 Coating System Instructions

Submit manufacturer's printed instructions, including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures of all coating materials. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

1.7 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, applicable standards, and as modified in this Section. Maintain temperature in storage spaces between 40 and 75 degrees F, and air temperature more than 5 degrees F above the dew-point at all times. Inspect materials for damage and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer.

If materials are approaching shelf life expiration and an extension is desired, samples must be sent to the manufacturer, along with complete records of storage conditions, with a request for shelf life extension. If the manufacturer finds the samples and storage data suitable for shelf life extension, the manufacturer must issue an extension, referencing the product evaluation and the review of storage records. Products must not be extended longer than allowed in the product specification.

1.8 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions must be followed throughout mixing, application, and curing of the coatings. During cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH must approve work procedures and personal protective equipment.

1.9 JOB SITE REFERENCES - SHOP

Make available to the Contracting Officer a copy of each standard to which the shop will be applying coatings under this Section.

1.10 JOB SITE REFERENCES - FIELD

Make available to the Contracting Officer a copy of each standard to which field coatings will be applied to under this Section, and an SSPC Certified Contractor Evaluation Form at the job site.

PART 2 PRODUCTS

2.1 SHOP-APPLIED COATING FOR BURIED PIPING

2.1.1 External Pipe Coating

For carbon steel, FBE coating: AWWA C213. For stainless steel, FBE coating: AWWA C213.

2.1.2 Internal Pipe Coating (Lining)

For carbon steel, FBE coating: AWWA C213. A certification must be provided from the coating manufacturer stating that the coating system is suitable for immersion service in aviation fuel.

2.2 FIELD-APPLIED EXTERNAL PIPE COATING

All coating materials used to coat external girth welds or repair existing coating must be from the same manufacture as the shop applied coating. Use one or more of the following repair methods, as modified herein, to repair shop applied coatings and coat external girth welds:

a. Fusion-Bonded Epoxy (FBE) Coating: NACE RP0402, coating material to be same as applied to pipe in shop

2.3 COATING FIELD SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit for each sample to be collected. For FBE coatings, each kit must contain: a one quart can for the dry/powder; dipping cups for sampling; a shipping box sized for the samples to be shipped; and packing material. For liquid coatings, each kit must contain: a one quart can for the base of each liquid coatings material; one appropriately sized can for the activator of each liquid coatings material; dipping cups for each component to be sampled; a shipping box sized for the samples to be shipped; and packing material. Mark cans for the appropriate components (powder, base, or activator), including manufacturer's name, address, batch numbers, batch size shipped to the project site, and date of manufacture. Provide shipping documents, including either pre-paid shipping or a shipping number that can be used by the QC Manager to arrange pickup, addressed to the INDEPENDENT THIRD-PARTY coating testing laboratory.

2.4 ABRASIVE FIELD SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit for each sample to be collected. Each kit must contain: one suitable plastic bag or container for each sample to be collected. Mark containers with manufacturer's name, address, batch number, batch size, and date of manufacture. Provide shipping documents, including either

pre-paid shipping label or a shipping number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

2.5 INSPECTION TEST KITS

2.5.1 Test Kit for Measuring Chloride, Sulfate, and Nitrate Ions on Steel and Coated Surfaces

Provide test kits that meet the following requirements:

a. Contains all materials, supplies, tools, and instructions for field testing and on-site quantitative evaluation of chloride, sulfate, and nitrate ions;

b. Extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;

c. Components and solutions are mercury free and environmentally friendly;

d. Contains new materials and solutions for each test extraction;

e. Contains an extraction test container (vessel, sleeve, cell) creates a sealed, encapsulated environment during salt ion extraction;

f. Contains a test extract container is suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;

g. All salt ion concentrations are directly measured in micrograms per square centimeter.

2.5.2 Test Kit for Measuring Chlorides in Abrasives

Provide test kits that meet all of the following requirements:

a. Be a completely self-contained test kit with all materials, supplies, tools, and instructions to take tests and identify results;

b. Use identifiable, consistent, factory pre-measured test extract solution;

c. Provide for testing equal volumes of abrasive and test solution;

d. Provide for taking direct measurements of the chloride ion in parts per million (PPM), without using conversion charts or tables;

e. Provide all new components for extraction and titration for each test;

f. Provide a factory sealed titration device for each test;

g. Use the extract sampling container as the titration container.

2.5.3 Test Kit for Identifying Amine Blush on Epoxy Surfaces

Provide test kits that meet all of the following requirements:

a. Be a completely self-contained field test kit with all materials, supplies, tools, and instructions to perform tests and indicate the

presence of unreacted amines;

b. Use an identifiable, consistent, uniform, pre-packaged, factory pre-measured indicating solution;

c. Contains no mercury or lead and is environmentally friendly;

d. Contains a solution of an unreacted amine for the purpose of "self checking" the indicator solution.

2.6 ABRASIVE

Use abrasive that is specifically selected to provide a sharp, angular profile to the specified depth. Abrasive must meet all requirements of this Section each time that it is placed in the blast pot. The referenced abrasive specifications have maximum limits for soluble salts contamination; however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors, such as on-site handling and recycling, can allow contamination of abrasive that can be transferred to the steel surface. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of contamination in abrasive does not negate the final acceptance testing of steel surfaces.

Non-ferrous abrasives must be used for abrasive blasting stainless steel piping.

Abrasive material must contain a maximum of one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 of 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

Gross gamma radioactivity must not exceed 5 picocuries per gram.

2.6.1 Non-Metallic Abrasive

Non-metallic abrasive must be graded to the appropriate surface profile range and must conform to the chemical and physical properties of SSPC AB 1, Class A except that:

a. The maximum allowable chromium and cadmium content of the work mix must be less than 0.1 percent by weight when tested in accordance with ASTM D3718 for chromium and ASTM D3335 for cadmium.

b. Must contain less than 7 PPM chlorides when tested with the kit provided in paragraph TEST KIT FOR MEASURING CHLORIDES IN ABRASIVES. Modify the requirements of SSPC AB 1 to substitute requirement for one chloride test for each "CONDUCTIVITY TEST" required in SSPC AB 1 (one random sample per 50 bags of abrasive or three random samples from each shipment, if abrasive is delivered in bulk).

PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coatings Work Plan. The Coatings Work Plan must be

submitted and approved by the PCS prior to mobilization in accordance with the paragraph entitled COATINGS WORK PLAN.

3.1 FIELD SAMPLE COLLECTION AND TESTING

Sample and test materials delivered to the jobsite as required in the subsequent subparagraphs. Notify Contracting Officer three days in advance of sampling. The QC Manager, and either the PCS or the Quality Assurance Coatings Inspector, must witness all sampling.

3.1.1 Coating Field Sample Collection

All coatings/resins applied in the shop and in the field require one sample to be collected from each coating type used. This sample must be collected and set aside for the duration of the project, and must be tested if unforeseen coatings issues arise or if testing is requested by the Contracting Officer.

Field applied coatings require a random field sample from each lot of coating material used on-site in accordance with ASTM D3925. Each random sample must be tested. Utilize sample collection kits as outlined in the paragraph entitled COATING FIELD SAMPLE COLLECTION AND SHIPPING KIT. For powder based coatings, collect a one quart sample from each lot by random selection. For two component liquid coatings, obtain a one quart sample of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers from each lot. Prior to sampling, mix contents of each sealed container to ensure uniformity. As an alternative to collecting small samples from kits, entire kits may be randomly selected and shipped to the THIRD-PARTY INDEPENDENT laboratory, observing all requirements for witnessing and traceability. For purposes of quality conformance inspection, a lot is defined as that quantity of materials from a single, uniform batch produced and offered for delivery at one time. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and ship one complete sample of each material in question (including powder or base and activator) with all batch information to the INDEPENDENT THIRD-PARTY laboratory for testing as required in paragraph COATING FIELD TESTING REPORTS.

3.1.2 Abrasive Field Sample Collection

Utilize the sample collection kits as required in paragraph ABRASIVE FIELD SAMPLE COLLECTION AND SHIPPING KIT to obtain samples from each lot of abrasive delivered to site using the sampling techniques and schedule of one sample per every 50 bags for ferrous metallic abrasive, paragraph 4 REQUIREMENTS FOR RECYCLED WORK MIX ABRASIVES of SSPC AB 2 for recycled ferrous metallic abrasives, or paragraph 5.3 SAMPLING FOR QUALITY CONTROL TESTS of SSPC AB 1 for non-metallic abrasives.

For purposes of quality conformance inspection, a lot must consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. The addition of any substance to a batch must constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession

of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved INDEPENDENT THIRD-PARTY laboratory for testing required in paragraph ABRASIVE SAMPLE TEST REPORTS.

3.1.3 Coating Field Test Reports

Submit test results for each sample that requires testing in the paragraph COATINGS FIELD SAMPLE COLLECTION. Test samples of coating material for compliance with requirements of NACE RP0402. Reject entire batch represented by samples that fail one or more tests, select new lots, and test samples.

3.1.4 Abrasive Field Test Reports

Submit test results for each lot of abrasive delivered to the jobsite. Test samples of ferrous metallic abrasive to the requirements of paragraph 5.2 TEST PARAMETERS of SSPC AB 3, excluding paragraph 5.2.4 DURABILITY. Test samples of recycled ferrous metallic abrasives to the requirements of paragraph 4 REQUIREMENTS FOR RECYCLED WORK MIX ABRASIVES of SSPC AB 2. Test samples of non-metallic abrasive to the requirements of paragraph 5.3 SAMPLING FOR QUALITY CONTROL TESTS of SSPC AB 1. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

3.2 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

3.3 ENVIRONMENTAL CONDITIONS

3.3.1 Automated Monitoring Requirements for Shop Applied Coating

Provide continuous monitoring of temperature, relative humidity, and dew point data at pertinent points in the shop, during surface preparation, coating application, and initial cure. This data does not suffice for documentation of conformity to surface conditions during application and cure of coating. Locate sensors to provide pertinent data for the surface preparation and coating application being performed, as well as the temperature extremes on the structure. Describe the location plan in the Coatings Work Plan. Monitor any heating, cooling, or dehumidification equipment used. Provide monitoring equipment to perform as follows:

a. Data is collected in 15-minute increments, and available for download (on-site) in a standard database format. Contractor must collect these data and make available to the Contracting Officer and QC Manager;

b. Monitoring equipment must have backup power such that data collection will be uninterrupted during the entire period of the dehumidification requirement;

c. Monitoring equipment must have capability to measure interior and exterior dry bulb temperature (DB), relative humidity (RH), and dewpoint temperature (DP).

There is no requirement for connectivity of the monitoring system to control the dehumidification equipment; therefore, any combination of equipment having the required functionality will be accepted.

3.3.2 Containment for Field Coating

Design and provide a containment system for the capture, containment, collection, storage, and disposal of the waste materials generated by the work under this Section, to meet the requirements of SSPC Guide 6, Class 3. Vapor concentrations must be kept at or below 10 percent of Lower Explosive Limit (LEL) at all times. Containment may be designed as fixed containment for complete structure or portable containment for sections of structure; however, containment must remain in any one place from beginning of abrasive blasting through initial cure of coating. Waste materials covered by this paragraph must not include any material or residue from removal of coatings containing lead, chromium, cadmium, PCB, or any other hazardous material.

It is the Contractors responsibility to insure the feasibility and workability of the containment system. The Contractor must perform their operations and work schedule in a manner as to minimize leakage of the containment system. The containment system must be properly maintained and must not deviate from the approved drawings. If the containment system fails to function satisfactorily, the Contractor must suspend all operations, except those required to minimize adverse impact on the environment or government property. Operations must not resume until modifications have been made to correct the cause of the failure.

3.3.3 Automated Monitoring Requirements for Field Coating

Provide continuous monitoring of temperature, relative humidity, and dew point data at pertinent points on the structure, during surface preparation, coating application, and initial cure. This data does not suffice for documentation of conformity to surface conditions during application and cure of coating. Locate sensors to provide pertinent data for the surface preparation and coating application being performed, as well as the temperature extremes on the structure. Describe the location plan, including required moves, in the Coatings Work Plan. Monitor any heating, cooling, or dehumidification equipment used. Provide monitoring equipment to perform as follows:

a. Data is collected in the field unit in 15-minute increments, and available for download (on-site) in a standard database format. Contractor must collect these data and make available to the Contracting Officer, Quality Assurance Coatings Inspector, and QC Manager;

b. Monitoring equipment must have backup power such that data collection will be uninterrupted during the entire period of the dehumidification requirement;

c. Monitoring equipment must have capability to measure surface temperatures at a minimum of four locations anywhere on a structure, regardless of the size of the structure;

d. Monitoring equipment must have capability to measure interior and exterior dry bulb temperature (DB), relative humidity (RH), and dewpoint temperature (DP).

There is no requirement for connectivity of the monitoring system to control the dehumidification equipment; therefore, any combination of equipment having the required functionality will be accepted.

3.4 SHOP APPLIED COATING OF BURIED PIPING

3.4.1 Surface Preparation for Shop Applied Coating

Prepare exterior steel surfaces in accordance with AWWA C213.

3.4.1.1 Abrasive Blasting Equipment for Shop Applied Coating of Buried Piping

Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D4285. Test air quality at each startup, but in no case, less often than every five operating hours.

3.4.1.2 Contamination Evaluation of Abrasive for Shop Applied Coating of Buried Piping

Test abrasive for salt contamination and oil contamination as required SSPC AB 1 for non-metallic abrasives, SSPC AB 2 for recycled ferrous abrasives, and SSPC AB 3 for ferrous metallic abrasives. Modify the schedule of testing to be daily, at startup, and every five operating hours thereafter.

3.4.1.3 Pre-Preparation Testing for Surface Contamination for Shop Applied Coating of Buried Piping

3.4.1.3.1 Pre-Preparation Testing for Oil and Grease Contamination for Shop Applied Coating of Buried Piping

Inspect all surfaces for oil or grease contamination using two or more of the following inspection techniques:

1) VISUAL INSPECTION - Observe surface for evidence of dirt or oil.

2) WATER BREAK TEST - Spray atomized mist of distilled water onto surface and observe for water beading. If water wets surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

3) CLOTH RUB TEST - Rub a clean, white, lint-free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

Reject oil or grease contaminated surfaces, clean in accordance with SSPC SP 1, and recheck for contamination until surfaces are free of oil and grease.

3.4.1.3.2 Pre-Preparation Testing for Soluble Salts Contamination for Shop Applied Coating of Buried Piping

Test each lot of pipe for soluble salt contamination on the external surfaces using the test kit described in paragraph TEST KIT FOR MEASURING CHLORIDE, SULFATE, AND NITRATE IONS ON STEEL AND COATED SURFACES. For pipes with an outer diameter (OD) of less than 6 inches, one test per 20 lineal feet is required. For pipes with an OD of more than 6 inches, three tests per 100 square feet must be taken, with a minimum of one test per section of pipe. Label all test tubes and retain for test

verification. Reject and wash surfaces of the entire lot if one or more readings greater than 3 micrograms per square centimeter of chlorides or 10 micrograms per square centimeter of sulfates or 5 micrograms per square centimeter of nitrates is measured.

Effective washing and removal of soluble salts will require removal of any barrier to the steel surface, including rust or mill scale. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water and soluble salt remover. The soluble salt remover must be acidic, biodegradable, non-toxic, non-corrosive, and after application, will not interfere with primer adhesion. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Additional testing is required when there are delays between testing and preparation or testing and coating application. Test methods and equipment used in this phase must be included in the Coatings Work Plan.

This phase is required because pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting. Successful completion of pre-preparation testing and washing does not negate the requirement for pre-application testing.

3.4.1.4 Abrasive Blasting External Surfaces for Shop Applied Coating of Buried Piping

For stainless steel, prepare surfaces in accordance with SSPC SP 17. The surface profile must be in accordance with the coating manufacturer's recommended range. Non-ferrous abrasives must be used. The surface profile must be in accordance with AWWA C213 and measured in accordance with ASTM D4417, Method A and Method C. The appearance of the surface after blasting must have the appearance of a Sand or Grit comparator. A rounded profile shape or peened surface is not acceptable. Measure profile at a rate of three measurements per lot at the beginning of the day.

3.4.1.5 Disposal of Used Abrasive for Shop Applied Coating of Buried Piping

Provide Disposal of Used Abrasive Shop Applied Coating, in accordance with Federal, State, and Local mandated regulations.

3.4.1.6 Pre-Application Testing for Surface Contamination for Shop Applied Coating of Buried Piping

3.4.1.6.1 Pre-Application Testing for Oil and Grease Contamination for Shop Applied Coating of Buried Piping

Ensure surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION FOR SHOP APPLIED COATING OF BURIED PIPING, except that only questionable areas need be checked for beading of water misted onto surface.

3.4.1.6.2 Pre-Application Testing for Surface Cleanliness for Shop Applied Coating of Buried Piping

Apply coatings to dust free surfaces. To test surfaces, use ISO 8502-3. Use a kit that is compliant with ISO 8502-3. A rating of 2 or better must

be achieved for acceptance. If a test does not result in a rating of 2 or better, reject contaminated surfaces, clean by vacuum cleaning, and retest. Test surfaces at rate of one test per joint or repair area where application will be performed. Provide two additional tests for each failed test or questionable test. Document test results in the Daily Inspection Report and attach tape to the Inspection Logbook.

Ferrous abrasives may become magnetized and difficult to remove from the steel substrate. If ferrous abrasives are used, additional visual inspection must be performed to ensure no surface contamination by the abrasive is present.

3.4.2 Mixing and Application of Shop Applied Coating of Buried Piping

3.4.2.1 Mixing Liquid Epoxy Coatings

Mix materials as stated in coating system instructions. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time.

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Do not add solvent to extend pot life. Add all required solvent, if allowable by the coating manufacturer, at time of mixing.

3.4.2.2 External Pipe Shop Applied Coating Application

Apply coatings in accordance with SSPC PA 1 and as specified in AWWA C213. Apply coatings to surfaces that meet all stated surface preparation requirements.

For the application of AWWA C213, the DFT must be a minimum of 15 mils and maximum of 20 mils. The coating thickness must not exceed the manufacturers recommendations.

The coating thickness must not exceed the manufacturers recommendations.

3.4.2.3 Internal Pipe Coating Application

For the application of AWWA C213, the DFT must be a minimum of 12 mils. The coating thickness must not exceed the manufacturers recommendations.

3.4.2.4 Holiday Testing and Shop Repair

Perform holiday testing on all shop-applied, externally coated areas and repair as outlined in AWWA C213.

3.5 FIELD REPAIRS TO EXTERNAL COATING OF BURIED PIPING

Field repairs must only be performed when repairing shop applied coatings in the field and coating external girth welds.

3.5.1 Surface Preparation for Field Coating of Buried Piping

Block or suspended pipeline at a height that will allow the blast nozzle to be perpendicular to the surface being blasted, and at the proper standoff distance, at all times.

3.5.1.1 Abrasive Blasting Equipment for Field Coating of Buried Piping

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D4285. Test air quality at each startup, but in no case, less often than every five operating hours.

3.5.1.2 Contamination Evaluation of Abrasive for Field Coating of Buried Piping

Test abrasive for salt contamination and oil contamination as required SSPC AB 1 for non-ferrous abrasives, SSPC AB 2 for recycled ferrous abrasives, and SSPC AB 3 for ferrous abrasives. Modify the schedule of testing to be daily, at startup, and every five operating hours thereafter.

3.5.1.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more one foot square steel panels in the manner specified in paragraph ABRASIVE BLASTING FOR FIELD COATING OF BURIED PIPING. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with ASTM D4417, Method C. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

3.5.1.4 Pre-Preparation Testing for Surface Contamination for Field Coating of Buried Piping

3.5.1.4.1 Pre-Preparation Testing for Oil and Grease Contamination for Field Coating of Buried Piping

Inspect all surfaces for oil or grease contamination using two or more of the following inspection techniques:

1) VISUAL INSPECTION - Observe surface for evidence of dirt or oil.

2) WATER BREAK TEST - Spray atomized mist of distilled water onto surface and observe for water beading. If water wets surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

3) CLOTH RUB TEST - Rub a clean, white, lint-free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

Reject oil or grease contaminated surfaces, clean using a water based pH neutral degreaser in accordance with SSPC SP 1, and recheck for contamination until surfaces are free of oil and grease.

3.5.1.4.2 Pre-Preparation Testing for Soluble Salts Contamination for Field Coating of Buried Piping

Prior to abrasive blasting, test all exposed girth welds and areas to be recoated for soluble salt contamination using the test kit described in paragraph TEST KIT FOR MEASURING CHLORIDE, SULFATE, AND NITRATE IONS ON STEEL AND COATED SURFACES. Label all test tubes and retain for test verification. Reject and wash surfaces if one or more readings greater than 3 micrograms per square centimeter of chlorides or 10 micrograms per square centimeter of sulfates or 5 micrograms per square centimeter of nitrates is measured.

Effective washing and removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water and soluble salts remover. The soluble salts remover must be acidic, biodegradable, non-toxic, non-corrosive, and after application, will not interfere with coating adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase must be included in the Coatings Work Plan.

This phase is required because pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION FOR FIELD COATING OF BURIED PIPING as a final acceptance test of prepared surfaces after abrasive blasting. Successful completion of pre-preparation testing and washing does not negate the requirement for pre-application testing.

3.5.1.5 Abrasive Blasting for Field Coating of Buried Piping

For stainless steel, prepare girth welds and repairs to bare steel to SSPC SP 17 immediately prior to coating application. Verify that prepared surfaces comply with SSPC VIS 1 at time of coating application. All other surfaces must be prepared in accordance with the appropriate coating standard referenced herein. The surface profile must be in accordance with the coating manufacturer's recommended range. Measure the surface profile in accordance with ASTM D4417, Method A and Method C. The appearance of the surface after blasting must have the appearance of a Sand or Grit comparator. A rounded profile shape or peened surface is not acceptable. For pipes with an outer diameter (OD) of less than6 inches, one test per 20 lineal feet is required. For pipes with an OD of more than 6 inches, three tests per 100 square feet must be taken, with a minimum of one test per section of pipe. Internal lining must not be used for stainless steel piping. Non-ferrous abrasive must be used. When surfaces are re-blasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Dust and debris tend to collect at welds, plate overlaps, and surface irregularities. Do not attempt to wipe surface clean.

3.5.1.6 Disposal of Used Abrasive for Field Coating of Buried Piping

Provide Disposal of Used Abrasive Field Applied Coating off Government property in accordance with Federal, State, and Local mandated regulations.

3.5.1.7 Pre-Application Testing for Surface Contamination for Field Coating of Buried Piping

3.5.1.7.1 Pre-Application Testing for Oil and Grease Contamination for Field Coating of Buried Piping

Ensure surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION FOR FIELD COATING OF BURIED PIPING, except that only questionable areas need to be checked for beading of water misted onto surface.

3.5.1.7.2 Pre-Application Testing for Soluble Salts Contamination for Field Coating of Buried Piping

Test surfaces for soluble salts using the test kit described in paragraph TEST KIT FOR MEASURING CHLORIDE, SULFATE, AND NITRATE IONS ON STEEL AND COATED SURFACES, test girth welds and areas to be recoated for soluble salts. Label all test tubes and retain for test verification. One or more readings greater than 3 micrograms per square centimeter of chlorides or 10 micrograms per square centimeter of sulfates or 5 micrograms per square centimeter of nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as required in paragraph PRE-PREPARATION TESTING FOR SOLUBLE SALTS CONTAMINATION FOR FIELD COATING OF BURIED PIPING, allow to dry, and re-test, and re-wash until all required tests show allowable results. Re-blast tested areas using vacuum equipped blast equipment.

3.5.1.7.3 Pre-Application Testing for Surface Cleanliness for Field Coating of Buried Piping

Apply coatings to dust free surfaces. To test surfaces, use ISO 8502-3. Use a kit that is compliant with ISO 8502-3. A rating of 2 or better must be achieved for acceptance. If a test does not result in a rating of 2 or better, reject contaminated surfaces, clean by vacuum cleaning, and retest. Test surfaces at rate of one test per joint or repair area where application will be performed. Provide two additional tests for each failed test or questionable test. Document test results in the Daily Inspection Reports and attach tape to the Inspection Logbook.

Ferrous abrasives may become magnetized and difficult to remove from the steel substrate. If ferrous abrasives are used, additional visual inspection must be performed to ensure no surface contamination by the abrasive is present.

3.5.2 Coating Mixing and Application for Field Coating of Buried Piping

3.5.2.1 Mixing Coating Materials for Field Coating of Buried Piping

a. Mix and apply coating materials in accordance with the approved coating system instructions, which may differ for each product. Do not mix partial kits unless standardized measuring cups are utilized. Do not alter mix ratios. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time. All mixing processes must be witnessed by the Quality Assurance Coatings Inspector.

b. Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform

wet film. Do not add solvent to extend pot life. Add all required solvent at time of mixing, as allowable per the coating system instructions.

c. If coating materials are not liquid materials (i.e., powder or extrusion materials), this paragraph may not apply. Follow the recommended instructions per the approved coating system instructions.

3.5.2.2 Application Conditions and Recoat Windows for Field Coating of Buried Piping

The application condition requirements for coatings are time and temperature sensitive. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for proper application of the coating materials, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating, cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.

Maintain air and steel surface temperature within the range allowable by the approved coating system instructions during application and initial cure. Maintain steel surface temperature more than 5 degrees F above the dew-point of the ambient air for the same period. These conditions may require environmental controls through containment.

3.5.2.3 Coating Application for Field Coating of Buried Piping

Apply coatings in accordance with SSPC PA 1 and as specified in AWWA C210, NACE RP0402. Apply coatings to surfaces that meet all stated surface preparation requirements.

3.5.2.4 Holiday Testing and Field Repair

Perform holiday testing on all field coated areas and repair as outlined in AWWA C210, NACE RP0402.

3.5.3 Final Inspection of Pipeline Prior to Burial

Verify that all surfaces of the pipeline are holiday-free at time of placement of backfill over pipe. Use holiday inspection requirements and acceptance criteria of the standards applicable to the coatings being tested.

3.5.4 Final Cleanup

Following completion of the work, remove debris, equipment, and materials from the site. Remove all foreign matter such as blast media, dust, dirt, debris, grease, and oils. Wipe all dry to handle coated surfaces with damp lint-free cloth. Remove temporary connections to Government- or Contractor-furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

3.6 FIELD AND SHOP QUALITY CONTROL

For marking of surfaces, use chalk for marking bare steel and water based markers for marking coated surfaces. Remove marks prior to coating. Do not use any wax or grease based markers, or any other markers that leave a residue or stain.

3.6.1 Inspection

3.6.1.1 Inspection Requirements

a. Perform inspections in accordance with ASTM D3276 and the approved Coatings Work Plan.

b. Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation to document a particular process or condition, as follows:

(1) Location or area;

(2) Purpose (required or special);

(3) Method;

(4) Criteria for evaluation;

(5) Results;

(6) Determination of compliance;

(7) List of required rework;

(8) Observations.

c. Collect and record environmental conditions as described in ASTM D3276 on a 24 hour basis, as follows:

(1) During surface preparation, every hour, or when changes occur;

(2) During coating application and the first four days of initial cure, every hour, or when changes occur;

(3) Note location, time, and temperature of the highest and lowest surface temperatures each day;

(4) Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

d. Data collected on environmental conditions in AUTOMATED MONITORING REQUIREMENTS may be used for overnight data; however, the data must be constantly verified as to location of sensors and validity of data with respect to the coating work being accomplished.

e. Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed. Work documented using data from equipment found to be out of calibration must be considered as non-compliant since last calibration or calibration check, as required.

f. Document Contractors compliance with the Coatings Work Plan.

3.6.1.2 Inspection Report Forms

Develop project-specific report forms as required to report measurements, test results, and observations being complete and conforming to contract requirements. This includes all direct requirements of the contract documents and indirect requirements of referenced documents. Show acceptance criteria with each requirement and indication of conformity of each inspected item. The data may be in any format, but must be legible and presented so that entered data can be quickly compared to the appropriate requirement.

3.6.1.3 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01 45 00 QUALITY CONTROL. Each report must be signed by the Quality Assurance Coatings Inspector and the QC Manager. Submit report within 24 hours of date recorded on the report.

3.6.1.4 Inspection Logbook

A continuous record of all activity related to this Section must be maintained in an Inspection Logbook on a daily basis. The logbook must be hard or spiral-bound book or digital program with consecutively numbered pages, and must be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

3.6.1.5 Inspection Equipment

All equipment must be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

3.6.2 Coatings Contractor QC Coatings Inspector's Responsibilities

The Coatings Contractor QC Coatings Inspector responsibilities include complete documentation of all daily inspection and production activities for the entire coatings project as outlined in the Coatings Work Plan, project program, and this Section. This includes, but is not limited to, the following:

a. Attending and documenting the pre-job meeting and acquiring the project program, inspection and testing plan (ITP), schedule, and a list of who will receive the QC daily inspection reports;

b. Performing a project site walk-through with the Quality Assurance Evaluator (QAE) or asset owner, Coatings Contractor QC, QC Manager, and Quality Assurance Coatings Inspector, inspecting at least the following:

(1) Asset(s) to be coated;

(2) Equipment and placement of equipment;

(3) Materials delivery and storage;

(4) Facility operational requirements during the project.

c. Perform all daily and hold point inspections including, but not limited to, the following:

(1) Check equipment, including blotter test to verify compressed air cleanliness;

(2) Perform non-visible contaminants testing (in accordance with PRE-PREPARATION TESTING FOR SOLUBLE SALT CONTAMINATION FOR SHOP APPLIED COATING OF BURIED PIPING, PRE-APPLICATION TESTING FOR SOLUBLE SALT CONTAMINATION FOR SHOP APPLIED COATING OF BURIED PIPING, PRE-PREPARATION TESTING FOR SOLUBLE SALT CONTAMINATION FOR FIELD COATING OF BURIED PIPING, and PRE-APPLICATION TESTING FOR SOLUBLE SALT CONTAMINATION FOR FIELD COATING OF BURIED PIPING);

(3) Perform visible contaminants testing (in accordance with PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION FOR SHOP APPLIED COATING OF BURIED PIPING, PRE-APPLICATION TESTING FOR OIL AND GREASE CONTAMINATION FOR SHOP APPLIED COATING OF BURIED PIPING, PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION FOR FIELD COATING OF BURIED PIPING, and PRE-APPLICATION TESTING FOR OIL AND GREASE CONTAMINATION FOR FIELD COATING OF BURIED PIPING);

(4) Obtain environmental readings;

(5) Perform abrasive testing per SSPC AB 1, SSPC AB 2, or SSPC AB 3;

(6) Perform surface preparation monitoring and testing;

(7) Perform surface cleanliness testing;

(8) Perform dust quantity testing;

(9) Record materials storage documentation (record all coatings and abrasive materials information, batch numbers, segregation, and storage temperature);

(10) Witness all coatings materials mixing and record mix materials temperatures, with verification of time of coatings pot life;

(11) Verify, witness, and record application method;

(12) Perform random wet film thickness (WFT) readings;

(13) Perform inspection of coatings application;

(14) Obtain dry film thickness (DFT) readings per SSPC PA 2;

(15) Perform holiday testing in accordance with HOLIDAY TESTING AND SHOP REPAIR and HOLIDAY TESTING AND FIELD REPAIR;

(16) Label asset identification (label stickers);

(17) Write Correction Action Reports (CAR), if needed;

(18) Write Non-Conformance Reports (NCR), if needed.

d. Writing a daily detailed summary of the work shift inspections, testing, and the day's events, including any meetings and prevalent conversations. The final daily report must include a project summary that must be part of the daily coatings inspection report.

e. The Coatings Contractor QC Coatings Inspector must stop all non-compliant work.

3.6.3 Quality Assurance Coatings Inspector's Responsibilities

The Quality Assurance Coatings Inspector's responsibilities include complete documentation of all on-site work associated with the coatings project. These responsibilities include, but are not limited to, the following:

a. Attending and documenting the pre-job meeting and acquiring the project program, inspection and testing plan (ITP), schedule, and a list of who will receive the QC daily inspection reports;

b. Performing a project site walk-through with the Quality Assurance Evaluator (QAE) or asset owner, prime Contractor, and coatings Contractor (QC Coatings Inspector and QC Manager), inspecting at least the following:

(1) Asset(s) to be coated;

(2) Equipment and placement of equipment;

(3) Materials delivery and storage;

(4) Facility operational requirements during the project.

c. Verifying all daily and hold point inspections performed by the Coatings Contractor QC Coatings Inspector or QC Manager by performing mirror inspections including, but not limited to, the following:

(1) Verify equipment check, including blotter test to verify compressed air cleanliness;

(2) Verify visible contaminants testing;

(3) Take environmental readings;

(4) Perform surface preparation monitoring and testing;

(5) Perform surface cleanliness testing;

(6) Perform dust quantity test;

(7) Record materials storage documentation (record all coating and abrasive information, batch numbers, segregation, and storage temperature);

(8) Witness all coatings materials mixing and record mix materials temperatures, with verification of time of coatings pot life;

(9) Verify, witness, and record application method;

(10) Inspect coatings application;

(11) Perform dry film thickness (DFT) readings per SSPC PA 2;

(12) Inspect asset identification (label stickers);

(13) Write Correction Action Reports (CAR), if needed;

(14) Write Non-Conformance Reports (NCR), if needed.

d. The following testing is witnessed by the Quality Assurance Coatings Inspector and performed by the Coatings Contractor QC Coatings Inspector or QC Manager:

(1) Wet film thickness (WFT) readings by coatings applicator(s);

(2) Non-visible contaminants testing for chlorides, sulfates, and nitrates (CSN);

(3) Abrasive testing per SSPC AB 1, SSPC AB 2, or SSPC AB 3;

(4) Holiday testing.

e. Writing a daily detailed summary of the work shift inspections, testing, and the day's events, including any meetings and prevalent conversations. The final daily report must include a project summary that will be part of the last daily coatings inspection report.

3.7 PROJECT IDENTIFICATION

At the completion of the work, affix pertinent coating data on structure at a location that is readily accessible and visible from the ground. Use either stencils or nameplates. The following list generally describes the pertinent coating data, but should be modified as required to describe the coating systems.

Date coated/accepted: _____/_____

Project Number: _____

Contractor: _____

Address: _____

Coating System

Manufacturer: _____

Surface Prep: SSPC SP ____ Profile: _____

Primer: _____ Thickness: ____

Intermediate: _____ Thickness: ____

Topcoat: _____ Thickness: ____

Total Thickness: _____

3.7.1 Stencils

Use stencils on piping 8 in or larger. Use stencils with 3/4- to one-inch Helvetica style letters and acrylic stencil paint of contrasting color.

3.7.2 Nameplates

Use nameplates for piping smaller than 8 inches. Construct plates of stainless steel. Install nameplates in prominent locations with nonferrous screws, nonferrous bolts, or permanent adhesive. Minimum size of nameplates must be one by 2.5 in. Lettering must be the normal block style with a minimum 0.25 in height. Accurately align all lettering on nameplates.

-- End of Section --

SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION
08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318M	(2019; Errata 2022) Building Code Requirements for Structural Concrete & Commentary
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2025) Structural Welding Code - Steel

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS8	(2013) Specification for Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV

ASTM INTERNATIONAL (ASTM)

ASTM A48/A48M	(2022) Standard Specification for Gray Iron Castings
ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B3	(2013; R 2024) Standard Specification for Soft or Annealed Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B496	(2016; R 2021) Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors

ASTM C32	(2023) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C309	(2019) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C478	(2018) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C857	(2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C990	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM F2160	(2022a) Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 48	(2020) Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE 400.2	(2013) Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)
IEEE 404	(2012) Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V
IEEE C2	(2023) National Electrical Safety Code
IEEE C37.20.3	(2013) Standard for Metal-Enclosed Interrupter Switchgear
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C119.1	(2023) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA C119.4	(2011) Electric Connectors - Connectors for Use Between Aluminum-to-Aluminum or Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93 Degrees C and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100 Degrees C
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2021) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA TC 7	(2021) Smooth-Wall Coilable and Straight Electrical Polyethylene Conduit
NEMA TC 9	(2020) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
NEMA WC 70	(2021) Power Cable Rated 2000 Volts or Less for the Distribution of Electrical Energy
NEMA WC 74/ICEA S-93-639	(2022) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)

ANSI/SCTE 77	(2013) Specification for Underground Enclosure Integrity

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60005	(Basic; Notice 2) Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole

UL SOLUTIONS (UL)

UL 6	(2022) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 44	(2018; Reprint May 2021) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 94	(2023; Reprint Jan 2024) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2018; Reprint Jul 2023) UL Standard for Safety Wire Connectors
UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514B	(2012; Reprint Mar 2024) UL Standard for Safety Conduit, Tubing and Cable Fittings
UL 651	(2011; Reprint May 2022) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 854	(2020; Reprint Jul 2024) Standard for Service-Entrance Cables
UL 1072	(2006; Reprint May 2024) Medium-Voltage Power Cables

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics

terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

d. Underground structures subject to aircraft loading are indicated on the drawings.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast Underground Structures; G

SD-03 Product Data

Medium Voltage Cable; G

Medium Voltage Cable Joints; G

Medium Voltage Cable Terminations; G

Precast Concrete Structures; G

Sealing Material

Pulling-In Irons

Manhole Frames and Covers; G

Handhole Frames and Covers; G

Frames and Covers for Airfield Facilities; G

Ductile Iron Frames and Covers for Airfield Facilities; G

Composite/Fiberglass Handholes; G

Cable Supports (racks, arms and insulators); G

SD-06 Test Reports

Medium Voltage Cable Qualification and Production Tests; G

Field Acceptance Checks and Tests; G

Arc-proofing Test for cable fireproofing tape; G

Cable Installation Plan and Procedure; G

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Separate sections by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Cable splicer/terminator; G

Cable Installer Qualifications; G

Directional Boring Certificate of Conformance; G

1.5 QUALITY ASSURANCE

1.5.1 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:

a. Material description (i.e., f'c and Fy)

b. Manufacturer's printed assembly and installation instructions

c. Design calculations

d. Reinforcing shop drawings in accordance with ACI SP-66

e. Plans and elevations showing opening and pulling-in iron locations and details

1.5.2 Certificate of Competency for Cable Splicer/Terminator

Submit certification of the qualification of the cable splicer/terminator for approval, 30 days before splices or terminations are to be made in medium voltage (5 kV to 35 kV) cables. Include the training, and experience of the individual on the specific type and classification of cable to be provided under this contract. Indicate that the individual has had three or more years recent experience splicing and terminating medium voltage cables. List a minimum of three splices/terminations that

have been in operation for more than one year. In addition, the individual may be required to perform a dummy or practice splice/termination in the presence of the Contracting Officer, before being approved as a qualified cable splicer. If that additional requirement is imposed, the Contractor must provide short sections of the approved types of cables along with the approved type of splice/termination kit, and detailed manufacturer's instructions for the cable to be spliced. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for certification of an alternate cable splicer.

1.5.3 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers. Cable installer must demonstrate experience with a minimum of three medium voltage cable installations. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for an alternate qualified cable installer.

1.5.4 Directional Boring Certificate of Conformance

Provide certification of compliance with the registered Professional Engineer's design requirements for each directional bore, including: HDPE conduit size and type, bend radius, elevation changes, vertical and horizontal path deviations, conductor size and type and any conductor derating due to depth of conduit. Record location and depth of all directional-bore installed HDPE conduits using Global Positioning System (GPS) recording means with "resource grade" accuracy.

1.5.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of IEEE C2 and NFPA 70 unless more stringent requirements are specified or indicated.

1.5.6 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.6.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.6.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.2 Plastic Duct for Concrete Encasement

Provide Type EPC-40 per UL 651 and NEMA TC 2, as indicated.

2.1.3 High Density Polyethylene (HDPE) Electrical Conduit for Directional Boring

Smoothwall, approved/listed for directional boring, minimum Schedule 80, ASTM F2160, NEMA TC 7.

2.1.4 Duct Sealant

UL 94, Class HBF. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be capable of curing in temperature ranges of 35 degrees F to 95 degrees F. Cured sealant must withstand temperature ranges of -20 degrees F to 200 degrees F without loss of function.

2.1.5 Fittings

2.1.5.1 Metal Fittings

UL 514B.

2.1.5.2 PVC Conduit Fittings

UL 514B, UL 651 and NEMA TC 3.

2.1.5.3 PVC Duct Fittings

NEMA TC 9.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements, or in accordance with NEMA WC 70. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller must be solid. Conductors No. 8 AWG and larger must be stranded.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW RHW conforming to UL 44. Copper conductors must be annealed copper complying with ASTM B3 and ASTM B8.

2.2.3 Jackets

Provide multiconductor cables with an overall PVC outer jacket.

2.2.4 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags in each manhole, handhole, junction box, and each terminal. Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Color code conductors. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Properly identify control circuit terminations. Color must be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals may be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems are as follows:

a. 208/120 volt, three-phase

    (1) Phase A - black

    (2) Phase B - red

    (3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 MEDIUM VOLTAGE CABLE

Cable (conductor) sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Provide single conductor type cables unless otherwise indicated.

2.5.1 Cable Configuration

Provide Type MV cable, conforming to NEMA WC 74/ICEA S-93-639 and UL 1072. Provide cables manufactured for use in duct applications as indicated. Cable must be rated 15 kV as indicated with 133 percent insulation level.

2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B compact round conductors. Provide soft drawn copper cables complying with ASTM B3 and ASTM B8 for regular concentric and compressed stranding or ASTM B496 for compact stranding.

2.5.3 Insulation

Provide tree-retardant cross-linked thermosetting polyethylene (XLP) insulation conforming to the requirements of NEMA WC 74/ICEA S-93-639 and AEIC CS8.

2.5.4 Shielding

Cables rated for 2 kV and above must have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper tape shield for each phase.

2.5.5 Neutrals

Neutral conductors must be copper, employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable.

2.5.6 Jackets

Provide cables with a PVC jacket.

2.6 MEDIUM VOLTAGE CABLE TERMINATIONS

IEEE 48 Class 1; of the molded elastomer, prestretched elastomer, or heat-shrinkable elastomer. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Provide terminations, where required, with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor. Provide terminations in a kit, including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations must be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

2.6.1 Cold-Shrink Type

Terminator must be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination must not require heat or flame for installation. Termination kit must contain all necessary materials (except for the lugs). Design termination for installation in low or highly contaminated indoor and outdoor locations and must resist ultraviolet rays and oxidative decomposition.

2.6.2 Heat Shrinkable Type

Terminator must consist of a uniform cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer covering that is nontracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition. Provide heat shrinkable sheds or skirts of the same material. Design termination for installation in low or highly contaminated indoor or outdoor locations.

2.6.3 Separable Insulated Connector Type

IEEE 386. Provide connector with steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material. Provide connectors of the loadbreak or deadbreak type as indicated, of suitable construction for the application and the type of cable connected, and that include cable shield adaptors. Provide external clamping points and test points. Do no use separable connectors in manholes/handholes.

a. 200 Ampere loadbreak connector ratings: Voltage: 15 kV, 95 kV BIL. Short time rating: 10,000 rms symmetrical amperes.

b. 600 Ampere deadbreak connector ratings: Voltage: 15 kV, 95 kV BIL. Short time rating: 25,000 rms symmetrical amperes. Connectors must have 200 ampere bushing interface as indicated.

c. Provide one set of three grounding elbows and one set of three feed-thru inserts. Deliver grounding elbows and feed-thru inserts to the Contracting Officer.

2.7 MEDIUM VOLTAGE CABLE JOINTS

Provide joints (splices) in accordance with IEEE 404 suitable for the rated voltage, insulation level, insulation type, and construction of the cable. Joints must be certified by the manufacturer for waterproof, submersible applications. Upon request, supply manufacturer's design qualification test report in accordance with IEEE 404. Connectors for joint must be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

2.7.1 Heat-Shrinkable Joint

Consists of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductor layer for shielding. Replace original cable jacket with a heavy-wall heat-shrinkable sleeve with hot-melt adhesive coating.

2.7.2 Cold-Shrink Rubber-Type Joint

Joint must be of a cold shrink design that does not require any heat source for its installation. Splice insulation and jacket must be of a one-piece factory formed cold shrink sleeve made of black EPDM rubber. Splice should be packaged three splices per kit, including complete installation instructions.

2.8 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling in accordance with Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).

2.9 TAPE

2.9.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.9.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 00 00 EARTHWORK.

2.9.3 Fireproofing Tape

Provide tape composed of a flexible, conformable, unsupported intumescent elastomer. Tape must be not less than .030 inch thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, adhesive-free, and must not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.10 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.11 GROUNDING AND BONDING

2.11.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length.

2.11.2 Grounding Conductors

Stranded-bare copper conductors must conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

2.12 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts must be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.13 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom must consist of reinforced concrete. Walls and bottom must be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, must be adequate to accommodate the cable.

2.13.1 Cast-In-Place Concrete Structures

Concrete must conform to Section 03 30 00 CAST-IN-PLACE CONCRETE. Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers. Concrete block is not allowed in areas subject to aircraft loading.

2.13.2 Precast Concrete Structures, Risers and Tops

Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.13.2.1 General

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.13.2.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.13.2.3 Construction

Provide a uniform thickness for structure top, bottom, and wall not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the precaster. Size of windows must exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.13.2.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to ASTM C990. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.13.3 Manhole Frames and Covers

Provide cast iron frames and covers for manholes conforming to CID A-A-60005. Cast the words "ELECTRIC" or "TELECOMMUNICATIONS" in the top face of power and telecommunications manhole covers, respectively.

2.13.4 Handhole Frames and Covers

Frames and covers of steel must be welded by qualified welders in accordance with standard commercial practice. Provide rolled-steel floor plate covers having an approved antislip surface. Hinges must be of stainless steel with bronze hinge pin, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and must be for full surface application by fillet welding. Hinges must have nonremovable pins and five knuckles. The surfaces of plates under hinges must be true after the removal of raised antislip surface, by grinding or other approved method.

2.13.5 Frames and Covers for Airfield Facilities

Fabricate frames and covers for airfield use of standard commercial grade

steel welded by qualified welders in accordance with AWS D1.1/D1.1M. Provide rolled steel floor plate covers having an approved anti-slip surface. Steel frames and covers must be hot dipped galvanized after fabrication.

2.13.6 Ductile Iron Frames and Covers for Airfield Facilities

At the Contractor's option, ductile iron covers and frames designed for a minimum proof load of 100,000 pounds may be provided in lieu of the steel frames and covers indicated. Covers must be of the same material as the frames (i.e. ductile iron frame with ductile iron cover, galvanized steel frame with galvanized steel cover). Perform proof loading in accordance with CID A-A-60005 and ASTM A48/A48M. Proof loads must be physically stamped into the cover. Provide the Contracting Officer copies of previous proof load test results performed on the same frames and covers as proposed for this contract. Modify the top of the structure to accept the ductile iron structure in lieu of the steel structure indicated. The finished structure must be level and non-rocking, with the top flush with the surrounding pavement.

2.13.7 Brick for Manhole Collar

Provide sewer and manhole brick conforming to ASTM C32, Grade MS.

2.13.8 Composite/Fiberglass Handholes and Covers

ANSI/SCTE 77. Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass with a design load (Tier rating) appropriate for or greater than the intended use. All covers are required to have the Tier level rating embossed on the surface which must not exceed the design load of the box.

2.14 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

Zinc coat the metal portion of racks and arms after fabrication.

2.14.1 Cable Rack Stanchions

The wall bracket or stanchion must be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, or 4 inches by approximately 1 inch glass-reinforced nylon with recessed bolt mounting holes, 48 inches long (minimum) in manholes. Space slots for mounting cable rack arms at 8 inch intervals.

2.14.2 Rack Arms

Cable rack arms must be steel or malleable iron or glass reinforced nylon and must be of the removable type. Rack arm length must be a minimum of 8 inches and a maximum of 12 inches.

2.14.3 Insulators

Insulators for metal rack arms must be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.15 CABLE TAGS IN MANHOLES

Provide polyethylene tags for each power cable located in manholes. Do not provide handwritten letters. The first position on the power cable

tag denotes the voltage. The second through sixth positions on the tag identifies the circuit. The next to last position denotes the phase of the circuit and include the Greek "phi" symbol. The last position denotes the cable size. As an example, a tag could have the following designation: "11.5 NAS 1-8(Phase A)500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil.

2.15.1 Polyethylene Cable Tags

Provide tags of polyethylene having an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag, having a minimum loop tensile strength of 175 pounds and black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.16 MEDIUM VOLTAGE ABOVE GROUND CABLE TERMINATING CABINETS

Cable terminating cabinets must be hook-stick operable, deadfront construction conforming to the requirements of IEEE C37.20.3, Category A. Provide cabinets with 600 A. dead-break junctions and elbow-type separable dead-break connectors, cable parking stands, and grounding lugs. Provide cable terminating equipment in conformance with IEEE 386.

Ratings at 60 Hz must be:

Nominal voltage (kV)	13.8kV
Rated maximum voltage (kV)	15
Rated continuous current (A)	600
One-second short-time current-carrying capacity (kA)	10kA
BIL (kV)	95 kV

2.17 LOW VOLTAGE ABOVE GROUND TERMINATION PEDESTAL

Provide copolymer polypropylene, low voltage above ground termination pedestal manufactured through an injection molding process. Pedestals must resist fertilizers, salt air environments and ultra-violet radiation. Pedestal top must be imprinted with a "WARNING" and "ELECTRIC" identification. Pedestal must contain four lay-in six port connectors, NEMA C119.4, Class "A", dual rated for aluminum or copper, and capable of terminating conductors ranging from 10 AWG to 500 kcmil. Protect each connector with a clear, hard lexan (plastic) cover. Provide pedestal with rust-free material and stainless steel hardware that is lockable.

2.18 SOURCE QUALITY CONTROL

2.18.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer must test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing tape per manufacturer's instructions. The arc and fireproofing tape must withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode must be obtained from a dc power source of 305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. Direct the arc toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Test each sample assembly at three unrelated points. Start time for tests must be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time must be minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape must indicate that the test has been performed and passed by the manufacturer.

2.18.2 Medium Voltage Cable Qualification and Production Tests

Results of AEIC CS8 qualification and production tests as applicable for each type of medium voltage cable.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 CABLE INSTALLATION PLAN AND PROCEDURE

Obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. Perform pulling calculations and prepare a pulling plan and submit along with the manufacturer's instructions in accordance with SUBMITTALS. Install cable strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

Calculations and pulling plan must include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall bearing pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.4 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors must be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide PVC, Type EPC-40 conduit from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

3.5 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Horizontal concrete surfaces of floors must have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound must conform to ASTM C309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Manhole locations, as

indicated, are approximate. Coordinate exact manhole locations with other utilities and finished grading and paving.

3.5.1 Cast-In-Place Concrete Structures

Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers.

3.5.2 Precast Concrete Construction

Set commercial precast structures on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to 1 inch size, extending 12 inches beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation must additionally conform to the manufacturer's instructions.

3.5.3 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices must be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor, locate the irons a minimum of 6 inches from the edge of the sump, and in the walls, locate the irons within 6 inches of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron must not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 6 inch clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 3 foot length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner must be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons must have a clear projection into the structure of approximately 4 inches and must be designed to withstand a minimum pulling-in load of 6000 pounds. Hot-dip galvanize irons after fabrication.

3.5.4 Cable Racks, Arms and Insulators

Cable racks, arms and insulators must be sufficient to accommodate the cables. Space racks in power manholes not more than 3 feet apart, and provide each manhole wall with a minimum of two racks. Space racks in signal manholes not more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. Methods of anchoring cable racks are as follows:

a. Provide a 5/8 inch diameter by 5 inch long anchor bolt with 3 inch foot cast in structure wall with 2 inch protrusion of threaded portion of bolt into structure. Provide 5/8 inch steel square head nut on

each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.

b. Provide concrete channel insert with a minimum load rating of 800 pounds per foot. Insert channel must be steel of the same length as "vertical rack channel;" and cast flush in structure wall. Provide 5/8 inch steel nuts in channel insert to receive 5/8 inch diameter by 3 inch long steel, square head anchor bolts.

c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert must have minimum 800 pound load rating. Provide 5/8 inch diameter by 3 inch long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

3.5.5 Field Painting

Clean cast-iron frames and covers not buried in concrete or masonry of mortar, rust, grease, dirt and other deleterious materials, and coat with bituminous paint.

3.6 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.6.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Provide a 4/0 AWG bare copper grounding conductor above medium-voltage distribution duct banks. Bond bare copper grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grounding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Terminate all PVC conduit end points in utility holes, switching cabinets, transform handholes and buildings with end bells. The bell end of the conduits that enter manholes and handholes must be flush with the wall.

Perform changes in ductbank direction as follows:

a. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.

b. The minimum manufactured bend radius must be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter.

c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of 25 feet for a change of direction of more than 5 degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections allowed for use in field manufactured longsweep bend: 30 degrees.

3.6.2 Treatment

Keep ducts clean of concrete, dirt, or foreign substances during

construction. Make field cuts requiring tapers with proper tools and match factory tapers. Use a coupling recommended by the duct manufacturer whenever an existing duct is connected to a duct of different material or shape. Store ducts to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Thoroughly clean ducts before being laid. Store plastic ducts on a flat surface and protected from the direct rays of the sun.

3.6.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.6.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, must be zinc-coated, rigid steel, jacked into place. Where ducts are jacked under existing pavement, install rigid steel conduit because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks must be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers.

3.6.5 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations must be PVC coated and extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.6.6 Multiple Conduits

Separate multiple conduits by a minimum distance of 3 inches, except that light and power conduits must be separated from control, signal, and telephone conduits by a minimum distance of 12 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.6.7 Conduit Plugs and Pull Rope

Provide new conduit indicated as being unused or empty with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.6.8 Conduit and Duct Without Concrete Encasement

3.6.8.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Extend concrete encasement at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks. Depths to top of the concrete envelope must be not less than 24 inches below finished grade.

3.6.8.2 Directional Boring

HDPE conduits must be installed below the frostline and as specified herein.

3.6.9 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Depths to top of the concrete envelope must be not less than 18 inches below finished grade, except under roads and pavement, concrete envelope must be not less than 24 inches below finished grade. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies, prevent floating during concrete pouring by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.6.9.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

3.6.9.2 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.6.9.3 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and bend out to tie into the reinforcing of the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.6.9.4 Connections to Existing Ducts

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks. Remove existing cables which constitute interference with the work.

3.6.9.5 Partially Completed Duct Banks

During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, and, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately one foot apart. Restrain reinforcing assembly from moving during concrete pouring.

3.6.9.6 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

3.6.10 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air, insects, and vermin.

3.7 CABLE PULLING

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.7.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.8 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable

insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.8.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

3.9 CONDUCTORS INSTALLED IN PARALLEL

Group conductors such that each conduit of a parallel run contains one Phase A conductor, one Phase B conductor, one Phase C conductor, and one neutral conductor.

3.10 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination pedestals.

3.11 MEDIUM VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.12 MEDIUM VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

3.12.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods must be as specified elsewhere in this section. Wire must be trained to the sides of the enclosure to prevent interference with the working area.

3.13 CABLE END CAPS

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at

all times will be rejected.

3.14 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

3.14.1 Fireproofing Tape

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

3.15 GROUNDING SYSTEMS

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 5 ohms.

3.15.1 Grounding Electrodes

Provide cone pointed driven ground rods driven or drilled full depth plus 12 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.
If the specified ground resistance is not met, provide an additional ground rod in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately. Contractor must drill a mininum 1 foot diameter hole and fill with conductive soil to install ground rod where refusal occurs during standard hammer drill installation.

3.15.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

3.15.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.15.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.15.5 Manhole Grounding

Loop a 4/0 AWG grounding conductor around the interior perimeter, approximately 12 inches above finished floor. Secure the conductor to the manhole walls at intervals not exceeding 36 inches. Connect the conductor to the manhole grounding electrode with 4/0 AWG conductor. Connect all incoming 4/0 grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum 6 AWG conductor.

3.15.6 Fence Grounding

Provide grounding for fences with a ground rod at each fixed gate post and at each corner post. Drive ground rods until the top is 12 inches below grade. Attach a No. 4 AWG copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 12 inches of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Bond each gate section to its gatepost by a 1/8 by one inch flexible braided copper strap and ground post clamps. Clamps must be of the anti-electrolysis type.

3.16 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 00 00 EARTHWORK.

3.16.1 Reconditioning of Surfaces

3.16.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Provide work in accordance with Section 32 92 19 SEEDING.

3.16.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.17 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.17.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Place slab on a 6 inch thick, well-compacted gravel base. Top of concrete slab must be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade must have 1/2 inch chamfer. Slab must be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.17.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.18 FIELD QUALITY CONTROL

3.18.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.18.1.1 Medium Voltage Cables

Perform tests after installation of cable, splices, and terminators and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Inspect for proper shield grounding, cable support, and cable termination.

(4) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.

(5) Inspect for proper fireproofing.

(6) Visually inspect jacket and insulation condition.

(7) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.

(2) Perform acceptance test on new cables before the new cables are connected to existing cables and placed into service, including terminations and joints. Perform maintenance test on complete cable system after the new cables are connected to existing cables and placed into service, including existing cable, terminations, and joints. Tests must be very low frequency (VLF) alternating voltage withstand tests in accordance with IEEE 400.2. VLF test frequency must be 0.05 Hz minimum for a duration of 60 minutes using a sinusoidal waveform. Test voltages must be as follows:

CABLE RATING AC TEST VOLTAGE for ACCEPTANCE TESTING	
5 kV	10kV rms(peak)
8 kV	13kV rms(peak)
15 kV	20kV rms(peak)
25 kV	31kV rms(peak)
35 kV	44kV rms(peak)

CABLE RATING AC TEST VOLTAGE for MAINTENANCE TESTING	
5 kV	7kV rms(peak)
8 kV	10kV rms(peak)
15 kV	16kV rms(peak)
25 kV	23kV rms(peak)
35 kV	33kV rms(peak)

3.18.1.2 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Verify tightness of accessible bolted electrical connections.

(4) Inspect compression-applied connectors for correct cable match and

indentation.

(5) Visually inspect jacket and insulation condition.

(6) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 1000 volts dc for one minute.

(2) Perform continuity tests to insure correct cable connection.

3.18.1.3 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.

3.18.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given 5 working days advance notice of the dates and times of checking and testing.

.... -- End of Section --

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2023) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-84-608	(2012) Broadband Twisted Pair Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements
ICEA S-87-640	(2023) Optical Fiber Outside Plant Communications Cable; 4th Edition
ICEA S-98-688	(2012) Broadband Twisted Pair Telecommunication Cable, Aircore, Polyolefin Insulated, Copper Conductors Technical Requirements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C62.61	(1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1; TIA 25-2) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-107-A	(1999) FOTP-107 Determination of Component Reflectance or Link/System Return Loss using a Loss Test Set
TIA-455-204-A	(2013) FOTP-204 Measurement of Bandwidth on Multimode Fiber
TIA-455-C	(2014) General Requirements for Standard Test Procedure for Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
TIA-472D000-B	(2007) Standard for Optical Fiber Outside Plant Communications Cable
TIA-455-78-B	(2020c) FOTP-78 Optical Fibres - Part 1-40: Measurement Methods and Test Procedures - Attenuation
TIA-492CAAA	(1998; R 2002) Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers
TIA-492E000	(1996; R 2002) Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1550 nm Window
TIA-526-7-A	(2015) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA-526-14-C	(2015) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
TIA-568.1-D	(2015; Add 1 2018) Commercial Building Telecommunications Infrastructure Standard
TIA-568.2-D	(2018) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568.3-D	(2016; Add 1 2019) Optical Fiber Cabling Components Standard
TIA-569-E	(2019) Telecommunications Pathways and Spaces

TIA-590-A	(1997) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant
TIA-598-D	(2014; Add 1 2018; Add 2 2018) Optical Fiber Cable Color Coding
TIA-606-C	(2017) Administration Standard for the Telecommunications Cabling Infrastructure
TIA-607-D	(2019) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA-758-B	(2012) Customer-Owned Outside Plant Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755	Telecommunications Standards and Specifications for Materials, Equipment and Construction
RUS Bull 345-50	(1979) Trunk Carrier Systems (PE-60)
RUS Bull 345-65	(1985) Shield Bonding Connectors (PE-65)
RUS Bull 345-72	(1985) Filled Splice Closures (PE-74)
RUS Bull 345-83	(1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)
RUS Bull 1751F-630	(1996) Design of Aerial Plant
RUS Bull 1751F-640	(1995) Design of Buried Plant, Physical Considerations
RUS Bull 1751F-643	(2002) Underground Plant Design
RUS Bull 1751F-815	(1979) Electrical Protection of Outside Plant
RUS Bull 1753F-201	(1997) Acceptance Tests of Telecommunications Plant (PC-4)
RUS Bull 1753F-401	(1995) Splicing Copper and Fiber Optic Cables (PC-2)

UL SOLUTIONS (UL)

UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 497	(2001; Reprint Jul 2022) UL Standard for Safety Protectors for Paired Conductor Communication Circuits

UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568.1-D, TIA-568.2-D, TIA-568.3-D, TIA-569-E, TIA-606-C, and IEEE 100 and herein.

1.2.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect - (MC).)

1.2.2 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

1.2.3 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.2.4 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect - (IC).)

1.2.5 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.3 SYSTEM DESCRIPTION

The telecommunications outside plant consists of cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at the entrance facility. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications Outside Plant; G

Telecommunications Entrance Facility Drawings; G

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Wire and Cable; G

Cable Splices, and Connectors; G

Closures; G

Building Protector Assemblies; G

Protector Modules; G

Cross-Connect Terminal Cabinets; G

Spare Parts; G

Submittals must include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals must also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information must be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required for certificates in Section 01 33 00 SUBMITTAL PROCEDURES.

Original submittals must clearly indicate on product sheet which product, option and/or accessory is being proposed if multiple products, options or accessories are available. Selected product, option or accessory must be highlighted in a contrasting color from the product sheet to indicate its selection.

Resubmittals must clearly indicate on product sheet which product, option or accessory is being proposed if multiple products, options or accessories are available. Selected product, option or accessory must be highlighted in a contrasting color from the product sheet to indicate its selection. Resubmittals must also be clouded to clearly indicate to the reviewer what selections have changed from the original submittal.

Failure to indicate specific product information as outlined above will require corrected submission of product data by Contractor.

SD-06 Test Reports

Pre-installation Tests; G

Acceptance Tests; G

Outside Plant Test Plan; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Minimum Manufacturer's Qualifications; G

SD-08 Manufacturer's Instructions

Building Protector Assembly Installation; G

Cable Tensions; G

Fiber Optic Splices; G

Submit instructions prior to installation.

SD-09 Manufacturer's Field Reports

Factory Reel Test Data; G

SD-10 Operation and Maintenance Data

Telecommunications Outside Plant (OSP), Data Package 5; G

Commercial off-the-shelf manuals must be provided for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications outside plant (OSP). Submit operations and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs TELECOMMUNICATIONS OUTSIDE PLANT SHOP DRAWINGS and TELECOMMUNICATIONS ENTRANCE FACILITY DRAWINGS.

SD-11 Closeout Submittals

Record Documentation; G

In addition to other requirements, provide in accordance with paragraph RECORD DOCUMENTATION.

1.5 QUALITY ASSURANCE

1.5.1 Shop Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams must identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings must indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals must include the nameplate data, size, and capacity. Submittals must also include applicable federal, military, industry, and technical society publication references.

1.5.1.1 Telecommunications Outside Plant Shop Drawings

Provide Outside Plant Design in accordance with TIA-758-B, RUS Bull 1751F-630 for aerial system design, and RUS Bull 1751F-643 for

underground system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings in accordance with TIA-606-C. Drawings must include wiring and schematic diagrams for fiber optic and copper cabling and splices, copper conductor gauge and pair count, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the telecommunications outside plant. The telecommunications outside plant (OSP) shop drawings must be included in the operation and maintenance manuals.

1.5.1.2 Telecommunications Entrance Facility Drawings

Provide T3 drawings for EF Telecommunications in accordance with TIA-606-C that include telecommunications entrance facility plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, backboard and wall elevations. Drawings must show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings must include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings. The telecommunications entrance facility shop drawings must be included in the operation and maintenance manuals.

1.5.2 Telecommunications Qualifications

Work under this section must be performed by and the equipment must be provided by the approved telecommunications contractor and key personnel. Qualifications must be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.5.2.1 Telecommunications Contractor Qualifications

The telecommunications contractor must be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor must demonstrate experience in providing successful telecommunications systems that include outside plant and broadband cabling within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Each of the key personnel must demonstrate experience in providing successful telecommunications systems in accordance with TIA-758-B within the past 3 years.

1.5.2.2 Key Personnel Qualifications

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel must demonstrate experience in providing successful telecommunications systems within the past 3 years.

Cable splicing and terminating personnel assigned to the installation of this system or any of its components must have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices must be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

Supervisors and installers assigned to the installation of this system or any of its components must have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person must include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications outside plant systems, including broadband cabling, and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience must have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons must be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal must do work on this solicitation's telecommunications system. Key personnel must function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.5.2.3 Minimum Manufacturer's Qualifications

Cabling, equipment and hardware manufacturers must have a minimum of 3

years experience in the manufacturing, assembly, and factory testing of components which comply with, TIA-568.1-D, TIA-568.2-D and TIA-568.3-D. In addition, cabling manufacturers must have a minimum of 3 years experience in the manufacturing and factory testing of cabling which comply with ICEA S-87-640, ICEA S-98-688, and ICEA S-84-608.

1.5.3 Outside Plant Test Plan

Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the copper conductor and optical fiber cables, components, and accessories for approval by the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least 30 days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with TIA-568.1-D and RUS Bull 1753F-201. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

1.5.4 Standard Products

Provide materials and equipment that are standard products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and must be the manufacturer's latest standard design that has been in satisfactory commercial or industrial use for at least 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Products supplied must be specifically designed and manufactured for use with outside plant telecommunications systems. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is provided.

1.5.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site must not be used, unless specified otherwise.

1.5.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.5.5.1 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate must state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.6 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels in 1000 feet length with a minimum overage of 10 percent. Radius of the reel drum must not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable must be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable must be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage must be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

1.7 MAINTENANCE

1.7.1 Record Documentation

Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to this project.

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606-C. T5 drawings must include schedules to show information for cut-overs and cable plant management, patch panel layouts, cross-connect information and connecting terminal layout as a minimum. T5 drawings must be provided on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation, must be provided. Provide the following T5 drawing documentation as a minimum:

a. Cables - A record of installed cable must be provided in accordance with TIA-606-C. The cable records must include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility in accordance with TIA-606-C. Include manufacture date of cable with submittal.

b. Termination Hardware - Provide a record of installed patch panels, cross-connect points, campus distributor and terminating block arrangements and type in accordance with TIA-606-C. Documentation must include the required data fields as a minimum in accordance with TIA-606-C.

1.7.2 Spare Parts

In addition to the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking. Spare parts must be provided no later than the start of field testing.

1.8 WARRANTY

The equipment items must be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products supplied must be specifically designed and manufactured for use with outside plant telecommunications systems.

2.2 TELECOMMUNICATIONS ENTRANCE FACILITY

2.2.1 Building Protector Assemblies

Provide self-contained 5 pin solid state unit supplied with a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for pairs as indicated on plans of outside cable. Building protector assembly must have interconnecting hardware for connection to interior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation.

2.2.2 Protector Modules

Provide in accordance with UL 497 three-electrode gas tube or solid state type 5 pin rated for the application. Provide gas tube protection modules in accordance with RUS Bull 345-83 and must be heavy duty, A>10kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with ANSI C62.61. The gas modules must shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with UL 497. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Underground Cable Closures

a. In vault or manhole: Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. Closure must be of suitable thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound must be reenterable and must not alter the chemical stability

of the closure. Provide filled splice cases in accordance with RUS Bull 345-72.

2.3.2 Fiber Optic Closures

2.3.2.1 In Vault or Manhole

Provide underground closure suitable to house splice organizer in a protective housing into which can be poured an encapsulating compound. Closure must be of thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound must be reenterable and must not alter the chemical stability of the closure.

2.4 PAD MOUNTED CROSS-CONNECT TERMINAL CABINETS

Provide in accordance with RUS 1755.910 and the following:

a. Constructed of 14 gauge steel.

b. Equipped with a double set of hinged doors with closed-cell foam weatherstripping. Doors must be locked and contain a marker as indicated.

c. Equipped with spool spindle bracket, mounting frames, binding post log, jumpering instruction label, and load coil mounting provisions.

d. Complete with cross connect modules to terminate number of pairs as indicated.

e. Sized as indicated.

2.5 CABLE SPLICES, AND CONNECTORS

2.5.1 Copper Cable Splices

Provide multipair, in-line splices of a moisture resistant, three-wire insulation displacement connector held rigidly in place to assure maximum continuity in accordance with RUS Bull 1753F-401. Cables greater than 25 pairs must be spliced using multipair splicing connectors, which accommodate 25 pairs of conductors at a time. Provide correct connector size to accommodate the cable gauge of the supplied cable.

2.5.2 Copper Cable Splice Connector

Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector must accommodate 22 to 26 AWG solid wire with a maximum insulation diameter of 0.065 inch. Fill connector with sealant grease to make a moisture resistant connection, in accordance with RUS Bull 1753F-401.

2.5.3 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for fusion methods at locations shown on the construction drawings. The splice insertion loss must be 0.3 dB maximum when measured in accordance with TIA-455-78-B using an Optical Time Domain Reflectometer (OTDR). Splices must be designed for a return loss of 40.0 db max for single mode fiber

when tested in accordance with TIA-455-107-A. Physically protect each fiber optic splice by a splice kit specially designed for the splice.

2.5.4 Fiber Optic Splice Organizer

Provide splice organizer suitable for housing fiber optic splices in a neat and orderly fashion. Splice organizer must allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. Splice organizer must accommodate individual strain relief for each splice and allow for future maintenance or modification, without damage to the cable or splices. Provide splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors in a splice organizer kit.

2.5.5 Shield Connectors

Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor in accordance with RUS Bull 345-65.

2.6 CONDUIT

Provide conduit as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7 PLASTIC INSULATING TAPE

UL 510.

2.8 WIRE AND CABLE

2.8.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors must be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core must be separated into compartments. Cable must be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor must verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor must determine the range of numbers of pairs specified; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). Copper conductor must conform to the following:

2.8.1.1 Underground

Provide filled cable meeting the requirements of ICEA S-84-608 and RUS 1755.390 RUS 1755.890.

2.8.1.2 Screen

Provide screen-compartmental core cable filled cable meeting the requirements of ICEA S-84-608 and RUS 1755.390.

2.8.2 Fiber Optic Cable

Provide single-mode, 8/125-um, 0.10 aperture 1310 nm fiber optic cable in

accordance with TIA-492CAAA single-mode, 8/125-um, 0.10 aperture 1550 nm fiber optic cable in accordance with TIA-492E000, TIA-472D000-B, and ICEA S-87-640 including any special requirements made necessary by a specialized design. Provide optical fibers as indicated. Fiber optic cable must be single-armored and specifically designed for outside use with loose buffer construction. Provide fiber optic color code in accordance with TIA-598-D

2.8.2.1 Strength Members

Provide central, non-metallic strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with ICEA S-87-640. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and must not serve as a pulling strength member.

2.8.2.2 Shielding or Other Metallic Covering

Provide copper, copper alloy or copper and steel laminate dual tape covering or shield in accordance with ICEA S-87-640.

2.8.2.3 Performance Requirements

Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

2.8.3 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with RUS 1755.200, TIA-607-D, IEEE C2, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B1 for sizes No. 8 AWG and smaller and stranded bare copper wire meeting the requirements of ASTM B8, for sizes No. 6 AWG and larger. Insulated conductors must have 600-volt, Type TW insulation meeting the requirements of UL 83.

2.9 T-SPAN LINE TREATMENT REPEATERS

Provide as indicated. Repeaters must be pedestal mounted with non-pressurized housings, sized as indicated and must meet the requirements of RUS Bull 345-50.

2.10 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags must be stainless steel and labeled in accordance with TIA-606-C. Handwritten labeling is unacceptable.

2.10.1 Stainless Steel

Provide stainless steel, cable tags 1 5/8 inches in diameter 1/16 inch thick minimum, and circular in shape. Tags must be die stamped with numbers, letters, and symbols not less than 0.25 inch high and approximately 0.015 inch deep in normal block style.

2.10.2 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum),

non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties must have a minimum loop tensile strength of 175 pounds. The cable tags must have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.11 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection in accordance with TIA-590 -A. Provide color, type and depth of tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 00 00 EARTHWORK.

2.12 GROUNDING BRAID

Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid must be made from flat tin-plated copper.

2.13 MANUFACTURER'S NAMEPLATE

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.14 FIELD FABRICATED NAMEPLATES

Provide laminated plastic nameplates in accordance with ASTM D709 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription must identify the function and, when applicable, the position. Nameplates must be melamine plastic, 0.125 inch thick, white with black center core. Surface must be matte finish. Corners must be square. Accurately align lettering and engrave into the core. Minimum size of nameplates must be one by 2.5 inches. Lettering must be a minimum of 0.25 inch high normal block style.

2.15 TESTS, INSPECTIONS, AND VERIFICATIONS

2.15.1 Factory Reel Test Data

Test 100 percent OTDR test of FO media at the factory in accordance with TIA-568.1-D and TIA-568.3-D. Use TIA-526-7-A for single mode fiber and TIA-526-14-C Method B for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), must meet the requirements of ICEA S-84-608. Enhanced performance air core OSP copper cables must meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions IEEE C2, NFPA 70, and as indicated. Provide

all necessary interconnections, services, and adjustments required for a complete and operable telecommunications system.

3.1.1 Contractor Damage

Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, must be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice must provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Cable Inspection and Repair

Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable must be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps must remain intact on the reel until the cable is ready for placement.

3.1.3 Direct Burial System

Installation must be in accordance with RUS Bull 1751F-640. Under railroad tracks, paved areas, and roadways install cable in conduit encased in concrete. Slope ducts to drain. Excavate trenches by hand or mechanical trenching equipment. Provide a minimum cable cover of 24 inches below finished grade. Trenches must be not less than 6 inches wide and in straight lines between cable markers. Do not use cable plows. Bends in trenches must have a radius of not less than 36 inches. Where two or more cables are laid parallel in the same trench, space laterally at least 3 inches apart. When rock is encountered, remove it to a depth of at least 3 inches below the cable and fill the space with sand or clean earth free from particles larger than 1/4 inch. Do not unreel and pull cables into the trench from one end. Cable may be unreeled on grade and lifted into position. Provide color, type and depth of warning tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 00 00 EARTHWORK.

3.1.3.1 Cable Placement

a. Separate cables crossing other cables or metal piping from the other cables or pipe by not less than 3 inches of well tamped earth. Do not install circuits for communications under or above traffic signal loops.

b. Cables must be in one piece without splices between connections except where the distance exceeds the lengths in which the cable is furnished.

c. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

d. Leave a horizontal slack of approximately 3 feet in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections.

3.1.3.2 Identification Markers

Provide a marker at each change of direction of the cable, over the ends of ducts or conduits which are installed under paved areas and roadways and over each splice. Identification markers must be of concrete, approximately 20 inches square by 6 inches thick.

3.1.3.3 Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable must be cushioned by a fill of sand or selected soil at least 2 inches thick on the floor of the trench before placing the cable or wire. The backfill for at least 4 inches above the wire or cable must be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire. If the buried cable is placed less than 24 inches in depth, a protective cover of concrete must be used.

3.1.4 Cable Protection

Provide direct burial cable protection in accordance with NFPA 70 and as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Galvanized conduits which penetrate concrete (slabs, pavement, and walls) must be PVC coated and must extend from the first coupling or fitting outside either side of the concrete minimum of 6 inches per 12 inches burial depth beyond the edge of the surface where cable protection is required; all conduits must be sealed on each end. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40 percent of cross-sectional area, or in concrete encased 4 inches PVC pipe. Conduit may be installed by jacking or trenching. Trenches must be backfilled with earth and mechanically tamped at 6 inches lift so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.4.1 Cable End Caps

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.1.5 Underground Duct

Provide underground duct and connections to existing manholes, handholes, concrete pads, and existing ducts as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein.

3.1.6 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.7 Penetrations

Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations

through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.8 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances must the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling must also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

3.1.8.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension must not be exceeded.

3.1.8.2 Pulling Eyes

Equip cables 1.25 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 1.25 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping must not be beaten into the cable sheath. Use a swivel of 3/4 inch links between pulling-in eyes or grips and pulling strand.

3.1.8.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 4 feet. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags.

3.1.9 Aerial Cable Installation

Where physical obstructions make it necessary to pull distribution wire

along the line from a stationary reel, use cable stringing blocks to support wire during placing and tensioning operations. Do not place ladders, cable coils, and other equipment on or against the distribution wire. Wire must be sagged in accordance with the data shown. Protect cable installed outside of building less than 8 feet above finished grade against physical damage.

3.1.9.1 Figure 8 Distribution Wire

Perform spiraling of the wire within 24 hours of the tensioning operation. Perform spiraling operations at alternate poles with the approximate length of the spiral being 15 feet. Do not remove insulation from support members except at bonding and grounding points and at points where ends of support members are terminated in splicing and dead-end devices. Ground support wire at poles to the pole ground.

3.1.9.2 Suspension Strand

Place suspension strand as indicated. Tension in accordance with the data indicated. When tensioning strand, loosen cable suspension clamps enough to allow free movement of the strand. Place suspension strand on the road side of the pole line. In tangent construction, point the lip of the suspension strand clamp toward the pole. At angles in the line, point the suspension strand clamp lip away from the load. In level construction place the suspension strand clamp in such a manner that it will hold the strand below the through-bolt. At points where there is an up-pull on the strand, place clamp so that it will support strand above the through-bolt. Make suspension strand electrically continuous throughout its entire length, bond to other bare cables suspension strands and connect to pole ground at each pole.

3.1.9.3 Aerial Cable

Keep cable ends sealed at all times using cable end caps. Take cable from reel only as it is placed. During placing operations, do not bend cables in a radius less than 10 times the outside diameter of cable. Place temporary supports sufficiently close together and properly tension the cable where necessary to prevent excessive bending. In those instances where spiraling of cabling is involved, accomplish mounting of enclosures for purposes of loading, splicing, and distribution after the spiraling operation has been completed.

3.1.10 Cable Splicing

3.1.10.1 Copper Conductor Splices

Perform splicing in accordance with requirements of RUS Bull 1753F-401 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

3.1.10.2 Fiber Optic Splices

Fiber optic splicing must be in accordance with manufacturer's recommendation and must exhibit an insertion loss not greater than 0.2 dB for fusion splices.

3.1.11 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, must have surge protection installed at each end which meet the requirements of RUS Bull 1751F-815.

3.1.12 Grounding

Provide grounding and bonding in accordance with RUS 1755.200, TIA-607-D, IEEE C2, and NFPA 70. Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.1.12.1 Primary Bonding Busbar (PBB)

The PBB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a PBB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.12.2 Incoming Cable Shields

Shields must not be bonded across the splice to the cable stubs. Ground shields of incoming cables in the EF Telecommunications to the PBB.

3.1.12.3 Campus Distributor Grounding

a. Protection assemblies: Mount CD protector assemblies directly on the telecommunications backboard. Connect assemblies mounted on each vertical frame with No. 6 AWG copper conductor to provide a low resistance path to PBB.

b. PBB connection: Connect PBB to Secondary Bonding Busbar (SBB) with copper conductor with a total resistance of less than 0.01 ohms.

3.1.13 Cut-Over

All necessary transfers and cut-overs, must be accomplished by the telecommunications contractor.

3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility in accordance with TIA-606-C. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware must be provided using laser printer.

3.2.2 Cable Tag Installation

Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice. Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract. The labeling of telecommunications cable tag identifiers must be in accordance with TIA-606-C. Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

3.2.3 Termination Hardware

Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers in accordance with TIA-606-C.

3.3 FIELD APPLIED PAINTING

Provide ferrous metallic enclosure finishes in accordance with the following procedures. Ensure that surfaces are dry and clean when the coating is applied. Coat joints and crevices. Prior to assembly, paint surfaces which will be concealed or inaccessible after assembly. Apply primer and finish coat in accordance with the manufacturer's recommendations. Provide ferrous metallic enclosure finishes as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Cleaning

Clean surfaces in accordance with SSPC SP 6/NACE No.3.

3.3.2 Priming

Prime with a two component polyamide epoxy primer which has a bisphenol-A base, a minimum of 60 percent solids by volume, and an ability to build up a minimum dry film thickness on a vertical surface of 5.0 mils. Apply in two coats to a total dry film thickness of 5 to 8 mils.

3.3.3 Finish Coat

Finish with a two component urethane consisting of saturated polyester polyol resin mixed with aliphatic isocyanate which has a minimum of 50 percent solids by volume. Apply to a minimum dry film thickness of 2 to 3 mils. Color must be the manufacturer's standard.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.5.1 Pre-Installation Tests

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests must be performed at the factory and certified test results must accompany the cable.

3.5.1.1 Cable Capacitance

Perform capacitance tests on at least 10 percent of the pairs within a cable to determine if cable capacitance is within the limits specified.

3.5.1.2 Loop Resistance

Perform DC-loop resistance on at least 10 percent of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

3.5.1.3 Pre-Installation Test Results

Provide results of pre-installation tests to the Contracting Officer at least 5 working days before installation is to start. Results must indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate that cable does not meet specifications, remove cable from the job site.

3.5.2 Acceptance Tests

Perform acceptance testing in accordance with RUS Bull 1753F-201 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing must be given to the Contracting Officer at least 14 days prior to any test unless specified otherwise. Testing must not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans must define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans must define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans must identify the capabilities and functions to be tested. Provide test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements must be tabulated on a pair by pair or strand by strand basis.

3.5.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with TIA-758-B:

a. Wire map (pin to pin continuity)

b. Continuity to remote end

c. Crossed pairs

d. Reversed pairs

e. Split pairs

f. Shorts between two or more conductors

3.5.2.2 Fiber Optic Cable

Test fiber optic cable in accordance with TIA-455-C and as further specified in this section. Two optical tests must be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test must be performed on all multimode optical fibers. These tests must be performed on the completed

end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

a. OTDR Test: The OTDR test must be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records must be obtained from the OTDR for each fiber in each span and must be included in the test results. The OTDR test must be measured in both directions. A reference length of fiber, 66 feet minimum, used as the delay line must be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results in accordance with TIA-526-7-A for single-mode fiber and TIA-526-14-C for multimode fiber. Splice losses must not exceed 0.3 db.

b. Attenuation Test: End-to-end attenuation measurements must be made on all fibers, in both directions, using a 850 1300 1310 1550 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with TIA-455-78-B for multimode and TIA-526-7-A for single-mode fiber optic cables. The measurement method must be in accordance with TIA-455-78-B. Attenuation losses must not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses must not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multimode fiber.

c. Bandwidth Test: The end-to-end bandwidth of all multimode fiber span links must be measured by the frequency domain method. The bandwidth must be measured in both directions on all fibers. The bandwidth measurements must be in accordance with TIA-455-204-A.

3.5.3 Soil Density Tests

a. Determine soil-density relationships for compaction of backfill material in accordance with ASTM D1557, Method D.

b. Determine soil-density relationships as specified for soil tests in Section 31 00 00 EARTHWORK.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 34 73 16

AIRFIELD GROUNDING
11/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B371/B371M	(2008; R 2013) Standard Specification for Copper-Zinc-Silicon Alloy Rod

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 407	(2022; TIA 21-1) Standard for Aircraft Fuel Servicing

UL SOLUTIONS (UL)

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

As-Built Drawings; G

SD-06 Test Reports

Tests

SD-07 Certificates

Grounding Rods

Copper Conductors

Grounding Connectors

1.3 AS-BUILT DRAWINGS

Submit as-built drawngs that provide current factual information, including deviations from and amendments to the drawings and changes in the work, concealed and visible.

PART 2 PRODUCTS

2.1 METALS

Do not use a combination of materials that forms an electrolytic couple, which accelerates corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such metals.

2.2 GROUNDING RODS

Use grounding rods, unless otherwise indicated, in accordance with UL 467 and made of copper-clad steel, copper, galvanized steel, or copper-zinc-silicone alloy. Use rods not less than 3/4 in in diameter and not less than 10 ft long. Use copper cladding in accordance with ASTM B371/B371M, Copper Alloy UNS No's. c 69400, c 69430, c 69440 or c 69450. Use copper cladding not less than 0.010 in thick at any point and complying with adherence requirements and the banding requirements of UL 467. Submit certificates of compliance stating that the grounding rods meet the specified requirements. Provide rods with a closed eye or shepherd's hook bend having an inside diameter of not less than 1-1/2 in.

2.3 COPPER CONDUCTORS

Use copper conductors that bare number 4 AWG copper wire in accordance with ASTM B8. Submit certificates of compliance stating that the copper conductors meet the specified requirements.

2.4 GROUNDING CONNECTORS

Use grounding connectors that comply with UL 467 for the required application. Submit certificates of compliance stating that the grounding connectors meet the specified requirements.

PART 3 EXECUTION

Prior to installing grounding rods, obtain approved digging permits in accordance with Section 01 11 00 SUMMARY OF WORK.

3.1 GROUNDING POINTS

Locate the grounding points as shown on the drawings to within plus or minus 2 in.

3.1.1 Pavement Recess

Set the top of the grounding rod at or not more than 1/4 in below the pavement surface grade. Provide a recess 3 in wide, and not more than 6 in long, with a smooth rounded edge in the pavement around the grounding point anchor eye to permit the entrance of lines into the eye and to allow for attachment of the grounding cable. Do not allow the depth of the recess to be deeper than the bottom of the opening of the grounding point eye.

3.1.2 Installation

3.1.2.1 New Rigid Pavement

Install the grounding rod by pushing or driving the rod through the pavement base courses and subgrade prior to concrete placement. Do not allow the installation technique chosen to damage the grounding rod. Keep hand finishing around the rod to a minimum.

3.1.3 Interconnection

For grounding rods installed at fueling hydrant outlets, electrically interconnect with the fuel piping with not less than a number 4 AWG bare copper conductor.

3.2 TESTS

Submit an independent testing agency's certified reports of inspections and tests, including analysis and interpretation of test results. Properly identify each report. Describe test methods and standards used. Measure resistance to ground tests as specified in NFPA 407. Submit test results to the Contracting Officer. Report immediately to the Contracting Officer ground rods that have more than 10,000 ohms of resistance.

-- End of Section --

THIS PAGE INTENTIONALLY LEFT BLANK