BUREAU OF RECLAMATION

San Juan Lateral – Block 2-3

Navajo-Gallup Water Supply Project, New Mexico

Upper Colorado Basin Region

U.S. Department of the Interior APRIL 2026

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NAVAJO-GALLUP WATER SUPPLY PROJECT - NEW MEXICO

SAN JUAN LATERAL –BLOCK 2-3

FOREWORD

Work is located on the Block 2-3 pipeline alignment, which begins south of the Frank Chee Willetto Reservoir approximately 17 miles east of Shiprock, New Mexico and terminates at the San Juan Lateral Water Treatment Plant approximately 6 miles east of intersection of U.S. Highway 491 and Navajo Route 36 in San Juan County.

The principal components of work include the following items:

1. 42-inch diameter buried water transmission pipe.
2. 48-inch diameter buried water transmission pipe.
3. Ground level regulating tanks, yard, and access road.
4. Wash crossings.
5. Bored crossings.
6. Precast manhole structures.
7. Concrete thrust collars, tapers, and encased miter bends.
8. Valves, air valves, and blowoffs.
9. Road crossings.
10. Utility crossings.
11. Erosion control.
12. Cathodic protection.
13. Supervisory Control and Data Acquisition (SCADA) equipment and fiber optic cabling.

PRE-BID SITE VISIT: A PREBID SITE VISIT WILL BE HELD ON APRIL 22, 2026 BEGINNING AT 10 AM MT. PARTICPANTS WILL MEET AT THE FOUR CORNERS CONSTRUCTION OFFICE, 1235 LA PLATA HIGHWAY, FARMINGTON, NM 87401. PROSPECTIVE BIDDERS SHOULD MAKE ARRANGEMENTS BY CONTACTING FRED MALONE AT THE 505-324-5014. ATTENDEES ARE TO PROVIDE AND WEAR SAFETY BOOTS, HARD HATS, SAFETY VESTS.

FOR DATE AND PLACE OF BID OPENING, SEE "SOLICITATION, OFFER, AND AWARD," STANDARD FORM 1442.

FOR INFORMATION REGARDING BUREAU OF RECLAMATION'S PUBLICATION "RECLAMATION SAFETY AND HEALTH STANDARDS" INCLUDING REVISIONS AT http://www.usbr.gov/ssle/safety/RSHS/rshs.html) WHICH IS APPLICABLE TO WORK UNDER THIS CONTRACT, SEE CLAUSE AT "WBR 1452.223-81 SAFETY AND HEALTH."

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CONTINUATION OF
SECTION B – SUPPLIES OR SERVICES AND PRICES
SAN JUAN LATERAL – BLOCK 2-3 PIPELINE
NAVAJO-GALLUP WATER SUPPLY PROJECT, NEW MEXICO

PRICE SCHEDULES

(a) Bids will be considered for award on the following Price Schedules, but no bid will be considered for award on only part of the Price Schedules. Bids are subject to the terms and conditions of this solicitation.

(b) Quantities in Price Schedule are estimated quantities for comparison of bids only. Except as provided in contract clause at H.4, Variation in Estimated Quantity, no claim shall be made against Government for overruns or underruns. Contract clause at H.4 Variation in Estimated Quantity does not apply to lump sum items.

(c) Reclamation is attempting to improve payment schedules and funds access to contractors, allowing awardees to access funds for monthly operations activities (labor and equipment reimbursement) previously burdened into other CLINs. Reclamation reserves the right, in coordination with the awardee, to restructure the Schedule B CLINs to allow "CLIN Work Groups" to be created specific to the winning bidder after award. Reclamation ***shall not*** advance pay invoices, progress payments must be tied to physical completion. The contractor may also decide it does not wish to pursue enhanced cash-flow access and Reclamation would not force any new pay schedule if it were not desired by the awardee, this is an optional process. If a bidder does not wish to pursue the payment restructuring after award it may leave the added table in each Schedule B Payment Schedule blank or fill with N/A (not applicable). ***Not filling out the added Schedule B tables shall not disqualify*** any bidder from receiving award. The advertised solicitation Schedule B conflicts with the specifications Schedule B, official changes to Schedule B would take place after award and be revised based on the negotiated payment schedule. If after modification the payment terms conflict with the specifications, the modification language and payment agreement would 'control' payment schedule or take precedence.

(1) **"CLIN Work Group (WG)" Generic Example:** Essentially "Work Groups" are several physical tasks invoiced under quantity surveys accompanied by a newly added percentage complete CLIN (traditional construction payment reimbursement based on percentage complete). 1st four (4) to five (5) tasks that logically and/or chronologically take place in the awardee's construction schedule (due after award - RSN 01 32 10-2 "Baseline Schedule") would be tied to a newly created separate Schedule B CLIN to allow access to operations costs (labor, equipment, etc.). The contractor would be allowed to bill monthly for operations cost and 'burden' for physical work completion completed to date of invoice, this is ***not a cost-type/cost-reimbursement setup*** it is a "Just Late" setup based on physical completion of work to date, funds will not be added to cover unexpected costs and is still a FFP contract payment tied to completion. As a generic working example, Schedule B WG CLINs 1.1, 1.2, 1.3, and 1.4 below in the Schedule B - Price Schedule 1 could, after award, be granted a "new" Schedule B WG CLIN 1.5 (would have to renumber all Schedule B CLINs with the approved CLIN restructure after award into the 'working groups' agreed to by both parties) that would allow the 'burden' or operations costs to be accessible for monthly billing in the newly established Schedule B Work Group, based on agreed percentage complete at time of invoice. Schedule B WG CLINs 1.1, 1.2, 1.3, and 1.4 would still be reimbursed under quantity survey verification, Schedule B WG CLIN 1.5 would essentially be a reimbursement by agreed percentage complete of WG CLINs 1.1, 1.2, 1.3, and 1.4 at time of invoicing. Specifics will be tailored to the awardee after the award is official (contract is awarded). ***This would be a bilateral modification to the contract after award.***

(2) **CLIN Work Group Illustration –** Example for illustrative purposes.

Work Group Example (1st Grouping)

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
WG-1.1	31 11 00	Clearing and Grubbing	For the lump sum of		$
WG-1.2	31 14 10	Topsoil Stripping, Stockpiling, and Placement	For the lump sum of		$
WG-1.3	31 23 22	Rock Excavation for Line Pipe	37,000 cu yd	$	$
WG-1.4	33 11 10	Line Pipe (Reach 2 – Can be in multiple work groups for different quantities – example 33% in WG1, 33% in WG2, 34% in WG3 – totaling 20,470 LF)	20,470 lin ft	$	$
WG-1.5	***Modification***	***Operational Costs and Burden of WG CLINs WG-1.1, 1.2, 1.3, & 1.4 (% Complete Payment – Monthly Billing for overhead, labor, equipment – Shall Not Advance Pay)***	***For the lump sum of***		***$***

(3) **Schedule B Table Addition:** A table has been added to the Bid Schedule B at the end of each Price Schedule to allow contractors to identify which schedule B CLINs carry the most 'burden' or access to cash-flow. The amounts in the newly added tables ***will NOT be publicly shared or announced during any bid opening,*** *this is considered competitive information and is exempt from FOIA and public reporting requirements*. The purpose is to allow Reclamation to posture for Schedule B restructuring with the awardee after award is official. It will aid Reclamation in ensuring it does not get into an advanced payment situation, while also identifying where the contractor needs the most access to cash-flow to keep operations more fluid.

(4) **Major Materials Reimbursement:** Reclamation is also willing to establish, with the selected awardee, a materials repayment schedule with the contractor for major purchases. Example: Steel Pipe, Reclamation is willing to reimburse 65-75% of the material costs at time of order with proof of paid invoices from the supplier. Upon successful delivery and certification/inspection of materials on site Reclamation would release the balance of the material cost (35-25%) to the contractor. Idea: Keeps the contractor liquid without violating advance payment rules and still provides Reclamation with enough assurance that the materials will be correct when delivered and verified to be acceptable before balance is released.

(d) See contract clause at WBR 1452.232-81, Payment for Mobilization and Preparatory Work, for CLIN 1-1 and 2-1.

(e) Definitions:
(1) CLIN – Contract Line Item Number

(f) Note: In accordance with Section 7-9-3.3 of New Mexico Statutes Annotated (NMSA) 1978 and Section 402 of Navajo Nation's Business Activity Tax Statute, it is Contractor's responsibility to

ensure that all applicable New Mexico Gross Receipts Tax and Navajo Nation Gross Receipts Tax are included in their bid.

(g) In accordance with FAR 52.232-5 (Payments under Fixed-Price Construction Contracts) (b)(2), payment may be approved for materials delivered to Contractor at locations other than the site if Contractor obtains CO approval prior to making arrangements for obtaining the materials. Contractor shall also be required to complete a "Materials on Hand Certificate" which will certify:

(1) Materials described for use on identified contract.

(2) Materials are clearly marked to identify that they belong to contract cited.

(3) Full title for those materials vested in Prime Contractor sited.

(4) Materials are free of liens and encumbrances.

(5) Materials are properly stored, secured, and protected against loss or damage.

PRICE SCHEDULE 1 (Reach 2)

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
1-1	WBR 1452.232-81	Mobilization and Preparatory Work	For the lump sum of		$
1-2	01 31 30	Contract Document Management System (CDMS)	For the lump sum of		$
1-3	01 56 15	Utility Crossing Investigations Reach 2	For the lump sum of		$
1-4	01 78 30	As-built Drawings Reach 2	For the lump sum of		$65,000
1-5	01 78 30	Final Drawings Reach 2	For the lump sum of		$17,000
1-6	26 42 00	Cathodic Protection and Corrosion Monitoring Systems for Reach 2	For the lump sum of		$
1-7	26 42 11	Buried Galvanic Anode Cathodic Protection for Reach 2	For the lump sum of		$
1-8	26 42 12	Buried Impressed Current Cathodic Protection for Reach 2	For the lump sum of		$
1-9	31 02 10	Water for Dust Abatement Reach 2	1,900 M (1,000) Gal	$	$
1-10	31 02 30	Dust Palliative Reach 2	94 acre	$	$
1-11	31 03 33	Removal of Water from Excavation Reach 2	For the lump sum of		$
1-12	31 11 00	Clearing and Grubbing	For the lump sum of		$
1-13	31 14 10	Topsoil Stripping, Stockpiling, and Placement	For the lump sum of		$
1-14	31 23 22	Rock Excavation for Line Pipe	37,000 cu yd	$	$
1-15	31 23 22	Use of Trench Box Reach 2	360 lin ft	$	$
1-16	32 15 10	Gravel Surfacing	470 sq yd	$	$
1-17	32 12 22	Asphalt Concrete Pavement	28 cu yd	$	$
1-18	32 91 60	Erosion Control Blanket	17,500 sq yd	$	$
1-19	32 92 20	Seeding	94 acre	$	$
1-20	33 05 21	Powerline Crossing at Station 2016+95	243 lin ft	$	$
1-21	33 05 21	U.S. Highway 64 Crossing at Station 2108+22	265 lin ft	$	$

PRICE SCHEDULE 1 (Reach 2)

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
1-22	33 05 21	Road 6700 Crossing at Station 2134+23	150 lin ft	$	$
1-23	33 05 21	Powerline Crossing at Station 2184+59	290 lin ft	$	$
1-24	33 05 21	ISR N 362 Crossing at Station 2189+73	85 lin ft	$	$
1-25	33 11 10	Line Pipe (Reach 2)	20,470 lin ft	$	$
1-26	33 11 10	Steep Line Pipe (Reach 2)	100 lin ft	$	$
1-27	33 11 10	Buried Manhole	1 Ea	$	$
1-28	33 11 10	Filling and Testing Pipe	For the lump sum of		
1-29	33 11 10	Repair Kits	For the lump sum of		
1-30	33 12 15	6-Inch Diameter Air Valve Assemblies	12 ea	$	$
1-31	33 12 15	6-Inch Diameter Air Valve with Manhole Assemblies	9 ea	$	$
1-32	33 12 15	6-Inch Diameter Blowoff Assemblies	11 ea	$	$
1-33	33 12 15	6-Inch Diameter Blowoff with Manhole Assemblies	8 ea	$	$
1-34	33 12 15	48-Inch Sectionalizing Valve Assemblies	3 ea	$	$
1-35	33 22 15	N.A.P.I. Turnout Assembly	For the lump sum of		$
1-36	35 42 35	Wash Crossings	For the lump sum of		$

Subtotal FOR PRICE SCHEDULE 1 (Reach 2) $_____

Estimated NMGRT at 6.8125% for Price Schedule 1 (if applicable) $_____

Estimated Navajo Nation Taxes at 6.00% for Price Schedule 1 (if applicable) $_____

TOTAL FOR PRICE SCHEDULE 1 $_____

OPTIONAL TABLE FOR WORK GROUP (WG) CLIN PAYMENT PRICE SCHEDULE 1

Schedule B CLIN Number	**Needed Access to Operations Costs ($ Amount)**	**Ballpark Date Needed (e.g. early contract performance, mid-performance, or late performance – Can be month or quarter if easier)**
Example: CLIN 1-1	*$5.00*	*Oct 2026, or 4th Qtr 2026, or early contract performance, etc.*
Contractor Input Below		

PRICE SCHEDULE 2 (Reach 3)

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
2-1	WBR 1452.232-81	Mobilization and Preparatory Work	For the lump sum of		$
2-2	01 31 30	Contract Document Management System (CDMS)	For the lump sum of		$
2-3	01 56 15	Utility Crossing Investigations Reach 3	For the lump sum of		$
2-4	01 78 30	As-Built Drawings Reach 3	For the lump sum of		$135,000
2-5	01 78 30	Final Drawings Reach 3	For the lump sum of		$31,000
2-6	25 00 01	System Control and Monitoring	For the lump sum of		$
2-7	26 05 02	Complete Electrical System	For the lump sum of		$
2-8	26 42 00	Cathodic Protection and Corrosion Monitoring Systems for Reach 3	For the lump sum of		$
2-9	26 42 11	Buried Galvanic Anode Cathodic Protection for Reach 3	For the lump sum of		$
2-10	26 42 12	Buried Impressed Current Cathodic Protection for Reach 3	For the lump sum of		$
2-11	26 42 15	Galvanic Anode Cathodic Protection for Welded Steel Tanks for Reach 3	For the lump sum of		$
2-12	31 02 10	Water for Dust Abatement	3,950 M (1,000) gal	$	$
2-13	31 02 30	Dust Palliative	166 acre	$	$
2-14	31 11 10	Clearing and Grubbing	For the lump sum of		$
2-15	31 14 10	Topsoil Stripping, Stockpiling, and Placement	For the lump sum of		$
2-16	31 23 11	Common Excavation for Structures	2,570 cu yd	$	$
2-17	31 23 11	Rock Excavation for Structures	650 cu yd	$	$
2-18	31 23 11	Compacted Backfill for Structures	3,120 cu yd	$	$
2-19	31 23 11	Processing for Site and Foundation Materials	3,120 cu yd	$	$
2-20	31 23 22	Rock Excavation for Line Pipe	82,000 cu yd	$	$
2-21	31 23 22	Use of Trench Box Reach 3	500 lin ft	$	$
2-22	31 37 00	Riprap	24 cu yd	$	$
2-23	32 15 10	Gravel Surfacing	4,100 sq yd	$	$

PRICE SCHEDULE 2 (Reach 3)

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
2-24	32 12 22	Asphalt Concrete Pavement	22 cu yd	$	$
2-25	32 31 10	Chain Link Fence	660 lin ft	$	$
2-26	32 91 60	Erosion Control Blanket	13,520 sq yd	$	$
2-27	32 92 20	Seeding	166 acre	$	$
2-28	33 05 21	Powerline Crossing at Station 3331+13	100 lin ft	$	$
2-29	33 05 21	Powerline Crossing at Station 3340+33	100 lin ft	$	$
2-30	33 05 21	ISR 36 Crossing at Station 3430+00	250 lin ft	$	$
2-31	33 05 21	Powerline Crossing at Station 3478+93	160 lin ft	$	$
2-32	33 05 21	Powerline Crossing at Station 3633+18	300 lin ft	$	$
2-33	33 05 21	Powerline Crossing at Station 3707+02	100 lin ft	$	$
2-34	33 11 10	48-Inch Line Pipe (Reach 3)	10,900 lin ft	$	$
2-35	33 11 10	42-Inch Line Pipe (Reach 3)	31,472 lin ft	$	$
2-36	33 11 10	Buried Manhole	10 ea	$	$
2-37	33 11 10	Filling and Testing Pipe	For the lump sum of		$
2-38	33 11 10	Repair Kits	For the lump sum of		$
2-39	33 11 10	4” NTUA Waterline Relocation	800 lin ft	$	$
2-40	33 12 15	6-Inch Diameter Air Valve Assemblies	2 ea	$	$
2-41	33 12 15	6-Inch Diameter Air Valve with Manhole Assemblies	11 ea	$	$
2-42	33 12 15	6-Inch Diameter Blowoff Assemblies	6 ea	$	$
2-43	33 12 15	6-Inch Diameter Blowoff with Manhole Assemblies	6 ea	$	$
2-44	33 12 15	42-Inch Sectionalizing Valve Assemblies	4 ea	$	$
2-45	33 12 15	48-Inch Sectionalizing Valve Assemblies	1 ea	$	$
2-46	33 16 00	San Juan Lateral Water Treatment Plant Regulating Tanks	For the lump sum of		$

PRICE SCHEDULE 2 (Reach 3)

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
2-47	33 42 30	Corrugated Metal Culverts	40 lin ft	$	$
2-48	35 21 95	Steel Manifold Piping	For the lump sum of		$
2-49	35 22 14	Valves and Equipment	For the lump sum of		$
2-50	35 42 35	Wash Crossings	For the lump sum of		$

Subtotal FOR PRICE SCHEDULE 2 (Reach 3) $_____

Estimated NMGRT at 6.8125% for Price Schedule 2 (if applicable) $_____

Estimated Navajo Nation Taxes at 6.00% for Price Schedule 2 (if applicable) $_____

TOTAL FOR PRICE SCHEDULE 2 $_____

TOTAL BID PRICE (TBP) - Price Schedules 1 & 2 without estimated taxes
$_____

OPTIONAL TABLE FOR WORK GROUP (WG) CLIN PAYMENT PRICE SCHEDULE 2

Schedule B CLIN Number	**Needed Access to Operations Costs ($ Amount)**	**Ballpark Date Needed (e.g. early contract performance, mid-performance, or late performance – Can be month or quarter if easier)**
Example: CLIN 2-1	*$5.00*	*Oct 2026, or 4th Qtr 2026, or early contract performance, etc.*
Contractor Input Below		

OTHER RATES

The following listed items must be provided and will be retained and applied to modification actions if applicable. This method allows us to use the initial award competition as the justification of reasonable rates throughout the performance of the contract which makes handling modifications easier throughout the life of the contract. The following items will be applied for the length of the contract including all modification actions after time of award:

a. – Overhead Rate _____

b. – Profit Rate _____

c. – General and Administrative (G&A) Rate if applied/applicable _____

d. – Pass-Through overhead and profit rates for subcontractors _____

END OF SUPPLIES OR SERVICES AND PRICES

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SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION

A. Work is located on the Block 2-3 pipeline alignment, which begins south of the Frank Chee Willetto Reservoir approximately 17 miles east of Shiprock, New Mexico and terminates at the San Juan Lateral Water Treatment Plant approximately 6 miles east of intersection of U.S. Highway 491 and Navajo Route 36 in San Juan County.

1.02 PRINCIPAL COMPONENTS OF WORK

A. The principal components of work include the following items:

1. 42-inch diameter buried water transmission pipe.
2. 48-inch diameter buried water transmission pipe.
3. Ground level regulating tanks, yard, and access road.
4. Wash crossings.
5. Bored crossings.
6. Precast manhole structures.
7. Concrete thrust collars, tapers, and encased miter bends.
8. Buried manholes.
9. Valves, air valves, and blowoffs.
10. Road crossings.
11. Utility crossings.
12. Erosion control.
13. Cathodic protection.
14. Supervisory Control and Data Acquisition (SCADA) equipment and fiber optic cabling.

1.03 SPECIFICATIONS REQUIREMENTS

A. Requirements in Division 1, General Requirements, apply to Divisions 2 through 53.

B. Imperative statements in these specifications are Contractor requirements, unless otherwise stated.

C. Where specifications are written in streamlined form, the words “shall be” are included by inference where a colon (:) is used within the sentence or phrase.

1.04 DEFINITIONS

A. When specifications use a word or term defined in the Federal Acquisition Regulations (FAR), definition of word or term shall be in accordance with FAR sections in effect at the time solicitation was issued.

1.05 REQUIREMENTS

A. Design and construct per National Fire Protection Association, NFPA 101, Life Safety Code.

1.06 ACRONYMS

A. The following acronyms apply to specifications Divisions 1 through 53:

1. CO: Contracting Officer.
2. COR: Contracting Officer's Representative.
3. NTUA: Navajo Tribal Utility Authority.
4. OGR: Onsite Government Representative.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 12 10
OTHER CONTRACTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 OTHER WORK

A. During work under this contract, other work may be performed in the vicinity of the work by Government or other contractors, including:

1. San Juan Lateral – Block 2-3 Horizontal Directional Drilling.
2. San Juan Lateral – Reach 1 Pipeline Improvements.
3. San Juan Lateral – Frank Chee Willetto Reservoir Improvements.
4. San Juan Lateral – Pumping Plant No. 1.
5. San Juan Lateral Water Treatment Plant.
6. San Juan Lateral – Reach 1 Bypass

B. Cooperate and coordinate with other contractors on access to and use of work areas and contractor use areas. Comply with clause at FAR 52.236-8, Other Contracts.

C. Coordinate work with COR so to not interfere with work of other contractors or Government in vicinity of work.

D. Cooperate and coordinate with other contractors on traffic control and use of temporary utilities.

E. Access roads are not for sole use of any one contractor.

F. Cooperate and coordinate with other contractors on maintaining dust-free operations.

G. Cooperate and coordinate work with surrounding residents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 14 10
USE OF SITE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. Cleaning Manual — Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species, available at: https://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2021.pdf

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 14 10-1, Land Use and Landscape Rehabilitation Plan:

1. Use site on Right-of-Way (ROW) or easements:

a. Show use location and extent of impact. Uses include but are not limited to the following:

1) Buildings and service areas including onsite offices, shops, warehouses, storage areas, fuel and oil storage areas, and fabrication yards.

2) Parking areas, temporary roads, and haul routes.

3) Utilities including gas, air, power, and water lines; fire hydrants; and compressor station.

4) First-aid and medical facilities.

5) Concrete, CLSM, pressure grouting, and aggregate plants. Show sizes, rated capacities, and general features of aggregate processing plant including transporting, storing, screening, and washing facilities; concrete batching and mixing plant; and concrete conveying, placing, and cooling plants.

6) Areas for processing, storing, and disposing of waste materials from construction operations.

7) Temporary fences.

b. Describe methods to preserve, protect, and repair, vegetation (such as trees, shrubs, and grass) and other landscape features on or adjacent to jobsite, which are not to be removed and which do not interfere with work required under this contract. Include methods to mark work area limits, protect disturbed areas, and prevent erosion.

c. Describe methods to reseed disturbed areas.

d. Describe methods to preserve, protect, identified cultural resources adjacent to jobsite, which are not to be removed and which do not interfere with work required under this contract. Include methods to mark work area limits, protect sensitive areas, and prevent erosion.

e. Describe methods to protect and repair, existing improvements and utilities at or near jobsite.

f. Describe methods for removing temporary structures and facilities, cleanup, and rehabilitating site after completion of construction activities.

g. Describe methods for cleaning construction equipment.

2. Submit revised drawings of changes in use of Government land made during design and erection stages or after use of Government land is in operation.

1.04 PROJECT CONDITIONS

A. Government land, ROW, and Easements as shown on drawings may be used for required construction facilities:

1. Refer to Contractor Use Areas as shown on drawings.

B. When private land is used for construction facilities, or other construction purposes, make necessary arrangements associated with use of private land:

1. Prior to using land outside of ROW, obtain cultural and environmental approvals in accordance with Section 01 31 19 – Project Management and Coordination and Section 01 57 90 – Preservation of Historical and Archeological Data.

C. Location, construction, operation, maintenance, and removal of construction facilities on ROW or Easements will be subject to approval of COR.

D. Do not interfere with work of other contractors, Navajo Nation or Government in vicinity, or with reservations made by Government for use of such land.

E. Government may backcharge contractor for costs incurred by the Government from contractors failing to cooperate with Government or other contractors.

F. Blasting is not allowed.

G. See 01 51 00 – Temporary Utilities.

H. Natural Conditions, Contractor to verify (https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm3340):

1. Ambient Temperature Range: Averages 16 to 93 degrees F with extremes of minus 21 to 110 degrees F possible.
2. Annual Average Precipitation: 7 to 8-inches.
3. Altitude: 5,000 to 5,450 feet.
4. Wind:
   a. Maximum sustained: 9.5 mph.
   b. Maximum gust: 64 mph.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CLEANING

A. Construction Equipment:

1. Before bringing on site, clean construction equipment, to remove dirt, vegetation, and other organic material to prevent introduction of noxious weeds, and invasive plant and animal species.
2. Contractor cleaning procedures shall result in equipment and vehicles being cleaned as well or better than procedures described in Cleaning Manual.
3. OGR will inspect construction equipment following procedures described in Cleaning Manual before allowing equipment onsite.

B. Within Mesa Verde Cactus Monitoring Area, in accordance with Section 01 57 60 – Protected Species.

3.02 MAINTENANCE

A. Clean and service portable toilets weekly or more frequently as directed by OGR.

B. Keep approach walks free of mud, water, ice, and snow.

3.03 RESTORATION

A. Restore Contactor use areas to preconstruction condition.

B. Restore temporary construction roads to original contours and make impassable to vehicular traffic when no longer required.

C. After completion of work, regrade and scarify Government land, easements, and ROWs used for construction purposes and not required for completed installation so that surfaces blend with natural terrain and are in a condition that facilitates revegetation, provides drainage, and prevents erosion.

END OF SECTION

SECTION 01 14 12
WORK RESTRICTIONS AND LIMITATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 WORK RESTRICTIONS AND LIMITATIONS

A. Allowable Work Hours: Sunrise to sunset, Monday through Saturday, unless otherwise authorized by COR.

B. Comply with noise and light restrictions listed in Section 01 57 20 – Environmental Controls and 01 35 20 – Safety and Health.

C. Perform work in roadways in accordance with Section 01 55 20 – Traffic Control.

D. Contractor may not access the north and west sides of Road 6800 until temporary wire safety fence is installed in accordance with Section 01 56 32 – Temporary Safety Fence.

E. No vehicles or construction equipment will be permitted to drive across the following, unless otherwise approved by the COR:

1. Shumway Arroyo.
2. San Juan River.
3. Chaco River.

F. Reach 2 Station 2002+00 to 2074+00 shall be constructed, tested, and completed by November 1, 2027 in accordance with Section 33 11 10 – Pipeline General Requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 31 04
PARTNERING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 MEETINGS

A. Team scoping/partnering workshop will be held immediately following Notice to Proceed to discuss the specific elements related to the preconstruction services phase of the project. Discussion shall include submittal requirements and process, reconciliation of submittal review comments, project goals, project communication and issue escalation plan, schedule management, risk analysis, construction partnering.

B. Traditional construction Partnering workshops will be held in addition to the initial team scoping/partnering workshop.

1.03 INTENT

A. Discuss effectively and successfully implementing work throughout construction. Form an informal management partnership with the Contractor to develop a cohesive building team.

B. Form a bilateral relationship striving for mutual trust, dedication to common goals and an understanding of individual expectations and values.

C. Develop a cooperative management team drawing on strengths of each team member. Expected benefits include improved efficiency, cost effectiveness and innovation between parties to ensure a quality deliverable completed on time and within budget.

D. Anticipated partnership between the primary contractor, subcontractors, and Reclamation.

E. Partnering Sessions:

1. Facilitated by a third party selected by the Contractor with approval by Reclamation.
2. Held in Farmington, New Mexico.
3. One half-day initial partnering session.
4. Quarterly half day sessions during construction.
5. Half-day final lessons learned session after construction is completed.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 31 19
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost: Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions, available at https://www.usbr.gov/safety/rshs/index.html

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 31 19-1, Written Summary:

1. Written weekly summary of upcoming work, traffic plans and progress meeting minutes. Provide work schedule for next 3 weeks including list of RSNs and RFIs.

C. RSN 01 31 19-2, Off ROW Land Use Coordination:

1. Show expanded use location and extent of impact.
2. Request cultural approvals:
   a. In accordance with Section 01 57 90 – Preservation of Historical and Archeological Data.
   b. Minimum information required for cultural analysis: Map and UTM data in NAD83 format of the location, narrative of intended use of the new area, summary of intended access to the new area, and a need by date.
3. Request or revise Environmental Permits in accordance with:
   a. Section 01 57 20 – Environmental Controls.
   b. Section 01 57 30 – Water Pollution Control.
   c. Section 01 57 50 – Tree and Plant Protection.
   d. Section 01 57 60 – Protected Species.
4. Do not use proposed land until approved by COR:
   a. Approvals may require up to 6 months.

5. Requirement does not apply to existing commercial facilities.

D. RSN 01 31 19-3, Key Personnel:

1. Submit list of key personnel:
   a. Project Manager.
   b. Site Superintendent.
   c. Contractor's Onsite Safety Representative.
   d. Quality Control Supervisor.
2. Include resume of Project Manager and Site Superintendent.
3. CO approval of key personnel required prior to work being performed.
4. Personally Identifiable Information (PII) shall be encrypted using WINZip or Adobe Acrobat before transmitting electronically.

E. RSN 01 31 19-4, Replacement of Key Personnel:

1. Submit key personnel changes with a minimum notice of 48 hours to CO.
2. CO approval of changes in key personnel required prior to work being performed by new personnel.

1.04 QUALIFICATIONS

A. Project Manager

1. Comparable role on three projects of similar nature, size, complexity.
2. Employed by prime contractor.

B. Site Superintendent:

1. Comparable role on three projects of similar nature, size, complexity.
2. Employed by prime contractor.

C. Contractor's Onsite Safety Representative: Meet requirements of Section 01 35 30 – Contractor's Onsite Safety Personnel.

D. Quality Control Supervisor: Meet requirements of Section 01 46 00 – Quality Procedures.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROJECT COORDINATION

A. Coordinate work with COR, other Bureau of Reclamation (Reclamation) staff, Bureau of Indian Affairs, and other Federal, Tribal, State, and local agencies, as needed.

B. Facilitate onsite work with above listed agencies.

C. 48-Hour Look Ahead Notification:

1. Provide COR, OGR, Cultural Contract COR, and Cultural Resource Contractor via email, and phone with a 48-hour notice when Cultural Resource Contractor monitoring services are required.
2. Contact information including Cultural Contract COR and Cultural Resource Contractor will be provided at preconstruction meeting.

3.02 MEETINGS

A. The following meetings are considered significant, but do not relieve Contractor from responsibility of other meetings required by contract:

1. Preconstruction Meeting:
   a. Meet with Government prior to start of construction. Meeting to occur after approval of RSN 01 35 20-1, Safety Program.
   b. Provide, as a minimum, Project Manager, Project Superintendent, and Project Engineer for Preconstruction Meeting.
   c. Review will include, but may not be limited to:
      1) Use of premises by Contractor, Government, and public:
         a) Off ROW land use coordination.
      2) Construction facilities and controls.
      3) Access to work and haul routes.
      4) Temporary utilities.
      5) Survey layout and installation of temporary fencing of the entire project work area prior to surveying.
      6) Security.
      7) Housekeeping procedures.
      8) Schedules and sequence of work.
      9) Procedures for testing.
      10) Procedures for maintaining record documents.
      11) Special site requirements:

a) Archeological: Refer to Section 01 57 90 – Preservation of Historical and Archaeological Data.

b) Biological: Refer to Section 01 57 60 – Protected Species.

c) Environmental: Refer to:

i. Section 01 57 20 – Environmental Controls

ii. Section 01 57 30 – Water Pollution Control.

12) Roles and responsibilities:

a) Government organization and personnel.

b) Contractor organization and personnel.

c) Subcontractors.

d) Proposed work schedule.

13) Contract requirements:

a) Progress payments.

b) Invoices.

c) Differing site conditions.

d) Changes.

e) Superintendence by Contractor.

f) Payment for mobilization and preparatory work.

g) Submittal procedures.

h) Emails and telephone calls.

2. Cultural Resource Sensitivity Awareness Training:

a. Refer to Section 01 57 90 – Preservation of Historical and Archaeological Data.

b. Complete Government-provided training before initial groundbreaking. Schedule for training will be mutually agreed upon.

3. Preconstruction Safety Meeting:

a. Meet with COR prior to start of construction. Meeting to occur after approval of RSN 01 35 20-1, Safety Program.

b. Review will include:

1) Safety requirements.

2) Protection of cultural resources and cultural sensitivity training requirements.

3) Monthly joint safety policy meetings.

4) Weekly toolbox safety meetings.

5) Safety program.

6) Job hazard analysis.

7) Required safety inspections.

8) Government will monitor Contractor's operations for compliance with RSHS.

4. Progress Meetings:

a. Meet weekly with Government to review:

1) Progress made.

2) Review as-built drawings.

3) Difficulties in performing work.

4) Safety performance.

5) Resolution necessary to meet specifications requirements.

6) Status of contract documents (e.g., RFI's, submittals).

7) Three-week look ahead, including installing temporary safety fencing and upcoming cultural monitoring areas discussed.

8) Updating of progress reports.

9) Other items as determined by COR and OGR.

b. Develop meeting agenda and minutes, may be used as Written Summary.

END OF SECTION

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SECTION 01 31 30
CONTRACT DOCUMENT MANAGEMENT SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Contract Document Management System:

1. Payment: Lump-sum prices offered in Price Schedules.

1.02 DEFINITIONS

A. CDMS: Contract Document Management System:

1. Contract documents include, but are not limited to:
   a. Specifications.
   b. Contract Drawings.
   c. Submittals.
   d. RFCs: Requests for Change (Contractor generated documents).
   e. RFIs: Requests for Information (Contractor generated documents).
   f. RFPs: Requests for Proposal (Government generated documents).
   g. CMs: Contract Modifications.
   h. Contractor Proposals.
   i. Value Engineering Proposals.
   j. Invoices and Progress Payments.
   k. Contract Schedules.
   l. Meeting Agendas and Meeting Minutes.
   m. Letters and Memos.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 31 30-1, Approval Data:

1. System provider experience, number of systems operations, references.
2. Documentation of system capabilities.
3. Instructions for system use.

C. RSN 01 31 30-2, Final Data:

1. Documents uploaded to CDMS on a Reclamation provided USB drive.

1.04 QUALIFICATIONS

A. System Provider: At least 5 years successful performance in providing required services.

1.05 CDMS REQUIREMENTS

A. CDMS shall be capable of generating, storing, tracking, categorizing, and managing Contract Documents.

B. Access:

1. Web-based:
   a. Contract Documents are stored and accessed by authorized individuals via an internet site.
   b. Compatible with web browsers Microsoft Edge, Apple Safari, Mozilla Firefox, and Google Chrome.
2. Ability to upload Contract Documents and make available for user download in the following supported file formats, minimum:
   a. Adobe Acrobat.
   b. MS Word.
   c. MS Excel.
   d. MS Project.
   e. Oracle Primavera P6 Project Manager.
   f. AutoCAD Civil 3D Version 2025 or later.
   g. Contract Manager.
3. Allow Contract Documents to be prepared by Contractor or by Government:
   a. Preparing organization will control access of documents. See Document Security and Backup paragraph below.
4. Contractor and Government shall each have a project manager for CDMS:
   a. Each project manager shall have capabilities to assign users within their organization and to assign user rights which control access to documents based on user class and document type.
   b. Each organization shall be capable of defining its access hierarchy.
   c. Inclusion of users will be prerogative of organizational project manager.
   d. Government shall be able to create and modify project properties (i.e., Contractor, project location, description, bid amount, and project directory).

5. Email notifications shall be automatically sent to selectable users when new documents are submitted and available for viewing, or alerts are generated. Examples include:
   a. Updates to project information (e.g., entry of a new submittal).
   b. Changes to project information (e.g., approval of a submittal).
   c. Alerts (e.g., submittal under review for greater than 15 days without action).
6. Ability to link files; examples include:
   a. RFP linked to a CM.
   b. Submittal linked to a Specification or Drawing.

C. Reports:
1. CDMS shall:
   a. Generate reports that list and sort documents by status; examples include:
      1) Submittals that have been approved.
      2) Invoices paid to date.
      3) RFIs under review.
   b. Generate alerts when documents requiring action approach or exceed allowable time.
   c. Generate customizable summary reports; examples include:
      1) Submittal Turn-around.
      2) RFI Turn-Around.
      3) CM Processing Turn-Around.
      4) Total CM Costs.
      5) Total CM Request Exposure.
   d. Reports shall be printable, exportable as searchable .pdf or printer friendly .html, and exportable to Excel (.xls, .xml, or .csv).
   e. Ability to link from an item in a report directly to item by clicking on it:
      1) For example: In submittal report, clicking on submittal that is 15 days old takes you directly to information on that submittal.
   f. Capable of producing complete and logically organized set of documents within CDMS in both .pdf and .xml formats.

D. Document Security and Backup:
1. Secure Server Language (SSL) encryption for secured data exchange between browser and server (Secure access to documents and information).

2. Allow document access security until authoring party chooses to share it with others:
   a. Show parties that have access to document.
   b. Extent of document sharing shall be determined by authoring party.
   c. Once documents are shared, track documents so that changes cannot occur without record of changes.
3. Backup/archiving to FTP site of documents to which an organization has access on a regular (minimum monthly) basis. Backups shall be in .pdf format.
4. Documents shall be downloadable to FTP sites where Government and other organizations can access their own data confidentially.

E. General Tracking and Control:
1. Documents shall be grouped into categories (Submittals, RFI, RFP, CM, Payments, Daily Inspection Reports, and Meeting Minutes).
2. CDMS shall track:
   a. When documents were received or returned, as well as status of documents (e.g., Under Review; Returned, Approved or Rejected).
   b. Document changes including who entered or changed document and date change was made.
   c. When a reviewer has opened an item.

F. Submittal Tracking and Control:
1. Ability to create master list of submittals ("Schedule of Submittals").
2. Supply standard submittal form for entering information. Allow customization of standard submittal form. Contractor shall be able to:
   a. Enter required submittal number (RSN), title, description, due date, and specification section.
   b. Upload submittal data in electronic format.
3. Track date received, date response due, date returned, and status:
   a. Status designations may be modified to fit Government standard designations – A/AAN/PAR/NA/ACK (Approved/Approved As Noted/Partially Approved - Resubmit/Not Approved/Acknowledged).
4. Supply Submittal Tracking form for Government to enter review comments and action taken. Allow customizing of submittal tracking form.
   a. Allow for Government to route submittal to third parties (e.g., consultant, internal design or operations and maintenance groups) by generating design-review transmittals with each submittal package item, to track status of individual sub-items within the submittal package, and to route each sub-item to appropriate reviewers.

5. Ability to generate automatic notification after specified days without response.

G. RFI Tracking and Control:

1. Provide standard RFI form to enter information.
2. Ability to create or attach documents to the RFI form or links to other documents within CDMS.
3. Ability for Reclamation to route RFI to appropriate reviewers and for reviewers to enter comments into standard response form.

H. Contract Modifications:

1. Supply standard Contractor Proposal form with ability to attach documents and link to other documents within CDMS.
2. Supply ability to upload Government's standard CM form and RFP forms, or create an acceptable alternative, to enter information.
3. Ability to attach documents to these forms, and link to other documents within CDMS.
4. Ability for Contractor to respond to RFP and CM form with Cost and Time impacts.
5. Ability to track date CM issued and date responded, with automatic notification after specified days without response.

I. Cost Tracking and Payment Request Management:

1. Ability to import payment bid items cost from a MS Excel spreadsheet.
2. Ability to edit percent complete and payment amount each month. Format to be spreadsheet; for example, items available for editing at once, rather than needing to edit one item at a time, save, open next item, and edit that.

J. Correspondence:

1. Ability to generate letters and memos:
   a. Ability to attach documents to letters and memos, and to reference other documents within CDMS.
   b. CDMS shall automatically assign sequential numbers to letters and memos.
2. Ability to generate responses to letters and memos:
   a. System automatically generates memo suffixes (e.g., the 1st response to Memo 32 to be 32.1 and 2nd response to be 32.2).
3. Official correspondence from Government to Contractor shall contain Government's official letterhead and corresponding logos.
4. Ability to generate meeting agendas and meeting minutes and to attach documents to the minutes:

a. CDMS shall automatically assign sequential meeting numbers.

K. Miscellaneous Tracking and Controls. Ability to:

1. Generate logs tracking RFIs, CORs, COs, Submittals, Payments, Memos, daily inspection reports, survey requests, plant inspection reports, and testing reports.
2. Filter logs based on criteria:
   a. Submittals: Specification Section, Days Out, Status (A/AAN/PAR/NA/ACK).
   b. RFIs: Days out, Status (Open/Closed), Specification Section/Drawing Number, Responsibility/Ball-In-Court.
3. Sort logs based on a criteria (e.g., for Submittal, Specification Section, Days Out, Status, or other criteria determined by COR).
4. Supply forms to match Government's CM Form and Progress Payment Form or other forms when needed.
5. Track Cost Exposure with links to RFI and CM requests.
6. Measure productivity benchmarks on a project such as computing average review days for RFIs and submittals, categorize CMs, and track total CM percentages by category.
7. Keyword search of documents in database.
8. Allow online Payment Requests (electronic invoicing) by Contractor.

L. Budget and Funding Source Tracking:

1. Ability to enter funding sources and assign contract line items to multiple funding sources.

PART 2 PRODUCTS

2.01 SOFTWARE

A. Procore, as manufactured by Procore, www.procore.com; or equal, having the following essential characteristics: Capable of performing requirements of Part 1 and Part 3.

PART 3 EXECUTION

3.01 IMPLEMENTATION

A. CDMS shall be in place and operating before Contractor transmits Contract Documents to Government, except RSN 01 31 30-1, Approval Data.

1. CDMS operation includes COR, or other authorized Government representative, having program control to assign users and user rights to Government personnel to access appropriate areas of system.

B. Input Schedule of Submittals before making submittals. Include:

1. RSNs listed in Table 01 33 00A – List of Submittals.
2. Scheduled submittal date.

C. Provide a report of submittal status monthly or as requested by COR. Submittal status report shall be in a table format and include:

1. Required Submittal Number (RSN).
2. Section Title.
3. Submittal Title.
4. Date Submitted.
5. Date of Response.
6. Approval Status: A/AAN/PAR/NA/ACK (Approved/Approved As Noted/Partially Approved - Resubmit/Not Approved/Acknowledged).
7. Days in Review.
8. Due Date.

D. CDMS shall be operational until final project closeout.

END OF SECTION

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SECTION 01 32 10
CONSTRUCTION PROGRAM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Costs:

1. Developing Baseline Schedule: Include in lump-sum price offered in Price Schedules for mobilization and preparatory work.
2. Updating and Using Construction Program: Include in prices offered in Price Schedules for other items of work.

1.02 DEFINITIONS

A. Schedule: Critical Path Method (CPM) of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and critical path of project.

B. Project Calendar(s): Cross reference of numerical work days with calendar days. Project calendar serves as basis for day/date conversion and assigns work days and non-workdays.

C. Resources: Equipment, labor or crews, materials, subcontractors, fabricators, manufacturers, and consultants.

D. Out of Sequence Work: An activity that starts before its predecessor activities are completed.

1.03 REFERENCE STANDARDS

A. Associated General Contractors of America (AGC)

1. AGC Manual-04 — Construction Planning and Scheduling Manual, 2nd Edition

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals:

1. Furnish database files in format compatible with Oracle Primavera P6 Professional Project Management.
2. Furnish schedule and analysis via CDMS.
3. Upon request, provide information and data used to develop and maintain Construction Program to COR.

B. RSN 01 32 10-1, Representative Information:

1. Designation of authorized representative to develop and maintain Construction Program. Include resume with training and experience.

C. RSN 01 32 10-2, Baseline Schedule:

1. Include:

a. Construction Program/Schedule database.

b. Definition of project calendars.

c. Primavera layout file (.plf).

d. Gantt chart (bar chart) for project on 11- by 17-inch prints and in portable document format (.plf).

e. Activity report including logic constraints consisting of predecessors, successors, and constraint dates.

f. Tabular listings of resources and resource limitations used to produce baseline schedule. Correlate resources with schedule assumptions and offered price. Resource listing may be independent of schedule database.

g. Narrative explanation of project schedule development. Include impacts or resource limitations and weather conditions on project schedule development. Include planned number of work hours per day and hours per day for subcontractors.

D. RSN 01 32 10-3, Updated Schedule Reports:

1. This submittal is required for a proper invoice for progress payments in accordance with the clauses at FAR 52.232-27, Prompt Payment for Construction Contracts.

2. Include:

a. Construction Program database with updated activity and milestone data.

b. Definition of project calendars if revised from baseline calendars.

c. Primavera layout file (.plf).

d. Gantt chart for project on 11- by 17-inch prints and in portable document format (.plf).

e. Narrative report specifically stating status of project:

1) When negative float exists, cite specific actions and conditions which caused "behind schedule" condition and provide proposed course of action to complete project within specified delivery time. When float changed from previous month’s updated schedule, explain reason for change.

2) List of Contractor-initiated changes to current schedule stating reason for action taken and any unresolved issues relating to Construction Program. Government reserves right to reject Contractor-initiated changes to current schedule which negatively impact any Government action which was initiated on basis of current schedule.

3) Discuss contract milestones and significant activities that were started, continued, or completed during update period or scheduled during next update period.

f. Submittals Register:

1) List submittals as listed in Table 01 33 00A – List of Submittals.

2) Update Submittal Register monthly to include submittals and revised submittal. Register fields shall include RSN name and number, planned submittal date, date submitted, date of response, status (e.g., approved, approved as noted/partially approved - resubmit/not approved/ acknowledged).

3) This register document is separate from scheduling database.

E. RSN 01 32 10-4, Time Impact Analysis:

1. Include:

a. Construction Program database with proposed revised activity and milestone data.

b. Proposed revised schedule due to change or delay with added, changed, or deleted activities.

c. Primavera layout file (.plf).

d. Gantt chart for project on 11- by 17-inch print(s) and in portable document format (.plf).

e. Narrative report explaining results and conclusions.

1.05 QUALIFICATIONS

A. Representative: Experienced in developing and maintaining construction schedules and knowledgeable of activities and progress onsite to develop and maintain accurate and reliable schedules.

1.06 GENERAL

A. Develop, maintain, and use Construction Program to plan, monitor, evaluate, and report accomplishment of work.

1.07 SCHEDULES

A. Prepare construction schedules using Critical Path Method, outlined in AGC Manual. Use computer software program to perform mathematical analysis of scheduling data:

1. Prepare schedule based on required sequence and interdependence of activities. Logically sequence activities.
2. Prepare detailed activity network for accomplishing required work organized by Work Breakdown Structure (WBS). Utilize WBS in lieu of activity codes for organization of schedule. If activity codes are utilized in addition to WBS, use unique activity code names assigned as project codes rather than global codes.
3. Activities except "Award" shall have predecessor activities and activities except "Contract Complete" shall have successor activities.
4. Meet contract requirements; milestone(s) in accordance with the clause at FAR 52.211-10, Commencement, Prosecution, and Completion of Work; and relevant clauses and specification sections. Include interim milestone dates, Government interface dates, contract completion date, and other time or seasonal constraints specified in contract documents.
5. Include work of subcontractors, Government interfaces, and contract milestones.
6. Adjust Construction Program/schedule for seasonal weather conditions. Provide a narrative explaining expected weather and plan for incorporation in schedule. Consider work influenced by high or low ambient temperatures or precipitation. Utilize Primavera P6 calendars to depict historical weather days that impact work. Assign weather calendars to work impacted by weather.
7. Define activities to level of detail resulting in durations being no greater than 20 workdays:
   a. Durations for administrative activities (e.g., submittals and reviews) fabrication, manufacturing, and typical level of effort activities (e.g., dewatering, storm water management) will not be subject to workday duration limitations.
8. Include separate activities for submittal preparation and submittal reviews when submittal addresses work that involves significant quantities, long lead times, is on the critical path or near critical path, or as requested by COR. Assign Government submittal review activities to a seven-day calendar with durations as specified in Section 01 33 00 – Submittals. Include required Submittal Number (RSN) in activity description.
9. Include separate activities for fabrication or manufacturing when work involves significant quantities, long lead times, is on the critical path or near critical path, or as requested by COR.
10. Include contract title, contract number, and Contractor's name on transmittal cover sheet and each sheet of Gantt chart.

11. For each activity on Gantt chart, display activity identification number, activity description planned or original duration, start date, finish date, total float, and calendar identification. Do not display early start and late start fields.
12. Include table of abbreviations used in schedule, listed and defined alphabetically.
13. Use finish to start logic relationships between activities. Do not utilize start to start, finish to finish, or start to finish logic relationships. Do not use negative lead or lag times.
14. Use durations in units of whole workdays.
15. Provide best estimate of time required to complete activity considering quantity of work, work conditions, location of work, and planned resources for activity.
16. Equate durations of Government reviews and other identified actions to maximum number of calendar days specified in their respective paragraphs.
17. Establish workday calendar(s), and use these in schedule to translate activity's workday duration into calendar dates. Use unique calendar names unique; do not use software default calendar names. Save as project calendars, not global calendars.

B. Baseline Schedule:

1. Represents Contractor's as-planned approach to accomplishing work. Do not include actual start dates, percent completes, or actual finish dates.

C. Updated Schedule:

1. Meet monthly with COR at Government's project office, or at location approved by COR, to review progress made to end date of progress payment period. Establish dates that activities were started and completed and remaining duration for each activity started but not completed during period:
   a. Discuss and mutually agree upon changes to schedule.
   b. Out-of-sequence activities are not allowed. Revise logic to reflect change in work plan.
   c. Finalize updated Construction Program database with mutually agreed upon changes.
2. Following receipt of executed contract modification, incorporate activity data stipulated in modification into current schedule for inclusion in next scheduled progress update. Provide appropriate logic relationships for revised activities.
3. Assign unique project file name for each schedule update.

1.08 TIME IMPACT ANALYSIS

A. Provide time impact analysis for contract changes, (e.g., a change order, proposed modification, or value engineering change proposal) to support a claim or request for equitable adjustment to contract which involves a delay or accelerated schedule.

B. CO may use time impact analysis to determine if a time extension or reduction to contract milestone dates are justified:

1. Time impact analysis is required for contract changes whether Contractor's current schedule milestone dates are same as, earlier than, or later than, those required under contract.

2. Changes, additions, or deletions to activities; activity durations; or activity time frames; or activity predecessors and successors will not automatically determine that an extension or reduction of contract time is warranted or due Contractor.

3. Time extensions for performance will be considered only to extent that Contractor's current scheduled milestone dates exceed contract milestone dates.

C. Float is not for exclusive use by or benefit of either Government or Contractor.

D. Perform time impact analyses using data in most recent approved schedule update prior to change or delay event:

1. Prepare proposed revised schedule and narrative description describing and highlighting changes or delays.

2. Prepare summary comparing results of two schedule analyses: One using current schedule data from last approved updated schedule prior to event requiring analysis, and one using proposed schedule data incorporating changes or delays:

a. Show contract milestones and activities whose periods of performance have shifted as result of change which affects production and/or manufacture schedules, material orders, construction seasons, and labor and/or equipment utilization.

b. For activities directly affected by change or delay, include current and proposed items:

1) Activity description.

2) Types and quantities or major pieces of equipment, principal manpower, and pacing materials (materials that affect activity start, duration, or finish).

3) Activity duration.

4) Narrative containing rationale used in developing proposed logic relationships and activity data.

c. Data date for impacted schedule used in comparison shall be same as approved updated schedule data date.

d. Base schedule comparisons on status or work and available float at time CO directs or proposes change to work, Contractor submits a value engineering change proposal, or when a delay occurs as shown in approved updated schedule.

1.09 REVIEW AND EVALUATION

A. Baseline Schedule:

1. Within 21 calendar days after receipt of baseline schedule:
   a. CO will accept or not accept proposed baseline schedule.
   b. Upon request from CO, meet with COR for joint review of proposed baseline schedule.
   c. If schedule is not accepted, revise and resubmit within 7 calendar days following date of rejection letter.
2. Do not proceed with onsite work, except mobilization and surveying, until baseline schedule has been approved by Government.

B. Updated Schedules:

1. Government will require 21 calendar days after receipt of each monthly updated schedule to review and accept or not accept updated schedule.
2. Submit updated schedule at time of submission of each invoice request for progress payment.
3. If updated schedule is not accepted, revise and resubmit updated schedule within 7 calendar days following date of rejection letter.

C. Failure to include any element of work in schedules will not release Contractor from completing required work under contract.

D. Performance will be evaluated by Government using approved CPM schedules.

1.10 FAILURE TO COMPLY

A. Failure to comply with requirements of this Section shall be grounds for a determination by CO that Contractor is not prosecuting work with sufficient diligence to ensure completion within specified time.

B. CO may terminate Contractor's right to proceed with work, or any separable part of it, in accordance with default terms of this contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost: Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME Y14.1-2020 — Decimal Inch Drawing Sheet Size and Format

B. National Institute of Building Sciences (NIBS)

1. NIBS NCS-2014 — United States National CAD Standards, Version 6

1.03 DEFINITIONS

A. Days: Calendar days.

B. Required Submittal Number (RSN): Identifies items to be submitted together as a complete submittal.

C. Submittal Types, as listed in Table 01 33 00A – List of Submittals:

1. A – Action:
   a. Government will respond as to adequacy of submittal.
   b. Action submittals: Considered to be "shop drawings" within terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction.
2. I – Informational:
   a. Government will acknowledge receipt of Informational submittals.
   b. Government may reject an Informational submittal when submittal does not comply with contract. Contractor shall correct mistakes or deficiencies in rejected Informational submittals and resubmit.
   c. Informational submittals: Considered to be "shop drawings" within terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction, except that approval by Government is not required.

1.04 SUBMITTAL REQUIREMENTS

A. In case of conflict between requirements of this section and requirements included elsewhere in these specifications, requirements included elsewhere take precedence.

B. General:

1. Prepare in English.
2. Label with contract number, title, and RSN.
3. Measurement units: US Customary Units.
4. Provide unique transmittal number for each submittal.

C. Drawings:

1. Minimum identification in title block:
   a. Contract number and title.
   b. Contractor's or supplier's title and drawing number.
   c. Date.
2. Reserve 3- by 3-inch space next to title block for review stamps.
3. Print Size: D size (22- by 34-inches) as defined by ASME Y14.1.
4. Draw to scale using computer drafting or drafting equipment, unless otherwise specified:
   a. Computer drafted drawings:
      1) In accordance with NIBS NCS.
      2) Electronic file format: Compatible with AutoCAD, Version 2018 or later.
      3) Compile using "eTransmit" utility in AutoCAD.
   b. Drawing prepared with drafting equipment, when allowed: Lettering shall be neat.
5. Drawings designated as "Government Format" in specifications:
   a. Computer drafted.
   b. Government will provide electronic AutoCAD format template.
   c. Title block and sheet format:
      1) As shown on Standard Drawing 40-D-7102.
      2) Government will provide template.
      3) Government will provide specific title block information to be used.

6. Final Drawings:
    a. Computer drafted.
    b. Government will provide electronic AutoCAD format template.
    c. Show as-built changes, including revision dates, made during installation. Indicate changes by clouding.
    d. Electronic Files: On Reclamation issued USB Drive.

D. Product Data:
1. Mark manufacturer's data for commercial products or equipment, such as catalog cut sheets:
    a. Identify manufacturer's name, type, model, size, and characteristics.
    b. Illustrate that product or equipment meets requirements of specifications.
    c. Mark items to be furnished in a manner that will photocopy (no highlighter).
    d. Strike through items that do not apply.

E. Certifications:
1. Certifications by a registered professional: Signed and sealed by registered professional:
    a. Not required for non-design work.
2. Manufacturer’s certifications: Signed by authorized representative of manufacturer.

F. Manuals:
1. Copies:
    a. Printed copies: Bound and indexed.
    b. Electronic copies: Searchable Adobe .pdf on Reclamation issued USB Drive:
        1) Bookmark longer files to assist in navigating file.
        2) Electronic files may be submitted as separate parts of a manual. After each separate electronic file is approved, compile each approved electronic file to assemble an entire manual which shall be consistent with final manual submittal.
2. Contents:
    a. Parts identification lists, lists of special tools, and accessories.
    b. Schematics and wiring diagrams.
    c. Detailed instructions for installing, operating, lubricating, and maintaining equipment.

d. As-built drawings, photographs, and test records or reports if required by specifications.

G. Photographs:

1. Digital files: In .jpeg or similar format.

1.05 SUBMITTALS PROCEDURES

A. Submit only checked submittals. Submittals without evidence of Contractor's approval will be returned for resubmission.

B. Submit complete sets of required materials for each RSN as specified in "Submittals Required" column in Table 01 33 00A – List of Submittals. A complete set includes all listed items for RSNs with multiple parts.

C. Submit sets specified in "Sets to be sent:" columns in Table 01 33 00A – List of Submittals:

1. Submittals identified with "CDMS" in "Sets to be sent" column shall be submitted electronically in accordance with Section 01 31 30 – Contract Document Management System.
2. Submittals identified with "CDMS" in the top row of the "Sets to be sent" column require approval (Action) or acknowledgement (Informational) before sending required sets of hardcopy submittals.
3. Submittals identified with "CDMS" in the bottom row of the "Sets to be sent" column require submittal of hardcopy submittals before finalizing submittal in CDMS.

D. Include the following information in transmittal letters:

1. Contract number and title.
2. RSN for each attached submittal.
3. Responsible code.
4. Number of sets for each RSN.
5. Identify submittal as initial or resubmittal.

E. Resubmittal of submittals not approved:

1. Mark changes such that they are readily identifiable and show revision date.
2. Describe reasons for significant changes in transmittal letter.
3. Resubmit returned submittals within 28 days after receiving the comments, unless otherwise directed.
4. Requirements for initial submittals apply to resubmittals.

1.06 REVIEW OF SUBMITTALS

A. Time Required:

1. Submittal review will require 28 days for review of each submittal or resubmittal, unless otherwise specified.
2. Time required for review of each submittal or resubmittal begins when complete sets of materials required for a particular RSN are received and extends through digital signature date stamp and upload date in CDMS.

B. Time in Excess of Specified:

1. CO may extend contract completion date to allow additional time for completing work affected by excess review time:
   a. Time extension will be to extent that excess review time caused delay to contract completion date.
   b. Time extension will not exceed time used in excess of specified number of days for review of submittals or resubmittals.
   c. Concurrent days of excess review time resulting from review of two or more separate submittals or resubmittals will be counted only once in extending contract completion date.
2. No time extension will be allowed if Contractor fails to make complete action submittals in sequence and within time periods specified.
3. Adjustment for delay will be made only to extent that:
   a. Approval was required under contract, and
   b. Requests for approval were properly and timely submitted and were approved.
4. Adjustment will be subject to terms of paragraphs (b) and (c) of the clause at FAR 52.242-14, Suspension of Work; however, no such delay shall be deemed to be a "suspension order" as the term is used in that clause.

C. Return of Submittals:

1. Return of submittals will be by CDMS response or hard copy, as applicable.
2. Action Submittals: One set of submittals required for action will be returned either approved, partially approved, approved subject to identified changes and resubmit, or not approved:
   a. Submittals that are not approved shall be revised and resubmitted.
   b. Do not change designs without approval of CO after drawings, documentation, and technical data have been approved.
   c. Exception: Schedules will be either accepted, partially accepted or not accepted.

3. Informational Submittals: Government will acknowledge Informational submittals:

   a. Informational submittals will not be returned when they comply with specifications.

   b. Informational submittals that do not comply with specifications may be returned for resubmittal or additional information may be requested.

1.07 HARD COPY OF TRANSMITTALS

A. Addresses for codes listed in Table 01 33 00A – List of Submittals:

   1. Contracting Officer, Bureau of Reclamation, Attn: UC-840, 125 South State St., Room 6107, Salt Lake City, UT 84138-1147.

   2. Construction Engineer, Bureau of Reclamation, 1235 La Plata Hwy, Farmington, New Mexico, 87401.

   3. Technical Service Center, Bureau of Reclamation, Attn: 86-68160, PO Box 25007, Denver CO 80225-0007; Express Mail: Sixth and Kipling, Building 67, Room 152.

   4. Navajo Tribal Utility Authority (NTUA), Attn: Operations Manager, PO Box 1749, Shiprock, NM 87420.

B. Send original transmittal letter with appropriate number of sets to office listed in "Responsible Code" column in Table 01 33 00A – List of Submittals:

   1. Responsible codes starting with "86-6" are located in the Technical Service Center (TSC). Send these submittals to the TSC address shown above.

C. Send copy of transmittal letter with appropriate number of sets to offices that are not the responsible code but show "No. of sets to be sent to" in Table 01 33 00A – List of Submittals.

D. Provide copy of transmittal letter on CDMS.

E. When "No. of sets to be sent to" is 0, send a copy of transmittal letter to that office.

F. Submittals required by the specifications, but not listed in Table 01 33 00A – List of Submittals:

   1. Submit in accordance with this section.

   2. Submit to CE, unless otherwise specified.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01 33 00A – List of Submittals

* Submittal types: A – Action, I – Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center, NTUA indicates the City of Gallup New Mexico.

RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
01 14 10-1	Use of Site	Land Use and Landscape Rehabilitation Plan	At least 63 days before use of ROW	A	CE	CDMS			
01 31 19-1	Project Management and Coordination	Written Summary	Monthly once onsite construction begins	A	CE	CDMS			
01 31 19-2	Project Management and Coordination	Off ROW Land Use Coordination	At least 6 months before use of OFF ROW land	I	CE	CDMS			
01 31 19-3	Project Management and Coordination	Key Personnel	Within 7 days after receipt of Notice of Award	A	CE	CDMS			
01 31 19-4	Project Management and Coordination	Replacement of Key Personnel	A minimum of 2 business days prior to work being performed by new personnel	A	CE	CDMS			
01 31 30-1	Contract Document Management System	Approval Data	Within 21 days of Award	A	CE	0	1	0	0
						CDMS			
01 31 30-2	Contract Document Management System	Final Data	Within 14 days of completion of work	A	CE	0	2	2	0
						CDMS			
01 32 10-1	Construction Program	Representative Information	Within 7 days after receipt of Notice of Award	I	CE	CDMS			
01 32 10-2	Construction Program	Baseline Schedule	Within 21 days after receipt of initial Notice to Proceed	A	CE	CDMS			
01 32 10-3	Construction Program	Updated Schedule Reports	Monthly or with Progress Payments	A	CE	CDMS			

Table 01 33 00A – List of Submittals

* Submittal types: A – Action, I – Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center, NTUA indicates the City of Gallup New Mexico.

RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
01 32 10-4	Construction Program	Time Impact Analysis	Within 28 days after CO directs a contract change, with any proposal for a future modification, with any value engineering proposal, or with any request or claim for an equitable adjustment to the contract.	A	CE	CDMS			
01 35 10-1	Safety Data Sheets	Complete LHM and SDS	At least 14 days before jobsite delivery of hazardous material	I	CE	CDMS			
01 35 10-2	Safety Data Sheets	Updated LHM and SDS	At least 14 days before jobsite delivery of hazardous material not previously listed	I	CE	CDMS			
01 35 20-1	Safety and Health	Safety Program	Submitted and accepted before commencing onsite work. Submit at least 45 days before beginning onsite work. See Section 1.03 of RSHS	A	CE	CDMS			
01 35 20-2	Safety and Health	Monthly Accident Summary Report	First day of each month. See paragraph 1.03.5.f of RSHS	A	CE	CDMS			
01 35 30-1	Contractor's Onsite Safety Personnel	Resumes	At least 45 days before beginning onsite construction; resubmit upon personnel change	A	CE	CDMS			

Table 01 33 00A – List of Submittals

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
01 35 30-2	Contractor's Onsite Safety Personnel	Safety Inspection Reports	At least once each week	I	CE	CDMS			
01 46 00-1	Quality Procedures	Contractor Quality Control (QC) Plan	At least 45 days before beginning onsite work	A	CE	CDMS			
01 46 00-2	Quality Procedures	Contractor's Quality Daily Report	Weekly	I	CE	CDMS			
01 46 00-3	Quality Procedures	Quality Control Supervisor (QCS) Resume	At least 45 days before beginning onsite work. Resubmit upon personnel change.	A	CE	CDMS			
01 46 00-4	Quality Procedures	Contractor's Quality Testing Plan	At least 45 days before beginning onsite work	A	CE	CDMS			
01 46 00-5	Quality Procedures	Summary of Monthly Test Results	Monthly, on or before 5th day of each month	A	CE	CDMS			
01 46 20-1	Testing Agency Services	Testing Agencies Services Plan	At least 45 days before testing is required	A	CE	CDMS			
01 55 00-1	Vehicular Access and Parking	Pre-construction Digital Recording	At least 21 days before beginning onsite work	A	CE	0	1	0	0
01 55 00-2	Vehicular Access and Parking	Right of Way (ROW) Access Plan	At least 21 days before beginning onsite work.	A	CE	CDMS			
01 55 00-3	Vehicular Access and Parking	Post-Construction and Post-Repair Digital Recording	At least 21 days before leaving site.	A	CE	0	1	0	0
01 55 20-1	Traffic Control	Information of Traffic Control Plan (TCP)	At least 70 days before affecting public traffic.	A	CE	CDMS			
01 55 20-2	Traffic Control	Approved NMDOT Permit(s)	At least 45 days before affecting public traffic.	A	CE	CDMS			
01 55 20-3	Traffic Control	Approved Permit(s) from San Juan County, Navajo DOT, and BIA	At least 45 days before affecting public traffic.	I	CE	CDMS			

Table 01 33 00A – List of Submittals

* Submittal types: A – Action, I – Information

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
01 56 10-1	Protection of Existing Installations	Plan for Protecting Existing Installations	At least 45 days before start of onsite construction work	A	CE	CDMS			
01 56 15-1	Protection of Existing Utilities	Utility Owner Acknowledgement	At least 45 days before start of onsite construction work	A	CE	CDMS			
01 56 15-2	Protection of Existing Utilities	Utility Crossing Investigation	At least 45 days prior to submitting RSN 33 11 12-5 and at least 45 days prior to excavation	A	CE	CDMS			
01 56 15-3	Protection of Existing Utilities	Work Plan within Utility Easements	At least 45 days before beginning onsite work	A	CE	CDMS			
01 57 20-1	Environmental Controls	Copy of Applicable Air Quality Permit	At least 14 days before beginning onsite work	I	CE	CDMS			
01 57 30-1	Water Pollution Control	Stormwater Pollution Prevention Plan (SWPPP)	At least 28 days before start of onsite construction work	A	CE	CDMS			
01 57 30-2	Water Pollution Control	Spill Prevention, Control, and Countermeasure (SPCC) Plan	At least 28 days before delivery or storage of oil	A	CE	CDMS			
01 57 40-1	Pesticides	Qualifications	At least 45 days before application of first pesticide	A	CE	CDMS			
01 57 40-2	Pesticides	Pesticide Use Plan	At least 45 days before application of first pesticide	A	CE	CDMS			
01 57 50-1	Tree and Plant Protection	Protection Plan	At least 45 days before beginning onsite work	A	CE	CDMS			

Table 01 33 00A – List of Submittals

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
01 57 90-1	Preservation of Historical and Archeological Data	Alternate Use Area	At least 45 days before beginning offsite work, if commercial site; if non-commercial site then at least 6-months prior to use of land	A	CE	CDMS			
01 61 10-1	Buy American	Buy American Certificates	Prior to Project Closeout	I	CE	CDMS			
01 71 20-1	Surveying	Surveying Plan	Within 45 days after Notice to Proceed, and approved before beginning survey work	A	CE	CDMS			
01 71 20-2	Surveying	Resume(s)	At least 45 days before beginning survey work; resubmit upon personnel change	I	CE	CDMS			
01 71 20-3	Surveying	Accuracy Check Results	At least 45 days before beginning survey work	I	CE	CDMS			
01 71 20-4	Surveying	Completed and Reduced Survey Notes	Within 2 days of completing and reducing notes	I	CE	CDMS			
01 71 20-5	Surveying	Original Field Survey Books	Weekly	I	CE	CDMS			
01 71 20-6	Surveying	Quantity Survey Notes and Computations	Accompanying progress payment requests	I	CE	CDMS			
01 71 20-7	Surveying	Workday's Survey Notes	At conclusion of workday if requested by Government	I	CE	CDMS			
01 74 00-1	Cleaning and Waste Management	Waste Production and Disposal Plan	At least 45 days before beginning onsite work	A	CE	CDMS			
01 74 00-2	Cleaning and Waste Management	Waste Production and Disposal Records	Within 7 days of hazardous waste disposal	I	CE	CDMS			

Table 01 33 00A – List of Submittals

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
01 74 00-3	Cleaning and Waste Management	Environmental Consultant Resume	At least 45 days before beginning environmental assessment	I	CE	CDMS			
01 74 00-4	Cleaning and Waste Management	Environmental Site Assessment	Within 14 days of completion of work	I	CE	CDMS			
01 78 30-1	Project Record Documents	Electronic Media Release Form Upon Request	With request for Electronic Drawings	A	CE	CDMS			
01 78 30-2	Project Record Documents	Progress As-Built Drawings	Monthly once onsite construction begins.	A	CE	CDMS			
01 78 30-3	Project Record Documents	Final As-Built Drawings	Within 28 days of Government issued substantial completion of work	A	CE	CDMS			
01 78 30-4	Project Record Documents	Final Drawings	Within 14 days of approval of RSN 01 78 30-3	I	CE	0	2	0	2
						CDMS			
03 11 10-1	Concrete Forming	Formwork Design and Drawings	At least 28-days before beginning concrete work	A	CE	CDMS			
03 15 12-1	PVC Waterstop	Purchase Orders	At least 35-days before beginning concrete work	I	CE	CDMS			
03 15 12-2	PVC Waterstop	Samples	At least 28-days before beginning concrete work	A	CE	0	1	1	0
						CDMS			
03 15 12-3	PVC Waterstop	Certification	At least 28-days before beginning concrete work	I	CE	CDMS			
03 15 12-4	PVC Waterstop	Drawings	At least 28-days before beginning concrete work	A	CE	CDMS			
03 15 12-5	PVC Waterstop	Instructions	At least 28-days before beginning concrete work	A	CE	CDMS			
03 15 18-1	Hydrophilic Waterstops	Product Data	At least 28-days before beginning concrete work	A	CE	CDMS			

Table 01 33 00A – List of Submittals

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
03 15 18-2	Hydrophilic Waterstops	Certification	At least 28-days before beginning concrete work	I	CE	CDMS			
03 15 18-3	Hydrophilic Waterstops	Instructions	At least 28-days before beginning concrete work	I	CE	CDMS			
03 15 18-4	Hydrophilic Waterstops	Samples	At least 28-days before beginning concrete work	A	CE	0	1	1	0
						CDMS			
03 20 00-1	Concrete Reinforcement	Reinforcement Diagrams and Lists	At least 28-days before beginning concrete work	A	CE	CDMS			
03 30 00-1	Cast-in-Place Concrete	Approval Data	At least 28-days before beginning concrete work	A	CE	CDMS			
03 30 00-2	Cast-in-Place Concrete	Concrete Placement Schedule	At least 28-days before beginning concrete work	I	CE	CDMS			
03 30 00-3	Cast-in-Place Concrete	Certifications	At least 28-days before beginning concrete work	I	CE	CDMS			
03 30 00-4	Cast-in-Place Concrete	Test Reports	Within 3 days of testing, immediately if test failed	I	CE	CDMS			
03 48 00-1	Precast Concrete Structures	Certificates	At least 28-days before beginning work	I	CE	CDMS			
03 48 00-2	Precast Concrete Structures	Shop Drawings	At least 28-days before beginning work	A	CE	CDMS			
03 48 00-3	Precast Concrete Structures	Product Data	At least 28-days before beginning work	A	CE	CDMS			
03 62 20-1	Nonshrink Grout for Equipment and Metalwork	Packaged Nonshrink Grout Data	At least 28-days before beginning work	I	CE	CDMS			
03 63 00-1	Epoxy Grout	Approval Data	At least 28-days before beginning work	A	CE	CDMS			
07 21 50-1	Spray-Applied Polyurethane Foam Insulation	Approval Data	At least 28-days before beginning work	A	CE	CDMS			

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
07 21 50-2	Spray-Applied Polyurethane Foam Insulation	Instructions	At least 28-days before beginning work	I	CE	CDMS			
07 21 50-3	Spray-Applied Polyurethane Foam Insulation	Documentation	At least 28-days before beginning work	I	CE	CDMS			
07 21 60-1	Insulation Jacket	Approval Data	At least 28-days before beginning work	A	CE	CDMS			
07 21 60-2	Insulation Jacket	Instructions	At least 28-days before beginning work	I	CE	CDMS			
08 31 25-1	Access Hatches	Product Data and Shop Drawings	At least 28-days before beginning work	I	CE	CDMS			
09 96 20-1	Coatings	Approval Data	At least 28-days before beginning coating work	A	TSC 86-68540	CDMS			
09 96 20-2	Coatings	Final Approval Data	At least 28-days before beginning coating work	A	TSC 86-68540	CDMS			
09 96 20-3	Coatings	Paint Chip Samples	At least 28-days before beginning coating work	A	TSC 86-68540	0	1	1	0
						CDMS			
09 96 20-4	Coatings	Qualifications	At least 28-days before beginning coating work	A	TSC 86-68540	CDMS			
09 96 20-5	Coatings	Quality Control Plan	At least 28-days before beginning coating work	A	TSC 86-68540	CDMS			
09 96 20-6	Coatings	Contractor Quality Testing Report	At least 14-days after completion of test	A	TSC 86-68540	CDMS			
10 14 26-1	Utility Markers	Utility Marker Plan	At least 28-days before beginning work	I	CE	CDMS			
25 00 01-1	System Control and Monitoring	Qualifications	At least 28-days before beginning work	A	CE	CDMS			
25 00 01-2	System Control and Monitoring	System Description Documentation	At the same time as equipment is shipped to the site	A	CE	CDMS			

Table 01 33 00A – List of Submittals

* Submittal types: A – Action, I – Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center, NTUA indicates the City of Gallup New Mexico.

RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
25 00 01-3	System Control and Monitoring	Approval Drawings and Data	Within 150-days after Notice to Proceed, and at least 45-days prior to installation	A	CE	CDMS			
25 00 01-4	System Control and Monitoring	Layout Drawings	Within 150-days after Notice to Proceed, and at least 45-days prior to installation	A	CE	CDMS			
25 00 01-5	System Control and Monitoring	Software Development Documentation	Within 150-days after Notice to Proceed, and at least 45-days prior to installation	I	CE	CDMS			
25 00 01-6	System Control and Monitoring	Final Drawings, Documentation, and Operations and Maintenance Manuals	Within 14-days of completion of work	I	CE	CDMS			
25 08 10-1	Automation System Testing and Acceptance	SPAT Procedure and Start Date	At least 28-days before beginning work	I	CE	CDMS			
25 08 10-2	Automation System Testing and Acceptance	SPAT Test Report	At least 14-days after completion of test	A	CE	CDMS			
25 08 10-3	Automation System Testing and Acceptance	Lateral Integration Test Report	At least 14-days after completion of test	I	CE	CDMS			
26 05 20-1	Conductors and Cables	Approval Data	At least 28-days before beginning work	A	CE	CDMS			
26 05 20-2	Conductors and Cables	Field Test Reports	At least 14-days after completion of test	I	CE	CDMS			
26 05 20-1	Grounding and Bonding	Approval Drawings and Data	At least 28-days before beginning work	A	CE	CDMS			
26 05 20-2	Grounding and Bonding	As-built Drawings	At commissioning	I	CE	CDMS			

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						CO	CE	TSC	NTUA
26 05 20-3	Grounding and Bonding	Test Reports	At least 14-days after completion of test	I	CE	CDMS			
26 05 33-1	Raceways and Boxes	Approval Drawings and Data	At least 28-days before beginning work	A	CE	CDMS			
26 05 33-2	Raceways and Boxes	As-built Drawings	At commissioning	I	CE	CDMS			
26 24 41-1	Distribution Panelboards	Approval Data	At least 28-days before beginning work	A	CE	CDMS			
26 24 41-2	Distribution Panelboards	Approval Layouts	At least 28-days before beginning work	A	CE	CDMS			
26 24 41-3	Distribution Panelboards	Test Data	At least 28-days before beginning work	A	CE	CDMS			
26 27 10-1	Meter Socket	Approval Drawings and Data	At least 28-days before beginning work	A	CE	CDMS			
26 42 00-1	Cathodic Protection Systems	Certification and Data	At least 42-days before procuring materials	A	86-68540	CDMS			
26 42 11-1	Buried Galvanic Anode Cathodic Protection	Certification and Data	At least 42-days before procuring materials	A	86-68540	CDMS			
26 42 11-2	Buried Galvanic Anode Cathodic Protection	Final Data	Within 7-days of final testing	A	86-68540	CDMS			
26 42 12-1	Buried Impressed Current Cathodic Protection	Certification and Data	At least 42-days before procuring materials	A	86-68540	CDMS			
26 42 12-2	Buried Impressed Current Cathodic Protection	Groundwater Mitigation Method	At least 14-days before start of onsite construction work	A	86-68540	CDMS			
26 42 12-3	Buried Impressed Current Cathodic Protection	Interference Mitigation Method	Within 7-days of final testing	A	86-68540	CDMS			
26 42 12-4	Buried Impressed Current Cathodic Protection	Preliminary Data	Within 7 days of completion of drilling	A	86-68540	CDMS			

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						CO	CE	TSC	NTUA
26 42 12-5	Buried Impressed Current Cathodic Protection	Final Data	Within 7-days of final testing	A	86-68540	CDMS			
26 42 15-1	Galvanic Anode Cathodic Protection for Welded Steel Tanks	Certification and Data	At least 42-days before procuring materials	A	86-68540	CDMS			
26 42 15-2	Galvanic Anode Cathodic Protection for Welded Steel Tanks	Final Data	Within 7-days of final testing	A	86-68540	CDMS			
31 02 10-1	Water for Dust Abatement	Meter Calibration	At least 42-days before beginning onsite work	A	CE	CDMS			
31 02 30-1	Dust Palliative	Proposed Application Area for Dust Palliative	At least 42-days before beginning onsite work	A	CE	CDMS			
31 03 33-1	Removal and Control of Water	Removal of Water Plan	At least 42-days before beginning onsite work	A	831X	CDMS			
31 23 02-1	Compacting Earth Materials	Test Results	Within 1-day of testing, immediately if test failed	I	CE	CDMS			
31 23 10-1	Earthwork for Structures	Processing Plan for Soils under Structures	At least 28-days before beginning onsite work	A	CE	CDMS			
31 23 10-2	Earthwork for Structures	Test Results	Within 1-day of testing, immediately if test failed	I	CE	CDMS			
31 23 22-1	Pipe Trench Earthwork	Processing Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
31 23 22-2	Pipe Trench Earthwork	Test Results	Within 1-day of testing, immediately if test failed	I	CE	CDMS			
31 23 22-3	Pipe Trench Earthwork	Cultural Site Trench Box Design	At least 28-days before use of trench box	A	CE	CDMS			
31 23 70-1	Controlled Low Strength Material (CLSM)	Approval Data for CLSM Mix	At least 28-days before beginning onsite work	A	CE	CDMS			

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						CO	CE	TSC	NTUA
31 23 70-2	Controlled Low Strength Material (CLSM)	Cold Weather Protection Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
31 23 70-3	Controlled Low Strength Material (CLSM)	Quality Control Test Results	Within 1-day of testing, immediately if test failed	I	CE	CDMS			
31 24 18-1	Gravel Drain for Water Storage Tanks	Laboratory Test Results	At least 28-days before beginning onsite work	I	CE	CDMS			
31 31 30-1	Soil-Applied Herbicide	Use Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
31 31 30-2	Soil-Applied Herbicide	Applicator Certification	At least 28-days before beginning onsite work	I	CE	CDMS			
31 32 36-1	HDPE Geomembrane for Water Storage Tanks	Qualifications	At least 28-days before beginning onsite work	A	CE	CDMS			
31 32 36-2	HDPE Geomembrane for Water Storage Tanks	Product Certificates, Test Reports, and Instructions	At least 28-days before beginning onsite work	I	CE	CDMS			
31 32 36-3	HDPE Geomembrane for Water Storage Tanks	Geomembrane Installation Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
31 32 36-4	HDPE Geomembrane for Water Storage Tanks	Construction	At least 28-days before beginning onsite work	A	CE	CDMS			
31 37 00-1	Riprap	Approval Data and Test Results	At least 28-days before beginning onsite work	I	CE	CDMS			
32 12 22-1	Asphalt Concrete Pavement	Job Mix Formula (JMF)	At least 28-days before beginning onsite work	I	CE	CDMS			
32 15 10-1	Gravel Surfacing	Gravel Certification	At least 35-days before placing surfacing	A	CE	CDMS			
32 15 10-2	Gravel Surfacing	Geotextile Installation	At least 28-days before placing surfacing	A	CE	CDMS			
32 15 10-3	Gravel Surfacing	Geotextile Certification	At least 28-days before placing surfacing	A	CE	CDMS			

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						CO	CE	TSC	NTUA
32 31 10-1	Chain Link Fence	Certification	At least 28-days before beginning onsite work	I	CE	CDMS			
32 91 60-1	Erosion Control Blanket	Manufacturer's Information	At least 28-days before beginning onsite work	I	CE	CDMS			
32 90 20-1	Seeding	Seeding Plan	At least 28-days before beginning onsite work	I	CE	CDMS			
32 90 20-2	Seeding	Certifications	At least 28-days before beginning onsite work	I	CE	CDMS			
33 05 21-1	Bored Crossings	Key Personnel Resumes	At least 28-days before beginning onsite work	A	CE	CDMS			
33 05 21-2	Bored Crossings	Material Certification	At least 28-days before beginning onsite work	I	CE	CDMS			
33 05 21-3	Bored Crossings	Boring and Placement Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
33 05 21-4	Bored Crossings	Monitoring Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
33 05 21-5	Bored Crossings	Draft Drill Logs	Within 1 day of pilot bore completion	I	CE	CDMS			
33 05 21-6	Bored Crossings	Final Drill Logs	Within 7-days of bore completion	I	CE	CDMS			
33 05 21-7	Bored Crossings	Copy of Application for Crossing Permits	At least 28-days before beginning onsite work	I	CE	CDMS			
33 11 10-1	Pipeline General Requirements	Qualifications	At least 28-days before beginning onsite work	I	CE	CDMS			
33 11 10-2	Pipeline General Requirements	Pipelaying Diagrams: Reach 2, Start of Reach 2 to Start of San Juan River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Respon-sible Code	No. of sets to be sent to:**			
						CO	CE	TSC	NTUA
33 11 10-3	Pipeline General Requirements	Pipelaying Diagrams: Reach 2, End of San Juan River HDD to end of Reach 2	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 10-4	Pipeline General Requirements	Pipelaying Diagrams: Reach 3, Start of Reach 3 to Start of Chaco River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 10-5	Pipeline General Requirements	Pipelaying Diagrams: End of Chaco River HDD to end of Reach 3	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 10-6	Pipeline General Requirements	Filling and Testing Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 10-7	Pipeline General Requirements	Flotation Prevention Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 10-8	Pipeline General Requirements	Pipe Deflection Measurements	Within 21 days of installation	I	CE	CDMS			
33 11 10-9	Pipeline General Requirements	NTUA Waterline Relocation Work Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 12-1	Steel Line Pipe	Steel Line Pipe Thicknesses	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 12-2	Steel Line Pipe	Shop Drawings: Reach 2, Start of Reach 2 to Start of San Juan River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 12-3	Steel Line Pipe	Shop Drawings: Reach 2, End of San Juan River HDD to end of Reach 2	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 12-4	Steel Line Pipe	Shop Drawings: Reach 3, Start of Reach 3 to Start of Chaco River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			

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						CO	CE	TSC	NTUA
33 11 12-5	Steel Line Pipe	Shop Drawings: End of Chaco River HDD to end of Reach 3	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 12-6	Steel Line Pipe	Ventilation Plan	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 12-7	Steel Line Pipe	Single Lap Weld Stress Calculations	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 13-1	Ductile Iron Pipe	Shop Drawings: Reach 2, Start of Reach 2 to Start of San Juan River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 13-2	Ductile Iron Pipe	Shop Drawings: Reach 2, End of San Juan River HDD to end of Reach 2	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 13-3	Ductile Iron Pipe	Shop Drawings: Reach 3, Start of Reach 3 to Start of Chaco River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 13-4	Ductile Iron Pipe	Shop Drawings: End of Chaco River HDD to end of Reach 3	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 13-5	Ductile Iron Pipe	Commercial Products	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 16-1	PVC Pressure Pipe	Shop Drawings: Reach 2, Start of Reach 2 to Start of San Juan River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 16-2	PVC Pressure Pipe	Shop Drawings: Reach 2, End of San Juan River HDD to end of Reach 2	At least 28-days before beginning onsite work	A	CE	CDMS			

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						CO	CE	TSC	NTUA
33 11 16-3	PVC Pressure Pipe	Shop Drawings: Reach 3, Start of Reach 3 to Start of Chaco River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 16-4	PVC Pressure Pipe	Shop Drawings: End of Chaco River HDD to end of Reach 3	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 16-5	PVC Pressure Pipe	Pipe Manufacture Certification	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 16-6	PVC Pressure Pipe	Fused Pipe Information	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 17-1	PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks	Certification	At least 28-days before beginning onsite work	I	CE	CDMS			
33 11 17-2	PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks	Pipe Layout Drawings	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 17-3	PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks	Product Approval Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 17-4	PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks	Final Data	At commissioning	I	CE	CDMS			
33 11 18-1	HDPE Pressure Pipe	Heat Fusion Joint Operator Qualifications	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 18-2	HDPE Pressure Pipe	Shop Drawings: Reach 2, Start of Reach 2 to Start of San Juan River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			

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						CO	CE	TSC	NTUA
33 11 18-3	HDPE Pressure Pipe	Shop Drawings: Reach 2, End of San Juan River HDD to end of Reach 2	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 18-4	HDPE Pressure Pipe	Shop Drawings: Reach 3, Start of Reach 3 to Start of Chaco River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 18-5	HDPE Pressure Pipe	Shop Drawings: End of Chaco River HDD to end of Reach 3	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 18-6	HDPE Pressure Pipe	Certification	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 18-7	HDPE Pressure Pipe	Fusion Procedures	At least 28-days before beginning onsite work	A	CE	CDMS			
33 11 50-1	Pipe Crossings at Existing Utility Pipelines	Rubber Gasket Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 12 10-1	Valves and Equipment for Line Pipe Installations	Commercial Product Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 12 10-2	Valves and Equipment for Line Pipe Installations	Valve Tags	At least 28-days before beginning onsite work	A	CE	CDMS			
33 12 10-3	Valves and Equipment for Line Pipe Installations	Service Manuals	At least 28-days before beginning onsite work	I	CE	CDMS			
33 16 00-1	Water Storage Tanks	Designer, Erection Engineer, and Contractor Qualifications	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 00-2	Water Storage Tanks	Commercial Products Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 00-3	Water Storage Tanks	Approval Drawings	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 00-4	Water Storage Tanks	Calculations	At least 28-days before beginning onsite work	A	CE	CDMS			

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						CO	CE	TSC	NTUA
33 16 00-5	Water Storage Tanks	As-Built Drawings, Manuals, and Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 50-1	Steel Tanks	Shop Drawings, Design Calculations and Design Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 50-2	Steel Tanks	Inspection Reports	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 51-1	Concrete Wire Wrapped Tank	Approval Drawings and Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 51-2	Concrete Wire Wrapped Tank	Test Reports	At least 28-days before beginning onsite work	I	CE	CDMS			
33 16 51-3	Concrete Wire Wrapped Tank	Documentation	At least 28-days before beginning onsite work	I	CE	CDMS			
33 16 51-4	Concrete Wire Wrapped Tank	Final Drawings and Data	At commissioning	I	CE	CDMS			
33 16 52-1	Concrete Prestressed Tank	Approval Drawings and Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 16 52-2	Concrete Prestressed Tank	Test Reports	At least 28-days before beginning onsite work	I	CE	CDMS			
33 16 52-3	Concrete Prestressed Tank	Documentation	At least 28-days before beginning onsite work	I	CE	CDMS			
33 16 52-4	Concrete Prestressed Tank	Final Drawings and Data	At commissioning	I	CE	CDMS			
33 21 95-1	Metal Piping for Line Pipe Installations	Shop Drawings: Reach 2, Start of Reach 2 to Start of San Juan River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 21 95-2	Metal Piping for Line Pipe Installations	Shop Drawings: Reach 2, End of San Juan River HDD to end of Reach 2	At least 28-days before beginning onsite work	A	CE	CDMS			

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						CO	CE	TSC	NTUA
33 21 95-3	Metal Piping for Line Pipe Installations	Shop Drawings: Reach 3, Start of Reach 3 to Start of Chaco River HDD	At least 28-days before beginning onsite work	A	CE	CDMS			
33 21 95-4	Metal Piping for Line Pipe Installations	Shop Drawings: End of Chaco River HDD to end of Reach 3	At least 28-days before beginning onsite work	A	CE	CDMS			
33 21 95-5	Metal Piping for Line Pipe Installations	Commercial Product Data	At least 28-days before beginning onsite work	A	CE	CDMS			
33 21 95-6	Metal Piping for Line Pipe Installations	Final Drawings and Data	At commissioning	I	CE	CDMS			
35 21 95-1	Steel Manifold Piping	Shop Drawings	At least 28-days before beginning onsite work	A	CE	CDMS			
35 21 95-2	Steel Manifold Piping	Commercial Product Data	At least 28-days before beginning onsite work	A	CE	CDMS			
35 21 95-3	Steel Manifold Piping	Pipe Installation Procedure and Calculations	At least 28-days before beginning onsite work	A	CE	CDMS			
35 21 95-4	Steel Manifold Piping	Source Quality Test Reports	At least 28-days before beginning onsite work	I	CE	CDMS			
35 21 95-5	Steel Manifold Piping	Final Drawings and Data	At commissioning	I	CE	CDMS			
35 22 14-1	Valves and Equipment	Commercial Products Data	At least 28-days before beginning onsite work	A	CE	CDMS			
35 22 14-2	Valves and Equipment	Shop Testing Certifications and Reports	At least 28-days before beginning onsite work	A	CE	CDMS			
35 22 14-3	Valves and Equipment	Valve Tags	At least 28-days before beginning onsite work	A	CE	CDMS			
35 22 14-4	Valves and Equipment	Service Manuals	At least 28-days before beginning onsite work	I	CE	CDMS			
35 22 14-5	Valves and Equipment	Test Reports	At least 28-days before beginning onsite work	I	CE	CDMS			

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						CO	CE	TSC	NTUA
35 42 35-1	Wash Crossing Bank Protection	Certifications	At least 28-days before beginning onsite work	I	CE	CDMS			
35 42 35-2	Wash Crossing Bank Protection	Field Verification of Wash Crossing Elevations	At least 28-days before beginning onsite work	A	CE	CDMS			

END OF SECTION

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SECTION 01 33 26
ELECTRICAL DRAWINGS AND DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 SUBMITTAL REQUIREMENTS

A. In addition to the requirements in Section 01 33 00 – Submittals, prepare electrical drawings and data submittals in accordance with the following.

B. Approval Data:

1. Manufacturer's technical catalog data:

   a. Provide technical data for each device or item of equipment.

   b. Include manufacturer's name and address; catalog number, type, style, or model number; electrical ratings; and dimensions.

   c. Where several items are listed on same sheet, indicate items being submitted for approval.

   d. Demonstrate proposed device or item of equipment meets specifications requirements.

   e. Mark catalog data sheet with appropriate bill of material (BOM) item number.

   f. Assemble catalog data sheets into one enclosing cover with BOM index.

C. Approval Drawings:

1. Equipment and cabinet/board/panel layout drawings:

   a. Indicate dimensions of equipment.

   b. Indicate location of devices and items of equipment including nameplates, terminal blocks, wiring ducts, bus, conduit entries, and other features in their relative physical location.

   c. Indicate method of securing equipment to deck, floor, or wall.

   d. Identify each device and item of equipment with a bill of material reference number.

2. Bill of material list or drawing:
   a. Provide information containing equipment's manufacturer, style, type, rating, quantity, and other identifying information.
   b. Provide unique reference number for each device or item of equipment listed on bill of material.
3. Panelboard schedule and circuit directory:
   a. Show breaker number and connected load.
   b. Use machine lettering for directory entries. Handwritten directory entries are not acceptable.

D. Test Reports:
1. Typed, 8 1/2- by 11-inch sheets.
2. Written certification by individual or authorized representative of organization performing the test.
3. Submit multi-page reports in bound folder or three ring binder.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 10
SAFETY DATA SHEETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 DEFINITIONS

A. LHM: List of Hazardous Materials.

B. SDS: Safety Data Sheet:

1. Referred to as Material Safety Data Sheets in clause at FAR 52.223-3, Hazardous Material Identifications and Material Safety Data - Alternate 1.

1.03 APPLICATION

A. For purpose of this contract, "delivered under this contract" in paragraph (b) of clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1, includes materials:

1. Delivered to Government.
2. Incorporated into work.
3. Materials used by Contractor during contract performance at jobsite.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 35 10-1, Complete LHM and SDS.

C. RSN 01 35 10-2, Updated LHM and SDS:

1. Comply with paragraph (e) of clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1.

1.05 DELIVERY

A. Do not deliver hazardous materials to jobsite which are not included on original or previously updated LHM and SDS before receipt of updated LHM and SDS by Construction Engineer (CE).

B. Maintain hard copy of complete updated LHM and SDS on site for use by Government and Contractor personnel.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 20
SAFETY AND HEALTH

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.
2. Costs for complying with updates to RSHS, FIST 1-1, and 29 CFR 1926 promulgated prior to contract completion are Contractor's responsibility.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions, available at https://www.usbr.gov/safety/rshs/index.html
2. FIST 1-1 (2019) — Hazardous Energy Control Program, available at: https://www.usbr.gov/power/data/fist_pub.html

B. Code of Federal Regulations (CFR)

1. 29 CFR 1926.32 — Definitions, Construction
2. 29 CFR 1926.103 — Respiratory Protection

C. Applicable Tribal and State Safety and Health Regulations for Construction.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 35 20-1, Safety Program:

1. Written safety program in accordance with RSHS.
2. Cover aspects of onsite and applicable off-site operations and activities associated with this contract.
3. Follow outline in Appendix 1.03C of RSHS.
4. Will not be accepted for review by COR unless it addresses, in order, lettered and numbered per Appendix 1.03C, a comprehensive narrative for each applicable item in outline. For items in outline that do not apply to this contract write “Not applicable to Contract” next to number/letter.

5. A generic company safety program is not acceptable. Site-Specific Safety Program required for this contract.

6. Submitted and accepted prior to commencing onsite work, including mobilization.

C. RSN 01 35 20-2, Monthly Accident Summary Report:

1. In accordance with RSHS.

1.04 DOCUMENTATION AND RECORDS

A. Prepare and retain all safety plans, programs, training content, and training records applicable to scope of work and make available to COR unless already included in written safety program. Some examples include but are not limited to:

1. Confined Space and when deemed necessary by existing or introduced hazards of Permit Required Confined Space through Written Program and Training Records.
2. Method for ventilating inside of pipe when placing mortar lining for joints.
3. Forklifts and Other Industrial Trucks Training Records.
4. Electrical Safety Requirement Training Records.
5. Emergency Action Plans Written Program and Training Records.
6. Fall Protection Written Program and Training Records.
7. Fire Protection and Prevention Written Program and Training Records.
8. Flammable and Combustible Liquids Written Spill Control Plan.
9. General Safety and Health Provisions, Written Safety Program, and Regular Safety Inspection Records.
10. Hazard Communication Written Program and Training Records.
11. Ladder Written Compliance Program and Training Records.
12. Lockout/Tagout: Hazardous Energy Control Program (HECP) Training Records. Refer to RSHS Sections 1.11 and 1.13.
13. Occupational Noise Exposure Written Program and Training Audiometric Testing Records.
14. Personal Protective Equipment (PPE) Hazard Assessments and Training Records.
15. Power Operated Hand Tools Training Records.
16. Respiratory Protection Written Program and Training Records.
17. Safety Training and Education Written Program and Training Records.
18. Scaffolds Training Records.
19. Steel Erection Training Records, if applicable.
20. Welding, Cutting, and Brazing Written Program and Training Records.

1.05 SAFETY AND HEALTH

A. Provide and maintain work environment and procedures that:

1. Safeguard public, Government personnel, and Contractor employees exposed to Contractor operations and activities.
2. Avoid interruptions of site operations and delays in project completion dates.
3. Control costs in contract performance.

B. Do not begin onsite work, including mobilization, until CE accepts Safety Program.

C. Participate in Contractor Safety Program Review meeting prior to mobilization.

D. Minimum work crew shall consist of no less than 2 people, unless approved by COR.

E. Develop JHA for each distinct phase of work under the contract.

1. Do not begin phase of work until JHA is acceptable to COR and OGR and shared with construction employees. At a minimum JHA to include elements in RSHS 1.05.
2. Activities involving hazardous materials shall have appropriate Safety Data Sheet(s) attached to JHA.
3. Maintain JHA records in CDMS. Update at least once monthly and submit with pay application.

F. Comply with RSHS and 29 CFR 1926. Include fatigue management plan as required by RSHS.

G. Minimum light requirements:

1. Perform on-site work between sunrise to sunset, unless approved by COR.
2. If COR approves work outside of daylight hours, submit after-hours plan to COR that includes light plants/equipment to provide a minimum of 20 foot-candles to illuminate all working areas.
    a. Provide additional lighting as necessary to comply with County and DOT requirements for night work within County or DOT Right of Way.

H. Confined Space:

1. Provide rescue team when entering confined space.
2. Complete a mock rescue prior to entering confined space.

I. Correct safety and health violations identified by CO, COR, or OGR. within 2 days for minor violations and immediately for serious violations.

J. When Contractor fails or refuses to correct a compliance directive, CO may issue order to stop all or part of the work:

1. When satisfactory corrective action is taken, order to resume work will be issued.
2. Contractor shall not be entitled to extension of time, claim for damage or additional compensation by reason of either directive or stop order.
3. Failure of CO to order discontinuance of Contractor's operations shall not relieve Contractor of responsibility for safety of personnel and property.

K. Maintain accurate records of and report to CO, COR, OGR, and as required in RSHS.

L. Rights and remedies of Government provided in this section are in addition to any other rights and remedies provided by law or under this contract:

1. In the event of a conflict between requirements contained in RSHS, specification paragraphs, Contractor's approved Safety Program, referenced safety and health codes and standards, or U.S. Department of Labor Construction Safety and Health Standards, promulgated under Section 107 of Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.), as amended, the most stringent requirement shall prevail.

M. Provide appropriate safety barricades, signs, and warnings.

N. Provide medical and emergency assistance in timely manner consistent with recognized emergency protocols.

O. In instances where local emergency responders are not readily available, responsibility to provide emergency services shall default to Contractor.

P. Perform all training as required by Federal, Tribal, State, and local regulations prior to any activity requiring training:

1. Submit training records to COR upon request.
2. In no case shall an employee perform work until all required training is complete.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 30
CONTRACTOR'S ONSITE SAFETY PERSONNEL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions, available at https://www.usbr.gov/safety/rshs/index.html

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 35 30-1, Resumes:

1. Resumes verifying qualifications listed in 1.04 Qualifications.
2. Include resumes for alternate Onsite Safety Representative, and Onsite Safety and Health Professional.
3. Contractor's Onsite Safety Representative.
   a. Include current telephone numbers of references, description of safety responsibilities, and copies of training certifications.
   b. Submit alternate safety manager as needed, who should have all qualifications as primary safety manager.
4. Contractor's Onsite Safety and Health Professional.
   a. Include resume with current telephone numbers of references, description of safety professional responsibilities on similar construction projects, and copies of OSHA 3015, training certifications, degree, and registration.

C. RSN 01 35 30-2, Safety Inspection Reports:

1. List noted deficiencies, digital photos, abatement dates, and follow-up action for jobsite activities.
2. Base inspection report on findings of jobsite walk-through with Government personnel.

1.04 QUALIFICATIONS

A. Contractor's Onsite Safety Representative:

1. Competent supervisory employee with current safety and health related training, at least 5 years' experience in pipeline construction as an onsite safety representative, and duties on at least three projects of similar nature, size, and complexity.

2. OSHA Construction 30-Hour Training Course including applicable elective subjects, for example Concrete and Masonry Construction; Confined Space Entry; Cranes, Derricks, Hoists, Elevators, and Conveyors; Ergonomics; Excavations; Fire Protection and Prevention; Materials Handling, Storage, Use, and Disposal; Motor Vehicles, Mechanized Equipment, and Marine Operations; Rollover Protective Structures and Overhead Protection; Signs; Signals, and Barricades; Powered Industrial Vehicles; Safety and Health Programs; Scaffolds; Steel Erection; Tools - Hand and Power; Welding and Cutting.

   a. Provide copy of OSHA Construction 30-Hour training certificate issued within the last 3 years required.

3. Current first aid and CPR certification. OSHA 3015 trained.

4. Knowledgeable of current safety trends and industry practices. Exercises technical expertise.

5. The Contractor Onsite Safety Representative shall have no other duties.

B. Contractor's Onsite Safety and Health Professional:

1. The Contractor shall identify a full-time Safety and Health Professional that is acceptable to Reclamation.

2. The individual shall be qualified by virtue of education, training, certification, and experience in which professional status in the construction safety field has been established.

3. The Contractor Onsite Safety and Health Professional shall have no other duties.

4. Competent supervisory employee with current safety and health related training, experience and duties on at least three projects of similar nature, size, complexity, and work to be performed as the current project

5. OSHA Construction 30-Hour Training Course including applicable elective subjects, for example Concrete and Masonry Construction; Confined Space Entry; Cranes, Derricks, Hoists, Elevators, and Conveyors; Ergonomics; Excavations; Fire Protection and Prevention; Materials Handling, Storage, Use and Disposal; Motor Vehicles, Mechanized Equipment and Marine Operations; Rollover Protective Structures and Overhead Protection; and Signs; Signals and Barricades; Powered Industrial Vehicles; Safety and Health Programs; Scaffolds; Steel Erection; Tools - Hand and Power; Welding and Cutting. Current first aid CPR certification.

6. Possessing at least a 4-year Bachelor's Degree from an accredited college or university in:
   a. Safety Engineering
   b. Safety and Occupational Health, or
   c. Industrial Hygiene (IH).
7. Registered Professional Safety Engineer, Certified Safety Professional (CSP), or CIH certified by the Board of Certified Safety Professionals/ American Board of Industrial.
8. Knowledgeable of current safety trends, industry practices, and can exercise technical expertise.

1.05 APPLICATION

A. Contractor's Onsite Safety Representative Authorities, Duties, and Responsibilities:

1. Responsible for effectively implementing Contractor's Safety Program.
2. Coordinate all emergency response activities.
3. Recommend controls for observed or predicted hazards.
4. Shall have full authorization to correct unsafe acts on the spot, including authority to stop work to correct safety and health problems.
5. Lead weekly safety meetings at jobsite.
6. Onsite during any and all construction activities.
7. Assemble, review, and sign each Job Hazard Analysis (JHA). Review JHA with employees.
8. Verify correct use of respiratory protection and personal protective equipment.
9. Conduct and prepare weekly safety inspections in conjunction with OGR listing noted deficiencies, abatement dates, and follow up action. Report shall be available for review onsite.
10. Provide direct oversight and assemble detailed report of all incident reviews, near-misses, accidents, and emergency response or rescue actions.
11. Contractor's Onsite Safety Representative shall have no other non-safety duties.
12. Report directly to project manager or higher. Duties to include subcontractor oversite.

B. Contractor's Onsite Safety and Health Professional Authorities, Duties, and Responsibilities:

1. Onsite Safety and Health Professional's job shall be hazard recognition, control, and accident prevention.
2. Onsite during any and all construction activities.

3. Shall NOT be supervised by the onsite superintendent but shall report directly to the corporate manager/owner.
4. Shall have full authorization to correct unsafe acts on the spot, including the authority to stop work to correct safety and health problems.
5. Shall participate in the planning, preparation, and execution of all activities including but not limited to:
    a. Development and approval of JHA.
    b. Review of equipment and materials.
    c. Employee training.
    d. Review of JHA with employees.
    e. Observing and reporting on activities.
6. Shall participate in the planning, preparation, and execution of high exposure activities.
7. Duties include, but are not limited to the following:
    a. Before start of construction, identify existing and predictable unsanitary, hazardous, or dangerous conditions.
    b. Approve the site-specific Contractor safety and health plans and program prior to submission.
    c. Coordinating all elements contained in the Contractor safety and health program and these specifications, including safety training.
    d. May act as the qualified person for designing fall protection, excavation and scaffolding systems in accordance with the regulatory standards. Review and finalize all incident reviews, near-misses and accident reports in accordance with RSHS 1.03.
    e. Assemble, review, and sign each Job Hazard Analysis (JHA).
    f. Review and finalize all incident reviews, near-misses, and accident reports in accordance with RSHS.
    g. Conduct and prepare weekly safety inspections in conjunction with the onsite government representative listing noted deficiencies, their abatement dates, and follow up action. The report shall be available for review onsite.
    h. Attend the Safety Program Review Meeting and Conduct the monthly Joint Safety Policy Meetings in accordance with the RSHS Section 1.03.

1.06 QUALITY ASSURANCE

A. Contractor's Onsite Safety Representative:

1. Effectiveness of Contractor's Onsite Safety Representative in prosecuting the safety program will be subject to continued review and approval by COR.

2. Should Contractor's onsite safety representative's effort be deemed insufficient, Contractor may be required to employ a full-time qualified Safety Professional at no cost to Government.

B. Contractor's Onsite Safety and Health Professional:

1. The effectiveness of the Contractor's Onsite Safety Professional in prosecuting the safety program will be subject to continued review and approval by the COR.

2. Should the Contractor's safety professional effort be deemed insufficient the Contractor may be required to provide the services of a qualified, full-time Safety and Health Professional at no additional cost to the Government.

C. Safety Program:

1. Effectiveness of Contractor's Safety Program will be subject to continued review and approval by CO.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 42 10
REFERENCE STANDARDS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Referenced editions of standard specifications, codes, and manuals form a part of this specification to extent referenced.

B. These specifications take precedence when conflicting requirements occur between specifications and referenced standard.

1.03 JOBSITE REFERENCE STANDARDS

A. Maintain at fabrication site, access to referenced standard specifications, codes, and manuals required for work in progress at fabrication site. Make available for use by Government.

B. Maintain onsite, access to referenced standard specifications, codes, and manuals required for onsite work in progress. Make available for use by Government.

1.04 AVAILABILITY

A. Code of Federal Regulation (CFR):

1. Available online, authorized by the National Archives and Records Administration (NARA) and the Government Printing Office (GPO), at https://www.govinfo.gov/help/cfr.

B. Federal Specifications, Standards, and Commercial Item Descriptions; and Military Specifications:

1. Copies of Federal Specifications, Standards, and Commercial Item Descriptions may be obtained from GSA Federal Supply Service, see the provision at FAR 52.211-1, Availability of Specifications Listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29.

2. Copies of Military Specifications may be obtained from Department of Defense, see the provision at FAR 52.211-2, Availability of Specifications, Standards, and Data Item Descriptions Listed in the Acquisition Streamlining and Standardization Information System (ASSIST).

C. Bureau of Reclamation (Reclamation) Documents:

1. Reclamation Safety and Health Standards (RSHS) may be downloaded at https://www.usbr.gov/safety/rshs/index.html.

2. Reclamation manuals and other publications including significant scientific, technical, and engineering works are available upon request to the CO.

D. Industrial and Governmental Documents:

1. When a reference has a joint designation (e.g., ANSI/IEEE) these specifications generally cite the proponent organization (e.g., IEEE).

2. Addresses for obtaining industrial and governmental (other than Federal and Reclamation specifications and standards) specifications, standards, and codes are listed in Table 01 42 10A – Addresses for Specifications, Standards, and Codes.

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AA	The Aluminum Association 1525 Wilson Boulevard Suite 600 Arlington, VA 22209	703-358-2960
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, NW., Suite 249 Washington, DC 20001 www.aashto.org	202-624-5800 800-231-3475
ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439 USA www.concrete.org	248-848-3700
AGC	Associated General Contractors of America 2300 Wilson Boulevard, Suite 300 Arlington, VA 22201 www.agc.org	703-548-3118
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 3100 Chicago, IL 60601-2001 www.aisc.org	312-670-2400
AMPP (Formerly SSPC/NACE)	15835 Park Ten Place Houston, Texas 77084 www.ampp.org	1-800-797-6223

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
APA/EWA	APA-The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	253-565-6600
ANSI	American National Standards Institute 1819 L. Street, NW. Washington, DC 20036 www.ansi.org	202-293-8020
ASCE	American Society for Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191 www.ascs.org	800-548-2723 703-295-6300
ASME	American Society of Mechanical Engineers Two Park Avenue New York, NY 10016-5990 www.asme.org	800-843-2763 646-616-3100
ASTM	ASTM International P.O. Box C700 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 www.astm.org	610-832-9500
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235 www.awwa.org	303-794-7711
AWS	American Welding Society 550 NW LeJeune Road Miami, FL 33126 www.amweld.org	800-443-9353 305-443-9353
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Rd. Suite B215 Columbia, MD 21046 www.chainlinkinfo.org	(301) 596-2583
FOA	Fiber Optic Association 1223 Wilshire Blvd. #820 Santa Monica, CA 90403 www.foa.org	N/A

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
GRI	Geosynthetic Research Institute Drexel University West Wing-Rush Building #10 Philadelphia, PA 19104	(215) 895-2343
ICC/IBC	International Code Council 200 Massachusetts Avenue Northwest, Suite 250 Washington, DC 20001 www.iccsafe.org	888-422-7233 202-370-1800
ICRI	International Concrete Repair Institute 1000 Westgate Drive, Suite 252 St. Paul, MN 55114 http://www.icri.org/	651-366-6095
ICEA	Insulated Cable Engineers Association P.O. Box 2694 Alpharetta, GA 30023 http://www.icea.net/	
IEC	International Electrotechnical Commission 3 reu de Varembe Geneva, Switzerland www.iec.ch	+41-22-919-02-11
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue,17th Floor New York, NY 10016-5997 www.ieee.org	212-419-7900
ISA	International Society of Automation P.O. Box 12277 Research Triangle Park, NC 27709 www.isa.org	919-549-8411
ISO	International Organization for Standardization 1, ch. de la Voie-Creuse, Case postale 56 CH-1211 Geneva 20, Switzerland www.iso.org	+41 22 749 01 11

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602 www.mss-hq.com	(703) 281-6613
NAPF	National Association of Pipe Fabricators 2887 Goat Creek Road, Box 242 Kerrvilee, TX 78028 www.napf.com	(889) 798-1924
NEMA	National Electrical Manufacturers Association 1300 17th Street North, Suite 900 Arlington, VA 22209 www.nema.org	703-841-3200
NETA	International Electrical Testing Association 3050 Old Centre Road, Suite 101 Portage, MI 49024 www.netaworld.org	888-300-6382
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, Massachusetts 02169	800-344-3555
NIBS	National Institute of Building Sciences 1090 Vermont Avenue Northwest, Suite 700 Washington, DC 20005 www.nibs.org	202-289-7800
NCPA	National Precast Concrete Association 10333 N. Meridian Street, Suite 272 Indianapolis, IN 46290 www.precast.org	317-571 9500
NSF	NSF International P.O. Box 130140 789 N. Dixboro Road Ann Arbor, MI 48113-0140 www.nsf.org	(734) 769-8010 (800) 673-6275
PPI	Plastics Pipe Institute 105 Decker Court, Suite 825 Irving, TX 75062 http://plasticpipe.org	469-499-1044 Fax 469-499-1063

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
PTI	Post Tensioning Institute 38800 Country Club Drive Farmington Hills, MI 48331 www.post-tensioning.org	(248) 848 3180
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance 1320 North Courthouse Road, Suite 200 Arlington, VA 22201 www.tiaonline.org	(703) 907-7700
WWPA	Western Wood Products Association 1500 SW First Ave,. Suite 870 Portland, OR 97201 www.wwpa.org	(503) 224-3930
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062 www.ul.com	847-272-8800

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 46 00
QUALITY PROCEDURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 DEFINITIONS

A. Quality Assurance: Inspection and tests performed by Government to ensure compliance with terms of contract.

B. Quality Control: Activities performed by Contractor to ensure work conforms to contract requirements:

1. Clause at FAR 52.246-12, Inspection of Construction, requires Contractor to establish an inspection system to ensure quality.
2. Quality Control includes activities in addition to specified Contractor Quality Testing to ensure work conforms to contract requirements.

C. Contractor Quality Testing: Specified tests shall be performed by Contractor:

1. Government may use test results for Quality Assurance.
2. Test results shall be a part of Contractor's Quality Control Program.
   a. Tests do not relieve Contractor of providing adequate quality control measures in accordance with clause at FAR 52.246-12, Inspection of Construction.

D. Definable Features of Work: Task that is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or may be work by the same trade in a different environment.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 46 00-1, Contractor Quality Control (QC) Plan:

1. Outline Contractors Quality Control Program. As a minimum, cover construction operations, both onsite and offsite, work by subcontractors, fabricators, suppliers, and purchasing agents. Include:
   a. Description of quality control organization, a chart showing lines of authority, and acknowledgement that Quality Control Supervisor (QCS)

staff shall implement the three-phase control system for all aspects of work specified.

b. Identify staff including a QCS who reports to project manager:

1) An alternate QCS with equal lines of authority to act on behalf of the primary QCS should they not be present on the project site.

2) Names, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.

c. Letter to QCS, signed by an authorized official of the firm.

1) Describe responsibilities and delegate sufficient authorities to adequately perform the functions of the QCS.

2) Include authority to stop work not in compliance with the contract.

d. QCS shall issue letters of direction to other quality control representatives outlining duties, authorities, and responsibilities.

1) Furnish copy of letters to Government.

e. Procedures for:

1) Scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.

2) Control, verification, and acceptance testing procedures for each specific test to include:

a) Test name.

b) Specification paragraph requiring test.

c) Feature of work to be tested.

d) Test frequency.

e) Person responsible for each test.

3) Tracking:

a) Preparatory.

b) Initial.

c) Follow-up control phases and control.

d) Verification and acceptance tests including documentation.

e) Construction deficiencies from identification through acceptable corrective action. Establish procedures to verify correction of identified deficiencies.

4) Reporting procedures, including proposed reporting formats.

f. Base program upon a mutually agreed upon list of Definable Features of Work. Include preparatory, initial, and follow-up for each definable feature.

2. Detail implementation of Quality Control Plan summarized in Article 3.01 below.

3. Include Quality Testing Plan that address methods, procedures, frequencies, and scheduling for performing quality testing as required in other specification sections.

C. RSN 01 46 00-2, Contractor's Quality Daily Report:

1. Submit quality daily reports on a weekly basis.

2. As a minimum, Contractor's Quality Daily Report shall:

a. Record Contractor's activities throughout shift regardless of how minor or complex.

b. Be started at beginning of shift, written during shift, and completed at end of shift.

c. Include such detail that a person not familiar with the day's work could determine what was done and calculate Contractor's direct cost for that day.

d. Include temperature (maximum/minimum), wind conditions, estimated humidity, sunshine, and precipitation (type and intensity), if necessary, for the type of work being performed.

e. Note name of contractor's representative on site during the shift and hours on site.

f. Document subcontractor activity.

g. Identify specific safety incidents noted during shift including action(s) taken, including:

1) Names of people involved.

2) Name of person confirming correction.

3) Record of significant discussions held between Reclamation and Contractor personnel or other parties involved with project.

h. Main body of report:

1) Locations and a detailed description of all work, including:

a) Sketches or photographs where appropriate to assist in description.

b) Description shall reflect what, where, when, why, who, and how work was being performed.

c) Provide:

i. Record of quantities installed.

ii. Specific stations or location of work.

iii. Description by CPM program activity (if applicable).

iv. Show labor classification, work labor force and equipment used during shift.

v. List equipment that is idle or being repaired.

i. List materials and equipment delivered to job site:

1) Materials installed during shift.

2) Materials refused or wasted during shift.

j. Other items to report include:

1) Changes in site conditions.

2) Modifications in design and installation.

3) Photographs taken.

4) Environmental compliance or noncompliance.

5) Hazardous waste and material concerns.

6) Landowner contacts.

7) Worker complaints.

8) Potential problems observed.

D. RSN 01 46 00-3, Quality Control Supervisor (QCS) Resume:

1. Designation of authorized individual as QCS to develop and manage quality control processes.

2. Designated QCS Resume.

E. RSN 01 46 00-4, Contractor's Quality Testing Plan:

1. Address methods, procedures, frequencies, and scheduling for performing quality testing as required in other specification sections.

F. RSN 01 46 00-5, Summary of Monthly Test Results.

1.04 QUALIFICATIONS

A. Designate an employee as Quality Control Supervisor (QCS).

B. Quality Control Supervisor (QCS):

1. Qualifications:

a. Graduate engineer, graduate architect, or graduate of construction management, with minimum 4 years' construction experience in charge of

quality control for projects similar in nature to that required by this contract; or

b. Construction person with 10 years' experience in related QC work.

2. Both QCS and alternate shall have the authority to stop work if necessary.

3. QCS shall hold no other duties.

1.05 TESTING ACCEPTANCE

A. Material acceptance based on passing of both quality control testing and quality assurance testing.

B. Government quality assurance testing results will prevail in the event of a discrepancy between Contractor's test results and Government test results.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 QUALITY CONTROL PLAN

A. Base program upon definable features of work. Include three phases for each feature:

1. Preparatory Phase:

a. Performed prior to beginning of work:

1) Notify COR, in writing, 3 business days prior to beginning required action of preparatory phase.

2) Review approved submittals and identify missing information or required submittals.

3) Review each paragraph of applicable specifications and references.

4) Review contract plans or shop drawings.

5) Verify materials and equipment have been tested, submitted, and approved.

6) Verify provisions have been made to provide required inspection and testing.

7) Examine work area to verify required preliminary work has been completed.

8) Physical examination of required materials, equipment, and sample work to assure:

a) Materials are on hand and conform to approved shop drawings or submitted data.

b) Have been properly stored.

9) Review of appropriate Job Hazard Analyses (JHAs).

10) Discuss procedures for constructing work, including review of repetitive deficiencies.

11) Arrange quality control testing if required.

b. Preparatory Meeting:

1) Conducted by QCS and attended by superintendent, other quality control personnel, foreman responsible for definable feature, and Government.

2) Discuss results of preparatory phase actions. Document by separate minutes prepared by QCS and attach to daily Contractor's Quality Control Report.

3) For meeting relating to concrete batch plant or concrete placing, also include the following attendees at a minimum:

a) Concrete forming, placing, and finishing on site supervisor(s); Contractor or subcontractor(s) employee as applicable.

b) Batch plant operator.

c) Concrete pump subcontractor on site supervisor, if applicable.

d) Contractor QC and Government QA testing personnel.

2. Initial Phase:

a. Notify COR and OGR 48 hours in advance of beginning any required action of initial phase.

b. Accomplished at beginning of a definable feature of work.

c. Verify that control for feature of work developed in Preparatory Meeting is implemented and feature of work is performed to the level of workmanship required.

d. Perform as detailed below:

1) Review minutes of Preparatory Meeting.

2) Check preliminary work.

3) Verify adequacy of controls to ensure full contract compliance.

4) Establish levels of workmanship.

5) Resolve all differences.

6) Check safety to include compliance with safety plan and JHA:

a) Review JHA with workers.

e. Initial Phase Meeting:

1) Conducted by QCS and attended by superintendent, other quality control personnel, foreman responsible for definable feature, and Government.

2) Discuss results of initial phase actions. Document by separate minutes prepared by QCS, and attach to daily Contractor's Quality Control Report.

3. Follow-Up Phase:

a. Perform daily checks to assure continuing compliance with contract requirements, including safety and control testing until completion of particular feature of work.

b. Make checks a matter of record in Contractor's Quality Control documentation.

c. Conduct final follow-up checks and confirm all deficiencies are corrected prior to start of additional features of work.

d. Quality control personnel shall continually refer to standards set in Preparatory Meeting and Initial Phases.

3.02 QUALITY ASSURANCE

A. During course of work, Government may perform quality assurance tests. Tests performed by Government will be used to ensure compliance with contract requirements and not as a replacement for specified Contractor quality testing:

1. Upon request, make measuring and testing devices available for use by Government for verification tests.

2. If a conflict arises between Contractor quality testing results and Government quality assurance tests, Government testing results will take precedence over Contractor testing results.

B. Contractor's QCS:

1. At project site during work activities and shall have complete understanding of all aspects of the work being performed.

2. Effectiveness of the QCS in prosecuting QC Program will be subject to continued review and approval by CO.

3. Should QCS's efforts be deemed insufficient, Contractor may be required to replace QCS at no additional cost to Government.

C. Contractor's Quality Control (QC) Program:

1. Effectiveness of Contractor's QC Program will be subject to continued review and approval by CO.

END OF SECTION

SECTION 01 46 20
TESTING AGENCY SERVICES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items of work requiring testing agency services.

B. Progress Payments: If test reports are not submitted in a timely manner, Contractor will be considered to be in non-compliance and delaying that phase of the work to which the testing applies. CO may retain appropriate amounts of applicable progress payments.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C1077-16a	Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
2.	ASTM D3666-16	Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
3.	ASTM D3740-23	Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
4.	ASTM E329-23	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
5.	ASTM E543-21	Agencies Performing Nondestructive Testing

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 46 20-1, Testing Agency Services Plan:

1. Include:

   a. Names of agencies to perform sampling and testing.

   b. Agency accreditation to perform specified testing or agency qualifications to perform specified testing.

c. Resumes of personnel performing tests.

d. Samples of report forms.

2. No change in the approved plan may be made without written concurrence by COR.

1.04 QUALIFICATIONS

A. Testing agency organization:

1. Agencies testing construction materials: Meet requirements of ASTM E329.
2. Agencies testing concrete and concrete aggregates: Meet requirements of ASTM C1077.
3. Agencies testing soil and rock: Meet requirements of ASTM D3740.
4. Agencies testing bituminous paving materials: Meet requirements of ASTM D3666.
5. Agencies engaged in nondestructive testing: Meet requirements of ASTM E543.

B. Equipment:

1. Calibrate measuring devices, laboratory equipment, and instruments at established intervals.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTRACTOR QUALITY TESTING

A. Employ accredited independent agency to perform sampling, testing, and reporting as required in the following Sections:

1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 09 96 20 – Coatings.
3. Section 31 23 02 – Compacting Earth Materials.
4. Section 31 23 70 – Controlled Low Strength Material (CLSM).
5. Section 32 15 10 – Gravel Surfacing.
6. Section 35 21 95 – Steel Manifold Piping.
7. Other sections as required.

3.02 GOVERNMENT CONTRACT QUALITY ASSURANCE

A. During course of work, Government may perform quality assurance tests. Tests performed by Government will be used to ensure compliance with contract requirements and not as replacement for specified Contractor quality testing:

1. Upon request, make measuring and testing devices available for use by Government for verification tests.
2. If a conflict arises between Contractor quality testing results and Government quality assurance tests, Government testing results will take precedence over Contractor testing results.

END OF SECTION

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SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work as applicable.

1.02 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2023 National Electrical Safety Code (NESC)

1.03 TEMPORARY ELECTRICITY

A. Provide electric power required for construction and testing through contract completion and acceptance by Government.

B. Contractor is responsible for making all arrangements and payments to utility companies for temporary electricity required for construction and testing through contract completion and acceptance by Government.

C. Comply with IEEE C2 clearances and spacing for temporary communications and supply lines.

1.04 TEMPORARY WATER

A. Provide water required for construction through contract completion and acceptance by Government.

B. Potential Sources:

1. Obtain required permits.
2. Depending on availability, the following entities may have potable water:
3. Contact for access, metering, and billing arrangements:
   a. Lower Valley Water Users Cooperative Association
      4286 US-64
      Kirkland, NM 87417
      www.lowervalleywater.com
      Telephone: 505-598-5585
   b. Navajo Agricultural Products Industry
      P.O. Drawer 1318
      Farmington, NM 87499

www.navajopride.com
Telephone: 505-566-2636
Fax: 505-599-0572

c. Navajo Nation Department of Water Resources
P.O. Box 678
Fort Defiance, AZ 86504
www.nndwr.navajo-nsn.gov, www.watercode.navajo-nsn.gov
Telephone: 928-729-4003
Fax: 928-729-4029

d. Navajo Tribal Utility Authority (NTUA)
P.O. Box 170
Fort Defiance, AZ 86504
Telephone: 928-729-5721

e. Reclamation – Four Corners Construction Office (FCCO)
1235 La Plata Highway
Farmington, NM 87401
Telephone: 505-324-5000

C. Use water which meets specified requirements for water used in concrete, soil-cement, masonry, grouting and other permanent work.

D. Arrange, pay, and transport water for use during construction.

1. Provide proof of payment to water utility.

E. Provide means of conveying water to points of use.

F. Measure water with Contractor supplied calibrated water meter. Meter calibration shall be traceable back to national measurement standards.

G. Calibrate water meter in accordance with national measurement standards.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide temporary sanitary facilities.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REMOVAL

A. Remove temporary equipment and facilities upon completion of work under this contract.

END OF SECTION

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SECTION 01 55 00
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 55 00-1, Pre-Construction Digital Recording:

1. Include roads, driveways, corrals, cattle guards, fences, and other areas as directed by OGR.

C. RSN 01 55 00-2, Right-of-Way (ROW) Access Plan:

1. In accordance with Article 1.04 A. 1.

D. RSN 01 55 00-3, Post Construction and Post Repair Digital Recording.

1.03 SITE CONDITIONS

A. Establish rights-of-way for access to work from existing roads.

1. In accordance with clause at FAR 52.236-10, Operations and Storage Areas, use only established roadways, parking areas, and haul routes; or temporary roadways, parking areas, or haul routes constructed by Contractor when and as authorized by CO.
2. Subject to clause at FAR 52.249-10, Default (Fixed-Price Construction), unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work.

1.04 REGULATORY REQUIREMENTS

A. Meet requirements established by jurisdictional authority for use of existing roadways and haul routes; including seasonal or other limitations or restrictions, payment of excess size and weight fees, and posting of bonds conditioned upon repair of damage.

B. Comply with applicable regulations for haul routes over public highways, roads, or bridges.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials to maintain and repair existing roadways, parking areas, and haul routes: In accordance with requirements of jurisdictional authority.

B. Materials to construct, maintain, and repair temporary roadways, parking areas, and haul routes: As approved by OGR.

C. Materials to maintain roadways and parking areas constructed under this contract and used by Contractor for construction work: In accordance with specified requirements for construction of those roadways and parking areas.

PART 3 EXECUTION

3.01 EXAMINATION

A. Investigate condition of available public or private roads for clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect access and transportation operations to and from jobsite.

B. Refer to 01 57 90 – Preservation of Historical and Archeological Data if cultural resources are discovered or if Contractor needs to make improvements outside of Construction ROW.

3.02 RECORDS

A. Make pre-construction, post construction, and post repair digital recordings as directed by OGR:

1. Contact OGR to make arrangement with road owners for crossings.
2. Submit on Reclamation-issued USB drive
3. Minimum 720p resolution.
4. Label:
    a. Contract number and title.
    b. Contractor's name.
    c. Date recording is made.
    d. Preface video with this information.

B. OGR will be present during recording. Notify OGR at least 3 days prior to recording.

3.03 ESTABLISHED ROADWAYS AND PARKING AREAS

A. Established roadways and parking areas are available for Contractor's use subject to existing restrictions, Jurisdictional Authorities, and approval of OGR. Do not adversely affect established roadways and parking area conditions.

B. Any modifications to existing roadways and parking areas require cultural clearance in accordance with 01 57 90 – Preservation of Historical and Archeological Data.

3.04 TEMPORARY ROADWAYS AND PARKING AREAS

A. Roadways:

1. All temporary roadways will be restricted to already cleared rights-of-way (ROW) for the project and access/staging areas already identified and cleared of cultural resources.
2. Construct temporary roadways for access from public thoroughfares to serve construction area, of a width and load-bearing capacity to provide unimpeded traffic for construction purposes.
3. Construction traffic to be free of debris prior to entry onto public thoroughfares as required by jurisdictional authorities.
4. Construct temporary bridges or culverts at stream crossings or cross-drainage channels to allow for unimpeded surface drainage.

B. Parking Areas:

1. Temporary parking areas will be restricted to already cleared ROW for the project and access/staging areas already identified and cleared of cultural resources.
2. Construct temporary parking areas to accommodate use of construction personnel.
3. Provide additional offsite parking when site space is not adequate.

3.05 HAUL ROUTES

A. Perform work on rights-of-way established by Government as necessary to construct and maintain any roads, bridges, or drainage structures required for establishment and use of haul routes for construction operations.

B. Use existing available public highways, roads, or bridges as haul routes subject to applicable local regulations.

C. Minimize interference with or congestion of local traffic.

D. Provide barricades, flaggers, and other necessary precautions for safety of public where haul routes cross public highways or roads in accordance with Section 01 55 20 – Traffic Control.

E. Detours: In accordance with Section 01 55 20 – Traffic Control.

3.06 MAINTENANCE

A. Maintain roadways, parking areas, and haul routes in a sound, smooth condition in accordance with these specifications and Jurisdictional Authorities.

B. Maintain surfacing of gravel surfaced roads and parking areas until completion and acceptance of work under this contract. As approved by COR, defer until latest practicable date within specified completion period, placement of surfacing on roads or parking areas subject to heavy and deteriorating use by Contractor's construction operations or equipment in accordance with these specifications and Jurisdictional Authorities.

C. Snow removal for convenience of Contractor or to facilitate work operations of Contractor is considered to be normal required maintenance.

3.07 REPAIR

A. Promptly repair ruts, broken pavement, potholes, low areas with standing water, and other deficiencies to maintain road surfacing and drainage in original or specified condition in accordance with these Specifications and Jurisdictional Authorities.

B. Notify applicable contact(s) below prior to making improvements:

New Mexico 811:
1021 Eubank Blvd NE
Albuquerque, NM 87112
www.nmonecall.org
Statewide: Dial 811 or 800-321-ALERT (2537) during regular business hours.
By Fax: 505-260-1248 or 800-727-8809 24 Hours a day.
By Web: Request a Line Spot 24 Hours a day.

Navajo Nation Division of Transportation (NNDOT):

Physical Address:
#16 Old Coalmine Road
Mentmore, NM 8719

Mailing Address:
PO Box 4620
Window Rock, AZ 86515
https://www.navajodot.org
505-371-8300/8301
Fax 505-371-8399

Bureau of Indian Affairs, Navajo Regional Office DOT
301 West Hill Street
Gallup, NM 87301
www.bia.gov
505-863-8314
Fax 505-863-8324

San Juan County Roads Department
305 S. Oliver Drive
Aztec, NM 87410
https://www.sjcounty.net/government/public-works
505-334-4520

New Mexico Department of Transportation (NMDOT)
1120 Cerrillos Road
Santa Fe, NM 87504-1149
https://www.dot.nm.gov
505-827-5100
Fax 505-827-5469

3.08 REMOVAL

A. Remove materials used to construct temporary roadways, parking areas, and haul routes prior to contract completion. Recycle salvageable materials as approved by OGR.

END OF SECTION

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SECTION 01 55 20
TRAFFIC CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Federal Highway Administration (FHWA)

1.	MUTCD, Part 6	Part 6, Temporary Traffic Control, Manual on Uniform Traffic Control Devices, available at: https://mutcd.fhwa.dot.gov/kno_11th_Edition.htm

B. New Mexico Department of Transportation (NMDOT)

1.	NMDOT Std Spec-2019	Available at: https://www.dot.nm.gov/infrastructure/plans-specifications-estimates-pse-bureau/standards/
2.	NMDOT Std Drawings-2019(r23)	Available at: https://www.dot.nm.gov/infrastructure/plans-specifications-estimates-pse-bureau/standards/
3.	NMDOT District 5	Permitting resources available at: https://www.dot.nm.gov/business-support/permits/

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 55 20-1, Information of Traffic Control Plan (TCP):

1. Provide approved copy of Traffic Control Plan.

C. RSN 01 55 20-2, Approved NMDOT Permit(s):

1. Temporary Access Control Permit Request.

D. RSN 01 55 20-3, Approved Permit(s) from San Juan County, Navajo DOT, and BIA:

1. Provide copy of approved crossing and access permits.

1.04 PROJECT CONDITIONS

A. Project includes access points and crossings at:

1. Various maintained roads.
2. Indian Service Routes.
3. Various unmaintained/unnamed roads.
4. Highways.
5. County roads.

1.05 REGULATORY REQUIREMENTS

A. Contractor shall submit Traffic Control Plan (TCP) to New Mexico Department of Transportation (NMDOT) to obtain required permit(s) to conduct operations along state highways for daily operations of construction and entry/exit into and out of project site.

B. Traffic Control Plan must be prepared and signed by a registered professional engineer in the State of New Mexico.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Obtain permits from:

1. Navajo Nation Division of Transportation (Navajo DOT)
   Physical Address:
   #16 Old Coalmine Road
   Mentmore, NM 87319
   Mailing Address:
   P.O. Box 4620
   Window Rock, AZ 86515
   https://www.navajodot.org
   505-371-8300
   Fax 505-371-8399
2. Bureau of Indian Affairs (BIA), Navajo Regional Office DOT
   301 West Hill Street
   Gallup, NM 87301
   www.bia.gov

505-863-8314
Fax 505-863-8324

3. San Juan County Roads Department
305 S. Oliver Drive
Aztec, NM 87410
www.sjcounty.net/government/public-works
505-334-4520
Fax 505-334-3645

4. New Mexico Department of Transportation (NMDOT)
1120 Cerrillos Road
Santa Fe, NM 87504-1149
https://www.dot.state.nm.us
505-827-5100
Fax 505-827-5469

B. Road Closures:

1. Keep public roads open.

2. Private roads, per written agreement with owner.

3.02 TRAFFIC CONTROL

A. Meet requirements of MUTCD, Part 6, RSHS and Jurisdictional Authorities.

B. Provide cones, delineators, concrete safety barriers, barricades, flasher lights, danger signals, signs, and other temporary traffic control devices as required to protect work and public safety.

C. Provide flaggers and guards as required to prevent accidents and damage or injury to passing traffic.

D. Do not begin work along public or private roads until proper traffic control devices for warning, channeling, and protecting motorists are in place in accordance with approved traffic control plan.

E. Maintain traffic flow and conduct construction operations to minimize obstruction and inconvenience to public traffic.

F. Provide unobstructed, smooth, and dustless passageway for two lanes of traffic through construction operations.

G. Maintain convenient access to driveways, houses, and buildings along line of work.

H. Protect roads closed to traffic with effective barricades and warning signs. Illuminate barricades and obstructions from sunset to sunrise.

I. Remove traffic control devices when no longer needed.

3.03 DETOUR

A. Obtain OGR approval prior to installing detours.

B. Construct and maintain detour to provide safe, continuous traffic flow during construction in accordance with Jurisdictional Authorities.

C. Limit detour use to 3 consecutive days without prior OGR approval or as required by permits.

D. Obtain earth materials for detour embankments from required excavation. Construct stable compacted embankments.

E. Superelevate detour curves as directed by OGR and in accordance with Jurisdictional Authorities.

F. Provide culverts and ditches as required to maintain surface drainage at detour.

G. Provide compacted gravel surfacing on detour.

H. Provide traffic control devices as required by MUTCD, Part 6.

I. Maintain detour in smooth, dust-free condition.

J. Remove the detour when no longer needed.

END OF SECTION

SECTION 01 56 10
PROTECTION OF EXISTING INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as specified.
2. Costs for repair of installations damaged by Contractor's operations are Contractor's responsibility.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 56 10-1, Plan for Protecting Existing Installations.

1.03 PROJECT CONDITIONS

A. Drawings included in these specifications show existing materials, equipment, and installations but may not show all installations existing at the jobsite.

B. Obtain location of embedded conduit, pipe, cable, ground mat, and other buried items before performing drilling or excavation.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROTECTION

A. Provide protection for personnel and existing facilities from harm due to Contractor's operations. Protection shall be subject to approval of Government.

B. Arrange protective installations to permit operation of existing equipment and facilities by Government while work is in progress.

3.02 REMOVAL OF PROTECTIVE INSTALLATIONS

A. Remove protective installations after purpose has been served. Materials furnished by Contractor to provide protection remain property of Contractor.

3.03 REPAIR

A. Repair, at Contractor's expense, damage to existing installations due to Contractor's operations or Contractor's failure to provide proper protection. At Government's option, damage may be repaired by Government, and Contractor will be backcharged repair costs.

END OF SECTION

SECTION 01 56 15
PROTECTION OF EXISTING UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Utility Crossing Investigations Reach 2:

1. Payment: Lump-sum price offered in Price Schedule 1.

B. Utility Crossing Investigations Reach 3:

1. Payment: Lump-sum price offered in Price Schedule 2.

C. Cost: Include in prices offered in Price Schedules for other items of work, except for Utility Crossing Investigations.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions, available at https://www.usbr.gov/safety/rshs/index.html

B. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C2-2023	National Electrical Safety Code (NESC)

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 56 15-1, Utility Owner Acknowledgement:

1. Copy of notification acknowledgement showing underground and overhead utility agreements.

C. RSN 01 56 15-2, Utility Crossing Investigation:

1. Include the following for each utility line as applicable:
   a. Owner company name, address, and telephone number.
   b. Utility line crossing location.
   c. Utility line or item material.
   d. Elevation.
   e. Diameter.

f. Service restrictions.

g. Powerline voltage.

D. RSN 01 56 15-3, Work Plan within Utility Easements:

1. Proposed installation method including construction equipment.
2. Methods for protecting.
3. Approval of work plan from Utility owner.

1.04 PROJECT CONDITIONS

A. Drawings included in these specifications show existing utilities but may not show all utilities existing at jobsite.

B. Unknown existing utility lines may cross pipeline alignment.

C. Government does not represent that location of known existing utilities shown on drawings are exact. It is Contractor's responsibility to determine actual location of and make provision for all known and unknown utilities:

1. Verify locations, depths, and clearances of both above and below ground utilities prior to excavation.

D. Ensure that each utility line is in service as required by each utility owner.

E. Coordinate work within existing pipeline and transmission line Rights-of-Way with all utility owners. Contractors shall comply with all Utility owner crossing requirements and shall be responsible for all costs associated with utility crossings. Obtain permission from utility owners before procuring materials to be installed in Right-of-Way.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Have New Mexico One Call 811 locate utilities before doing underground work.

1. New Mexico 811
   1021 Eubank Blvd NE
   Albuquerque, NM 87112
   www.nm811.org
   Statewide: Dial 811 or 800-321-ALERT (2537) during regular business hours.
   By Web: Request a Line Spot 24-hours a day.

2. Navajo Tribal Utility Authority (NTUA)

   Shiprock District

   PO Box 1749, Shiprock, NM 87420

   Telephone: 928-729-5721

B. Utility Crossing Investigation:

1. Determine height and voltage of overhead utility lines. Clearances in accordance with RSHS and OSHA, whichever is more stringent.
2. Determine location, elevations, diameters, and materials of each underground utility line by potholing or test pits or as approved by utility owners.
3. Obtain permission from utility owner before performing physical utility investigation (potholing or test pits).
4. Reference notes on drawings.

C. Notify impacted property owner at least 2 working days before disturbing waterline that serves their property. Water service to property shall not be shut off for more than 8 hours.

D. No excavation will be permitted within 10 feet of gas lines when in service without written approval from Gas Company.

E. Protect and support existing utilities that intersect work area. Before commencing work, obtain approval and necessary permits from utility owners within project ROW:

1. Protect overhead power facilities as required by utility owner if working in their ROW.
2. Protect existing waterlines as required by utility owner when working within 100 feet of their lines.

F. For abandoned electric and water lines near Shumway Arroyo on Reach 2, contact power and water companies to turn off lines prior to work.

G. Repair existing utilities damaged during construction as approved by COR and utility owner.

3.02 CLEARANCE

A. Obtain clearances required for construction operations; provide in accordance with RSHS and IEEE C2.

3.03 INTERFERENCE WITH OPERATION OR MAINTENANCE

A. Do not interfere with operation or maintenance service on utilities, existing on date offers are received:

1. Provide for access to utilities in a manner satisfactory to owners and operators and Government.

B. Provide required temporary structures; make necessary repairs, replacements, or similar operations; and furnish indemnity or other bonds.

C. Do not cross, park or travel along utility ROW without written permission from utility owner:

1. Permission shall be obtained by Contractor.
2. If permit(s) are required, Contractor shall include Government as permittee.

END OF SECTION

SECTION 01 56 20
EXISTING FENCES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rebuild fence with new material unless otherwise approved by COR.

B. Provide replacement materials of similar type, when necessary.

2.02 ACCESS GATE

A. Metal corral panel gate, 12-ft.

B. 2-inch, 6 bar.

C. Lock and chain.

PART 3 EXECUTION

3.01 FENCE REMOVAL

A. Remove existing fences where necessary for performance of work, only when authorized by COR. Maintain fences, where designated, until work is completed or their removal is authorized.

3.02 TEMPORARY FENCES

A. Where fences are removed on rights-of-way, provide temporary fence protection for adjacent lands to prevent livestock from straying from or onto adjacent lands, complete with gates and cattle guards.

B. Where existing chain link fence is removed, protect openings made in existing chain link fencing to prevent unauthorized entry.

1. Provide temporary fencing or other approved means to protect openings, such that entry through or over protection will entail no less difficulty than that provided by adjacent existing fencing.
2. Maintain temporary protection until openings are closed by permanent construction.

C. If Contractor does not provide necessary temporary fencing or protection within a reasonable time after need for fencing or protection arises, CO will cause work to be performed and backcharge Contractor for such work.

D. Remove temporary fences and protection as a part of cleanup operations prior to final acceptance of completed work.

3.03 FENCE REBUILDING

A. Where fences are removed to accommodate construction, immediately after construction, rebuild at original location or as close as possible with OGR approval.

B. Construct rebuilt fencing that is structurally sound and matches, or is better than, existing fencing installation.

3.04 ACCESS GATE INSTALLATION

A. At locations as shown on drawings, or as approved by COR.

END OF SECTION

SECTION 01 56 32
TEMPORARY SAFETY FENCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

PART 2 PRODUCTS

2.01 SAFETY FENCE

A. Fence:

1. High-density polyethylene grid.
2. Minimum height: 48 inches.
3. Color: Safety orange.
4. Recovered Material Content:
   a. 90 to 100 percent.
5. Postconsumer Content:
   a. 60 to 100 percent.

B. Posts: Steel fence posts.

2.02 WIRE SAFETY FENCE

A. Install wire safety fence at locations listed in Section 01 57 60 – Protected Species or as shown on drawings.

B. Metal t-posts with metal grid.

PART 3 EXECUTION

3.01 INSTALLATION

A. Erect fence around work areas at location approved by OGR, prior to mobilization to a work area:

1. Install safety fence as required in Section 31 23 22 – Pipe Trench Earthwork and Section 33 05 21 – Bored Crossings.

2. Install wire safety fence along Road 6800 in accordance with Section 01 14 12 – Work Restrictions and Limitations and Section 01 57 60 – Protected Species.

3. Install safety fence at Right-of-way (ROW) width changes, as shown on drawings, or as directed by OGR.

4. Install temporary safety fencing prior to ground disturbing activities, including surveying. Fencing shall be inspected and accepted by OGR prior to ground disturbing activities, including surveying.

   a. Cultural monitoring and avoidance area fencing shall be installed and maintained.

B. Space posts 10 feet, maximum, on center.

C. Secure grid to posts.

3.02 MAINTENANCE AND REMOVAL

A. Maintain fence until work in area is complete and accepted by OGR.

B. Remove fence when no longer required, except:

1. Along Road 6800 in accordance with Section 01 57 60 – Protected Species.

END OF SECTION

SECTION 01 57 20
ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as specified.
2. Costs for damages and work stoppage are Contractor's responsibility.

B. See Section 31 02 10 – Water for Dust Abatement, for measurement and payment for applying water used for dust abatement within rights-of-way.

C. See Section 31 02 30 – Dust Palliative, for measurement and payment for applying dust palliative within rights-of-way.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions, available at: https://www.usbr.gov/safety/rshs/index.html

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 57 20-1, Copy of Applicable Air Quality Permit.

1.04 REGULATORY REQUIREMENTS

A. Comply with Federal, Tribal, State, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

D. Contractor shall be responsible for damages resulting from dust originating from Contractor operations in accordance with clause at FAR 52.236-7, Permits and Responsibilities.

E. CO may stop construction activity in violation of Federal, Tribal, State, or local laws, and additional expenses resulting from work stoppage will be responsibility of Contractor.

1.05 PERMITTING

A. Develop draft environmental permit applications not covered in other sections and forward to COR for review and submission by Government to relevant authorities having jurisdiction.

1.06 DUST CONTROL

A. Provide dust control and abatement during performance of work.

B. Prevent, control, and abate dust pollution on rights-of-way provided by Government or elsewhere during performance of work.

C. Provide labor, equipment, and materials, and use efficient, environmentally acceptable methods to prevent dust nuisance or damage to persons, property, or activities, including, but not limited to, crops, cultivated fields, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions.

D. Provide means for eliminating atmospheric discharges of dust during mixing, handling, and storing of cement, pozzolan, and concrete aggregate.

1.07 AIR POLLUTION CONTROL

A. Air Quality Permits are not required for control of fugitive dust generated as result of construction-related activities on a short-term basis; however, permits are required with specific emission sources tied to aggregate processing and batch plant operations releasing particulates to atmosphere.

B. Air Quality Permits are required for certain construction-related activities including, but not limited to, sandblasting, aggregate processing, or other processes which discharge pollutants into open air.

C. Air Quality Permits, and information concerning requirements, are available from: New Mexico Environmental Department (505-827-2855; https://www.env.nm.gov/air-quality/) and the USEPA.

D. Use reasonably available methods and devices to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.

E. Do not operate equipment and vehicles that show excessive exhaust gas emissions until corrective repairs or adjustments reduce such emissions to acceptable levels.

1.08 NOISE CONTROL

A. Only construction activities approved by COR will be allowed between dusk and dawn.

1.09 LIGHT CONTROL

A. Shine direct stationary floodlights downward at an angle less than horizontal.

B. Shield floodlights so that floodlights will not be a nuisance to surrounding areas.

C. Direct lighting so that residences are not in direct beam of light.

D. Correct lighting control problems when they occur as approved by COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 57 30
WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions, available at https://www.usbr.gov/safety/rshs/index.html

B. Code of Federal Regulations (CFR)

1.	40 CFR Part 110	Discharge of Oil
2.	40 CFR Part 112	Oil Pollution Prevention

C. Public Law

1.	Sections 311, 402, and 404	Clean Water Act (Public Law 92-500, as amended)

D. U.S. Environmental Protection Agency (USEPA)

1.	EPA CGP-22	Stormwater Discharge Permit associated with a Construction Site including revisions, available at: https://www.epa.gov/npdes/2022-construction-general-permit-cgp
2.	EPA Developing a SWPPP	SWPPP template and instructional resources, available at: www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 57 30-1, Stormwater Pollution Prevention Plan (SWPPP):

1. As required by the EPA CGP.

2. Include copy of permits.

C. RSN 01 57 30-2, Spill Prevention, Control, and Countermeasure (SPCC) Plan:

1. Submit when SPCC Plan is required in accordance with 40 CFR Part 112.

a. Required where release of oil and oil products could reasonably be expected to enter into or upon navigable waters of the United States or adjoining shorelines in quantities that may be harmful (40 CFR Part 110) and aggregate on site oil storage capacity is over 1,320 gallons. Only containers with capacity of 55 gallons and greater are included in determining onsite aggregate storage capacity.

b. Include:

1) Oil Storage Quantity.

2) Drawings of containment system.

3) Response plan to spill.

c. Reviewed and certified by a registered professional engineer in accordance with 40 CFR Part 112, as required by Section 311 of the Clean Water Act (Public Law 92-500 as amended).

1.04 REGULATORY REQUIREMENTS

A. Construction Safety Standards:

1. Comply with sanitation and potable water requirements of EPA Construction General Permit (CGP).

B. Laws, Regulations, and Permits:

1. Perform construction operations to comply, and ensure subcontractors comply, with:

a. Applicable Federal, Tribal, State, and local laws, orders, regulations, and Water Quality Standards concerning control and abatement of water pollution; and terms and conditions of applicable permits issued by permit issuing authority.

b. If conflict occurs between Federal, Tribal, State, and local laws, regulations, and requirements, the most stringent shall apply.

C. Contractor Violations:

1. If noncompliance should occur, verbally report noncompliance within 2 hours to CO. Submit specific written information within 24 hours including corrective actions.

2. Violation of applicable Federal, Tribal, State, or local laws, orders, regulations, or Water Quality Standards may result in CO stopping site activity until compliance is ensured.

3. Contractor shall not be entitled to extension of time, claim for damage, or additional compensation by reason of such a work stoppage.

4. Corrective measures required to bring activities into compliance shall be at Contractor's expense.

1.05 REQUIRED PERMITS

A. Wastewater Discharge Permit:

1. Permit:

   a. Prior to discharging other wastewater or other pollutants, provide draft permit(s) to discharge pollutants as required under Section 402 of Clean Water Act (Public Law 92-500 as amended) and New Mexico Environment Department Surface Water Quality Bureau.

   b. Submit permit applications to Government, for review and Government's submittal.

   c. Government will support Contractor in obtaining permits, as deemed appropriate by Government.

2. Terms and Conditions: Comply with terms and conditions as stated in permits.

3. Monitoring and Treatment:

   a. Provide monitoring and water treatment to achieve compliance with permit conditions.

   b. Provide recordkeeping required of permittee, as stated in Section 402 permit.

4. Sampling: Include sampling in monitoring required of Contractor to meet Section 402 requirements, as well as required laboratory tests to determine effluent characteristics.

5. Monitoring Results:

   a. Provide monitoring results to appropriate agency as required by permit.

   b. Send copies of information transmitted to appropriate agency to COR.

B. Stormwater Discharge Permit Associated with a Construction Site (EPA CGP):

1. Stormwater Pollution Prevention Plan (SWPPP): Comply with terms and conditions to obtain and maintain CGP.

2. Notice of Intent (NOI):

   a. Submit a NOI to obtain coverage under CGP.

   b. Submit NOI via the EPA's eNOI system (go to www.epa.gov/npdes/electronic-notice-intent-enoi)

      1) To obtain coverage under construction general permit to control stormwater and certain regulated non-stormwater discharges

associated with construction activity including construction dewatering.

2) Outlined in Part 1 of Final 2022 CGP required under provisions of Clean Water Act, 33 U.S.C. § 1251.

3) Amended by Water Quality Act of 1987 (P.L. 100-4).

3. Monitoring and Water Treatment:

a. Provide monitoring and water treatment to achieve compliance with applicable Water Quality Standards and CGP.

b. Provide recordkeeping required by CGP associated with construction activity.

C. Stormwater Discharge Permit Associated with Industrial Activity:

1. Stormwater Discharge Permit:

a. If construction activities will entail use of a mobile CLSM plant, concrete plant, or nonmetallic borrow areas, a stormwater discharge permit associated with industrial activity may be required.

2. Terms and Conditions:

a. Comply with terms and conditions to obtain and maintain industrial stormwater discharge permit, including preparation of a Pollution Prevention Plan.

3. Monitoring and Water Treatment:

a. Provide monitoring and water treatment, if necessary, to achieve compliance with applicable Water Quality Standards.

b. Provide recordkeeping required by stormwater discharge permit associated with industrial activity.

D. 404 Permit and 401 Water Quality Certification:

1. Government will apply for a permit to discharge dredged or fill material into waters of the United States (including wetlands) as required under section 404 of Clean Water Act (Public Law 92-500 as amended).

2. If a 404 permit is required, Government will obtain a CWA 401 water quality certification from regulatory authority(s) having jurisdiction: NMED, NNEPA, and/or USEPA.

3. Contractor shall:

a. Coordinate with Government and meet requirements of 404 permit and water quality certifications.

b. Provide documentation to support permit application, monitoring, and close out.

1.06 CONTRACTOR RESPONSIBILITIES

A. Permits:

1. Obtain permits in Government and Contractor's name.
2. Any permits obtained by Government are exceptions to clause at FAR 52.236-7, Permits and Responsibilities, which requires the Contractor to obtain necessary licenses and permits.

B. Monitoring:

1. Conduct monitoring to meet requirements of permits which may include:
   a. Sampling.
   b. Site inspections.
   c. Required laboratory tests to determine effluent characteristics.

C. Reporting:

   a. Provide monitoring results to appropriate agency as required by permit.
   b. Send copies of information transmitted to appropriate agency to COR.

D. Recordkeeping: Retain records and data for life of project or as required by permits, whichever is longer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 POLLUTION CONTROLS

A. Control pollutants by use of sediment and erosion controls, wastewater and stormwater management controls, construction site management practices, and other controls including Federal, Tribal, State, and local control requirements.

B. Sediment and Erosion Controls:

1. Establish methods for controlling sediment and erosion including vegetative practices, structural control, silt fences, straw dikes, wattles, sediment controls, and operator controls as appropriate.
2. Institute stormwater management measures as required, including velocity dissipators, and solid waste controls which address controls for building materials and offsite tracking of sediment.

C. Wastewater and Stormwater Management Controls:

1. Pollution prevention measures:

a. Use methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials which include prevention measures to control silting and loss of soil due to wind and water erosion, and which will intercept and settle runoff of sediment-ladened waters.

b. Prevent wastewater from general construction activities such as drainwater collection, aggregate processing, concrete batching, and drilling, grouting, or other construction operations, from entering flowing or dry watercourses without the use of approved turbidity control methods.

c. Divert stormwater runoff from upslope areas away from disturbed areas.

2. Turbidity Prevention Measures:

a. Use methods for prevention of excess turbidity which include, but are not restricted to, intercepting ditches, settling ponds, gravel filter entrapment dikes, flocculating processes, recirculation, combinations thereof, or other approved methods that are not harmful to aquatic life.

b. Wastewaters discharged into surface waters shall meet conditions of permits.

c. Do not operate mechanized equipment in waterbodies without having first obtained a Section 404 permit and 401 water quality certifications, and then only as necessary to construct crossings or perform required construction.

D. Construction Site Management:

1. Contractor construction operations:

a. Perform construction activities by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources:

1) Pollutants and wastes include but are not restricted to refuse, garbage, cement, sanitary waste, industrial waste, hazardous materials, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

2. Stockpiled or deposited materials:

a. Do not stockpile or deposit excavated materials or other construction materials, near or on, stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can encroach upon watercourse.

3. Petroleum product storage tanks management:

a. Place oil or other petroleum product storage tanks at least 100 feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and other water sources. Do not place petroleum product storage tanks within a watercourse's 100-year floodplain.

b. Do not use underground storage tanks.

c. Construct storage area dikes at least 12 inches high or graded and sloped to permit safe containment of leaks and spills equal to storage tank capacity located in the area plus sufficient freeboard to contain 25-year rainstorm:

1) Line diked areas with an impermeable barrier at least 50 mils thick.

d. Areas for refueling operations: Lined with impermeable barrier at least 10 mils thick covered with 2 to 4 inches of soil.

3.02 CROSS DRAINAGE

A. Flows from natural drainage channels intercepted by work shall be directed through construction.

B. Provide and maintain temporary construction required to control, bypass, or otherwise cause flows to be harmless to work and public or private property.

C. Perform additional ditching and grading for drainage as directed by OGR.

D. Remove temporary construction and restore site to original condition, as approved by COR, when temporary construction is no longer needed and prior to acceptance of work.

E. Return drainage to original grade and slope once pipe is in place and backfilled.

F. Damage to work under these specifications and to public or private property shall be restored to original condition, as approved by COR, at Contractor's expense.

END OF SECTION

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SECTION 01 57 40
PESTICIDES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.
2. Contractor is responsible for damages resulting from use of pesticides under these specifications in accordance with the clause at FAR 52.236-7, Permits and Responsibilities.

1.02 DEFINITIONS

A. Pesticides: Includes herbicides, insecticides, fungicides, rodenticides, piscicides, avicides, surface disinfectants, animal repellants, and insect repellants.

1.03 REFERENCE STANDARDS

A. Code of Federal Regulations (CFR)

1.	40 CFR Subchapter E	Pesticide Programs
2.	40 CFR 156.10	Labeling Requirements for Pesticides and Devices

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 57 40-1, Qualifications:

1. Certifications.
2. Resubmit within 10 days of personnel change.

C. RSN 01 57 40-2, Pesticide Use Plan:

1. Not required for insect repellant to be applied directly to clothing, or for small quantities of aerosol insecticide, such as fly and spider sprays, to be applied within or directly to offices or shop buildings.
2. For each pesticide:
   a. Provide a Safety Data Sheet (SDS).
   b. Complete label as defined by 40 CFR 156.10, containing the following:
      1) Name, brand, or trademark product sold under.

2) Name and address of the producer or registrant.

3) Net contents.

4) Producing establishment's number.

5) Ingredient statement.

6) Warning or precautionary statements.

7) Directions for use.

8) Use classification.

1.05 QUALIFICATIONS

A. Certified to apply appropriate weed and vegetation control measures in the project area. Possess, at a minimum, a commercial applicator's license for the State of New Mexico to dispense herbicides in industrial-rights-of-ways, rangeland settings, and in wetland areas for weed control work involving herbicide application.

B. Apply pesticides in accordance with the Mesa Verde Cactus Construction Plan (see Section 01 57 60 – Protected Species), once plan has been approved by the U.S. Fish and Wildlife Service and Navajo Nation Department of Fish and Wildlife.

C.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with labeling and Safety Data Sheet (SDS) requirements when dealing with pesticides.

B. Keep records of pesticide types and amounts purchased, delivered, stored, mixed, and actually used, and disposal means of excess. Make records available for review by COR upon request.

PART 2 PRODUCTS

2.01 PESTICIDES

A. Allowed pesticides:

1. Appropriate for site-specific conditions where applied.
2. Refer to pesticides in Section 51 00 70 – BLM Herbicides.
3. Not prohibited by State, Navajo Nation, or local agencies.

PART 3 EXECUTION

3.01 APPLICATION

A. Apply pesticides only as allowed by labeling.

B. Apply pesticides in accordance with the Mesa Verde Cactus Construction Plan (see Section 01 57 60 – Protected Species), once plan has been approved by the U.S. Fish and Wildlife Service and Navajo Nation Department of Fish and Wildlife.

C. In accordance with and only after approval of Pesticide Use Plan.

END OF SECTION

SECTION 01 57 50
TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as specified.
2. Costs for repair or treatment of injured vegetation and replacement of trees or shrubs are Contractor's responsibility.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 57 50-1, Protection Plan:

1. Description of protective barriers or other methods used to protect vegetation from damage or injury caused by construction operations.

C. RSN 01 57 50-2, Qualifications:

1. List of not less than 3 comparable completed jobs similar in size and scope, including owner's name, address, and telephone numbers completed within the last five years.

1.03 QUALIFICATIONS

A. Experienced Arborist:

1. Minimum 5-years' experience as an Arborist.
2. Completed at least 3 projects of similar size, type, application, and complexity.

PART 2 PRODUCTS

2.01 REPLACEMENT TREES AND SHRUBS

A. Species: Same as removed tree or shrub or other species approved by COR.

B. Size: Same size as removed tree or shrub, or maximum practicable size that can be planted and sustained in the particular environment as approved by COR.

PART 3 EXECUTION

3.01 PRESERVATION AND PROTECTION

A. Preserve natural landscape and preserve and protect existing vegetation not required or otherwise authorized to be removed:

1. Submit requests to remove vegetation not specifically required to be removed to COR.

B. Conduct operations to prevent unnecessary destruction, scarring, or defacing of natural surroundings in vicinity of work.

C. Move crews and equipment within rights-of-way and over routes provided for access to the work in a manner to prevent damage to grazing land, crops, or property.

D. Protect vegetation from damage or injury caused by construction operations, personnel, or equipment by use of protective barriers or other methods approved by COR.

E. Minimize, to greatest extent practicable, clearings and cuts through vegetation. Irregularly shape authorized clearings and cuts to soften undesirable aesthetic impacts.

F. Do not use trees for anchorages except in emergency cases or as approved by COR:

1. For such use, wrap trunk with a sufficient thickness of approved protective material before rope, cable or wire is placed.
2. Submit requests to use trees for anchorage, except for emergencies. Include description of protective material.

G. Use safety ropes where tree climbing is necessary; do not use climbing spurs.

3.02 REPAIR, TREATMENT, OR REPLACEMENT

A. Contractor is responsible for injuries to vegetation caused by Contractor operations, personnel, or equipment. Repair, treat or replace injured vegetation as directed by COR.

B. Employ the services of an experienced arborist to direct repair, treatment, and replacement of injured vegetation.

C. Repair or treat injured vegetation without delay and as recommended by and under direction of an experienced arborist.

D. Removed and dispose of trees or shrubs not required or otherwise authorized to be removed that, in the opinion of COR, are injured beyond saving.

E. Replace removed tree or shrub with tree or shrub approved by COR.

END OF SECTION

SECTION 01 57 60
PROTECTED SPECIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 PROJECT CONDITIONS

A. Certain native plant and animal species in the State of New Mexico are protected under Federal, State and Tribal laws. Government has ascertained that protected species and/or their habitats may exist in the areas to be disturbed by construction activities. These species include, but may not be limited to, the following:

1. Migratory Birds.
2. Burrowing Owl.
3. Ferruginous Hawk.
4. Prairie Dog.
5. Kit Fox.
6. Mesa Verde Cactus.
7. Raptors.

B. Federal legislation provides for protection of Threatened and Endangered Species, which might otherwise be lost due to alteration of terrain as a result of any Federal construction projects.

C. Project is designed to comply with Environment Commitments of Navajo-Gallup Water Supply Project Final Environmental Impact Statement, Realignment of the Northern Portion of the San Juan Lateral Environmental Assessment, and Final Biological Opinion for the Navajo-Gallup Water Supply Project reissued by U.S. Fish and Wildlife Service on September 20, 2022.

D. Insert this section in subcontracts.

E. In accordance with Federal, State, and Tribal Law, Government may arrange for removal of protected species.

1. Cooperate with those performing such removal.
2. If these species are not removed, cooperate with and abide by protection plans developed by appropriate Federal, State, and Tribal entities to avoid damage to or disturbance of protected species.

F. Persons who, without permission contribute to the take of threatened and endangered species are subject to arrest and penalty of United States, Navajo Nation, and New Mexico laws.

1. Take: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct.
2. Harm: includes significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.
3. Harass: intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.
4. Incidental take: take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.
5. Offenders will be subject to United States, Navajo Nation, and New Mexico environmental protection laws and civil penalties.

G. Immediately notify COR if protected species listed above are disturbed. Include written account, map, extent of disturbance, number of impacted species, and circumstances. COR will coordinate notifications to USFWS and Navajo Nation.

1.03 SPECIAL REQUIREMENTS

A. Migratory Birds

1. Nesting may occur in area between March 15th and August 15th.
2. Government will survey for nesting birds in vegetated areas to be disturbed. Evaluation shall be performed no more than 5 days prior to area disturbance.
3. Notify OGR 10 days before disturbing an area.
4. Do not disturb a nesting pair of birds with eggs.
5. Avoid birds and modify construction activities as directed by COR.

B. Mesa Verde Cactus

1. Mesa Verde Cactus is found directly adjacent to construction areas.
   a. Government will monitor work in these areas.
   b. Coordinate work with COR and OGR.
   c. Government will conduct preconstruction surveys for Mesa Verde Cactus. Evaluation shall be performed in blooming season in the year prior to construction.
      1) Blooming may occur from April to May.
   d. Notify OGR before a minimum of 14 days prior to disturbing an area to complete spring surveys.

1) Do not disturb potential Mesa Verde Cactus habitat prior to preconstruction surveys.

2) Modify construction activities as directed by COR.

e. Onsite Contractor personnel shall complete Mesa Verde Cactus awareness training prior to working in project area.

1) Government will provide training to inform onsite personnel of environmental requirements and expectations.

2) Training session will occur during preconstruction meeting or other mutually agreed upon time before initial groundbreaking takes place.

a) Duration: Approximately 1 hour.

b) Training will be recorded, and a digital copy of Mesa Verde Cactus awareness training will be provided to Contractor

3) Require onsite personnel to complete required Mesa Verde Cactus awareness training before being allowed to work in project area.

4) Maintain training records

5) Onsite personnel added after completion of Government-provided training session shall view digital copy of training before being allowed to work in project area.

6) The Contractor shall adhere to all requirements outlined in the Mesa Verde Cactus Education and Awareness training, which will include requirements Reclamation develops in coordination with the United States Fish and Wildlife Service (FWS) during preparation of the Mesa Verde Cactus Construction Plan.

a) Construction Plan is a required Conservation Measure of the FWS's 2022 Final Re-issued Biological Opinion, No, 2-22-01-F-532.

C. Raptors:

1. Raptor nesting may occur in the area from January 15th to July 15th:

a. Minimize disturbance to raptors. Government will conduct raptor surveys prior to construction that is to begin between January 15th and July 15th. Evaluation shall be performed no more than 5 days prior to area disturbance. The survey will include all potential nesting habitat within specified buffer distances (0.25-mile to 0.625-mile, depending on the species) of the construction right- of-way.

2. Notify COR 10 days prior to construction to allow for raptor nest surveys.

3. Do not disturb an active raptor nest:

a. Government will notify Contractor of nest locations.

b. No construction will be allowed within the above months within 0.25-mile to 0.625-mile of active nests, depending on the species.

4. Raptor Safe Utility Poles:

a. All above ground utility poles shall conform to a design standard(s) that comply with the Raptor Electrocution Prevention Regulations RCS-43-08 published September 10, 2008. This is to avoid unintentional electrocution of raptors that may perch on the utility pole.

D. Ferruginous Hawk

1. Nesting may occur in the area from March 1st to July 31st.

a. Government will conduct pre-construction surveys for nesting hawks in areas to be disturbed within 1.0 km (0.62 miles) of suitable nesting habitat during species breeding and chick reading seasons (March 1st to July 31st, of any year). Evaluations shall be performed no more than 5 days before an area is disturbed.

b. Notify COR 10 days before disturbing an area.

c. Do not disturb nesting birds within buffers established by Navajo Nation Department of Fish and Wildlife.

1) Avoid hawks and modify construction activities as directed by COR.

E. Burrowing Owl

1. Nesting may occur in the area from March 1st to August 31st.

a. Government will survey for burrowing owls if any work is proposed during the species' active season (March 1st to August 31st, of any given year). Surveys shall occur within 0.4 km (1/4 mile) of the project location and follow appropriate protocols.

1) If burrowing owl(s) are found during survey, no surface work shall occur within ¼ mile of the active nest until after the nesting period (March 1st -August 15th); additionally, no habitat alteration is allowed year-round within 0.2 km of nest site.

2) If burrowing owls are found that impact the contractor's work, a contract modification may be issued.

b. Notify COR 10 days before disturbing an area.

c. Do not disturb nesting owls within buffers established by Navajo Nation Department of Fish and Wildlife.

F. Kit Fox

1. Active Kit fox den sites may occur in the project area.

a. Government will survey for kit fox den sites in areas disturbed.

b. Notify COR 30 days before disturbing an area.

c. Do not disturb kit fox den sites during breeding and reproduction season (December 1st to August 1st) within buffers established by Navajo Nation Department of Fish and Wildlife (0.2 km or 1/8 mile).

1) Avoid kit fox den site and modify construction activities as directed by COR.

G. Prairie Dogs

1. Active prairie dog colonies may be present in portions of the project area.

a. Government will survey for prairie dogs in these project areas if any work is proposed in the species' breeding and reproduction season (March 1st to June 1st).

b. Notify COR 30 days before disturbing an area.

2. Do not disturb prairie dogs during breeding and reproduction season.

a. Breeding and reproduction may occur from March 1st to June 1st.

b. Avoid breeding prairie dogs and modify construction activities as directed by COR.

1.04 REPLACEMENT PLANTS

A. Protected plant species shall not be removed or damaged by Contractor.

1. If inadvertent effects occur to protected species during construction:

a. Notify COR:

1) Verbal: Within 2 hours.

2) Written: Within 24 hours.

b. Cease work in affected work area until consultation commitments are completed.

2. Government, in consultation with Bureau of Indian Affairs (BIA) and State of New Mexico, will manage required removal/replacement planting in accordance with consultation commitments.

3. Replacement numbers/ratio in accordance with consultation commitments.

1.05 DISCOVERY OF RESOURCES

A. When Contractor or parties operating or associated with Contractor, in performance of this contract discover threatened and endangered species on ROW:

1. Immediately cease work within 50 feet of discovery location.

a. Place temporary safety fence in accordance with 01 56 32 –Temporary Safety fence to prevent disturbance until biologist can investigate to avoid inadvertent disturbance by construction activities.

2. Verbally notify CO and OGR within 2 hours, giving location and nature of findings.
   a. Follow with written confirmation to CO within 12 hours.
3. Verbally notify Reclamation staff biologist within 2 hours.
   a. Name of assigned staff biologist and telephone number will be provided at preconstruction meeting.

B. Do not disturb or damage threatened and endangered species discovered during construction activities. Provide cooperation and assistance to preserve findings for removal or other disposition by CO.

C. Government, in consultation with appropriate regulatory agencies upon discovery of threatened and endangered species, will manage required removal/replacement planting in accordance with consultation commitments.
   1. When discovery mitigation has been completed, CO will notify Contractor that work can resume in discovery area.
   2. Do not resume work in area of discovery until receipt of written notice to proceed from CO.

D. Where appropriate by reason of discovery, CO may order delays in time of performance or changes in work or both. When such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 MESA VERDE CACTUS MONITORING AREA

A. See Section 01 14 12 – Work Restriction and Limitations for access to north and west sides of Road 6800.

B. Provide 30-day notice to OGR prior to approaching or entering the Mesa Verde Cactus Monitoring Area (Road 6800) for pre-construction activities.
   1. Coordinate with the Government for a biological monitor for new ground disturbing construction activities along the Shumway Arroyo HDD or other areas as directed by COR.

C. Install and maintain approximately 1,355 feet of fence from Station 2054+45 to 2068+00 prior to disturbing these areas.

1. Fence shall be installed and remain in place for the duration of the contract.
2. Government Biologist will be on site during fence installation
   a. COR will coordinate Government Biologist attendance.
   b. Notify COR 7 days prior to fence installation.
3. Fence will be built of materials that will not draw attention to the sensitive area and shall be simple t-post and wire. Refer to wire safety fence in Section 01 56 32 – Temporary Safety Fence.
4. Government may direct Contractor to remove fence prior to completion of the project.
   a. Government Biologist will be on site during fence removal.
5. Notify COR 28 days prior to project completion for direction from the government.
6. When construction is complete, temporary access roads and staging areas within the Mesa Verde Cactus Monitoring Area shall be closed and hand-ranked to remove tire tracks.

D. Provide 48-hour notice to OGR prior to approaching or entering the Mesa Verde Cactus Monitoring Area (Road 6800) for construction activities.
   1. Coordinate with the Government for a biological monitor for new ground disturbing construction activities along the Shumway Arroyo or other areas as directed by COR.

E. Cleaning Construction Equipment:
   1. If within Mesa Verde Cactus Monitoring Area, follow cleaning protocols outlined in the Mesa Verde Cactus Construction Plan.

END OF SECTION

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SECTION 01 57 90

PRESERVATION OF HISTORICAL AND ARCHEOLOGICAL DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as provided for an equitable adjustment.

1.02 DEFINITIONS

A. Cultural Resources: Includes prehistoric, historic, architectural, and traditional cultural properties. These include, but are not limited to, human skeletal remains, archaeological artifacts, records, and material remains related to such property.

B. Cultural Items: Native American cultural items (i.e., funerary objects, sacred objects, objects of cultural patrimony, or human remains) for which protection is prescribed under the Native American Graves Protection and Repatriation Act (NAGPRA) - Public Law 101-601; 104 Stat. 3042, Section 3(d); and 43 CFR Part 10.4.

C. Human Remains: Physical remains of the body of a person.

D. Funerary Objects: Native American items that, as part of the death rite or ceremony of a culture, are reasonably believed to have been placed intentionally at the time of death or later with or near individual human remains.

E. Native American: Of, or relating to, a tribe, people, or culture that is indigenous to the United States.

F. Sacred Objects: Native American items that are specific ceremonial objects needed by traditional Native American religious leaders for the practice of traditional Native American religions by their present-day adherents. These items are specifically limited to objects that were devoted to a traditional Native American religious ceremony or ritual and which have religious significance or function in continued observance or renewal of such ceremony.

G. Sacred Sites (Traditional Cultural Properties): Native American traditional ceremonial locations identified for Native American practice of traditional Native American religious activities.

H. Objects of Cultural Patrimony: Native American items having ongoing historical, traditional, or cultural importance central to the Indian tribe itself, rather than property owned by an individual tribal member. These objects are of such central importance that they may not be alienated, appropriated, or conveyed by any individual tribal member.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 57 90-1, Alternate Use Area:

1. When use area areas other than those approved are to be used, submit map showing location of unapproved use areas, for approval and obtain cultural and environmental approvals in accordance with Sections 01 31 19 – Project Management and Coordination and 01 57 90 – Preservation of Historical and Archeological Data.

1.04 PROJECT CONDITIONS

A. Project site has been surveyed and cleared of cultural resources for construction within Rights-of-Way (ROW) by agencies having jurisdiction (e.g., Navajo Nation Heritage and Historic Preservation Department (NNHHPD), State Historic Preservation Office (SHPO) and/or Bureau of Indian Affairs (BIA), etc.).

B. Government will retain an Archeologist to monitor ground disturbing activity work within 50 feet of identified sites:

1. Coordinate work at minimum weekly with OGR and Government Archeologist.
2. Provide a request for an Archaeologist to conduct monitoring within identified Required Monitoring Areas at least 48 hours ahead of anticipated work in those areas.

C. Onsite Contractor personnel shall undergo cultural resource sensitivity awareness training to inform onsite personnel of cultural resource requirements and expectations during pre-construction meeting before initial groundbreaking takes place:

1. Government will provide training:
   a. Training will take approximately 1 hour.
   b. Schedule for training will be mutually agreed upon.
   c. Digital recording and/or PowerPoint of Cultural Sensitivity Training will be provided to Contractor.
2. Contractor shall:
   a. Require onsite personnel to complete required cultural sensitivity awareness training before being allowed to work in project area.
   b. Require onsite personnel added after completion of required cultural sensitivity awareness training to view Cultural Sensitivity Training digital recording or PowerPoint provided to Contractor at Cultural Sensitivity Training before being allowed to work in project area.
   c. Maintain training records.

D. Federal legislation provides for protection, preservation, and collection of scientific, prehistorical, historical, and archeological data, including relics and specimens, which might otherwise be lost due to alteration of terrain as a result of any Federal construction project.

E. Persons who, without permission, injure, destroy, excavate, appropriate, or remove historical or prehistorical artifacts, objects of antiquity, or archeological resources on private, State and Tribal lands of the United States are subject to arrest and penalty of United States, Navajo Nation, and New Mexico Cultural Resource Protection laws. Offenders will be subject to Navajo Nation and New Mexico Cultural Resource Protection laws and civil penalties.

F. Comply with Federal, State and Tribal laws when operating on Federal, State, and Indian lands.

G. Attend weekly coordination meetings. Refer to Section 01 31 19 – Project Management and Coordination.

H. Discovery of Resources:

1. When Contractor or parties operating or associated with Contractor, in performance of this contract discover cultural resources on ROW:

   a. Immediately cease work within 50 feet of discovery location:

      1) Place temporary safety fence in accordance with 01 56 32 – Temporary Safety fence to prevent disturbance until archaeologist can investigate to avoid inadvertent disturbance by construction activities.

   b. Verbally notify CO and OGR within 2 hours, giving location and nature of findings.

   c. Verbally notify Reclamation staff archaeologist within 2 hours. Name of assigned staff archaeologist and telephone number will be provided at pre-construction meeting.

   d. Follow with written confirmation to CO within 12 hours.

2. Do not disturb or damage cultural resources uncovered during construction activities. Provide cooperation and assistance to preserve findings for removal or other disposition by CO.

3. Upon completion of concurred upon discovery treatment by Cultural Resources Contractor, a 48-hour consultation period will be conducted:

   a. When discovery mitigation has been completed CO will be notified that work can resume as recommended by Cultural Resources Contractor and OGR will notify Contractor work can resume in discovery area.

4. Do not resume work in area of discovery until receipt of written notice to proceed from CO.

I. Where appropriate by reason of discovery, CO may order delays in time of performance or changes in work, or both. When such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

J. Mitigate cultural resources as directed by Government on lands outside of Permanent or Construction ROW, including private lands:

1. Specifically comply with cultural resource stipulations as shown on drawings.

K. Insert this section in subcontracts which involve performance of work on jobsite terrain.

L. Obtain Government clearance before disturbing lands outside of ROW in accordance with Section 01 14 10 – Use of Site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CULTURAL MONITORING AREA

A. 48-hour notice must be provided to OGR, Government Archeologist and Cultural Resources Contractor prior to approaching or entering a cultural monitoring area for construction activities.

B. Install temporary fencing of the ROW extents at identified required monitoring areas and/or in constricted width ROW segments before site disturbance including surveying activities begin in these areas. Refer to Section 01 56 32 – Temporary Safety Fence.

C. An archeological monitor is required on all new ground disturbing construction activities within identified required monitoring areas.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. When Price Schedule includes a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in price offered in Price Schedule for item.
2. When Price Schedule does not include a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in price offered in Price Schedule for items of work requiring the material.

1.02 DEFINITIONS

A. Essential Characteristics: As used in these specifications, the term "essential characteristics" is synonymous with the term "salient characteristics."

B. Salient Characteristics: Those qualities of an item that are essential to ensure that intended use of item can be satisfactorily realized.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-2024	Unified Inch Screw Threads, (UN and UNR Thread Form)
2.	ASME B1.20.1-2013(R2018)	Pipe Threads, General Purpose, Inch

B. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions, available at https://www.usbr.gov/safety/rshs/index.html

1.04 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle manufactured products in accordance with manufacturer's instructions.

B. Store and protect manufactured products in accordance with manufacturer's instructions and RSHS. Obtain instructions from manufacturer before delivery of materials to jobsite. Maintain a copy of instructions at jobsite.

C. Protect materials from adverse effects of moisture, sunlight, ultraviolet light or weather during storage at jobsite.

D. Remove and replace damaged items with new items.

E. Store curing compounds, sealants, adhesives, paints, coatings, sealers, joint compounds, grouts, and similar products at temperature and environmental conditions recommended by manufacturer.

1.05 MAINTENANCE

A. Extra Materials:

1. Furnish additional maintenance materials specified as "extra materials" in specifications. Provide maintenance material identical to installed material and provide from same manufacturer's production lot as installed material.
2. Package extra materials for storage and label with complete product identification on packaging.
3. Deliver extra materials to Government at storage location within 150 miles of project in accordance with written direction from Government. Place in storage as directed by COR.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials required for completion of work.

B. Provide type and quality described in these specifications. Make diligent effort to procure specified materials from all available sources.

C. Furnish new materials conforming to referenced standards unless otherwise specified.

D. For materials not covered by these or referenced specifications, furnish materials of standard commercial quality.

E. If materials to be used deviate from or are not covered by recognized specifications and standards, submit, for approval, justification for and exact nature of the deviation, and complete specifications for materials proposed for use.

F. Make parts accurately to standard gauge where possible:

1. Use unified screw threads conforming to ASME B1.1 or ASME B1.20.1 for threads, including but not limited to those of bolts, nuts, screws, taps, pipes, and pipefittings.

2. For internal connections only, Contractor may deviate from ASME standards, provided a complete set of taps and dies are furnished as required to facilitate repair or replacement.

G. Permanently mark fasteners with a symbol identifying manufacturer and with symbol(s) indicating grade, class, type, and other identifying marks in accordance with reference or applicable standard.

2.02 SUBSTITUTIONS

A. If materials required by these specifications become unavailable because of Government priorities or other causes, substitute materials may be used.

B. Obtain written approval to use substitute materials from CO. State in request for approval the amount of adjustment, if any, to be made in favor of Government.

C. Government's determination as to whether substitution will be permitted and as to what substitute materials may be used, shall be final and conclusive.

D. If approved substitute materials are of less value to Government or involve less cost to Contractor than specified material, a contract adjustment will be made in favor of Government. Where amount involved or importance of substitution warrants, a deductive modification to contract will be issued.

E. No payments in excess of prices offered in Price Schedule will be made because of substitution of one material for another or because of use of one alternate material in place of another.

2.03 WORKMANSHIP

A. Accurately manufacture and fabricate materials in accordance with best modern practice and requirements of these specifications, notwithstanding minor errors or omissions therein.

B. Use liberal factors of safety and adequate shock-absorbing features in designs, especially for parts subjected to variable stress or shock, including alternating or vibrating stress or shock.

C. Include provisions which prevent components from loosening for shock-absorbing features and parts subject to vibration.

2.04 GOVERNMENT CONTRACT SOURCE QUALITY ASSURANCE

A. Materials will be subject to inspection in accordance with clause at FAR 52.246-12, Inspection of Construction at following locations, as determined by CO:

1. Place of production or manufacture.

2. Shipping point.

3. Jobsite.

B. To allow sufficient time to provide for inspection, submit at time of issuance, copies of purchase orders, including drawings and other pertinent information, covering material on which inspection will be made as advised by CO, or submit other evidence if such purchase orders are issued verbally or by letter.

C. Inspection of materials at locations specified above or waiving of inspection shall not be construed as being conclusive as to whether materials and equipment conform to contract requirements under the clause at FAR 52.246-12, Inspection of Construction nor shall Contractor be relieved thereby of responsibility for furnishing materials meeting requirements of these specifications.

D. Acceptance of materials will be made only at jobsite.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's recommendations unless otherwise specified.

3.02 GOVERNMENT CONTRACT FIELD QUALITY ASSURANCE

A. Final inspection and acceptance of materials will be made only at jobsite after installation and testing.

END OF SECTION

SECTION 01 61 10
BUY AMERICAN

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedules for other items of work.

1.02 DEFINITIONS

A. Buy American Material: In accordance with FAR 52.225-11, Buy American-Construction Materials under Trade Agreements.

1.03 SUBMITTAL

A. Include applicable certification for material in each RSN listed in Table 01 33 00A – List of Submittals in accordance with FAR 52.225-11, Buy American-Construction Materials under Trade Agreements.

B. Submit the following in accordance with Section 01 33 00 - Submittals.

C. RSN 01 61 10-1, Buy American Certificates:

1. Prior to project closeout provide applicable Buy American Certificate for materials used on the project.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CERTIFICATION

A. Deliver applicate certificate in accordance with 52.225-11 Buy American-Construction Materials under Trade Agreements to OGR with material delivered to the site.

B. Reclamation will not accept material without proper certification.

END OF SECTION

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SECTION 01 71 20
SURVEYING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 DEFINITIONS

A. GNSS: Global Navigation Satellite Systems.

B. GPS: Global Positioning System.

C. TPS: Terrestrial Positioning Systems such as total stations and automatic levels.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 71 20-1, Surveying Plan:

1. Describe work layout and survey methods.
2. Surveying schedule.
3. Example of field records format on electronic data collection devices.

C. RSN 01 71 20-2, Resume(s):

1. Responsible Professional: Proof of Registration as a licensed surveyor or engineer in New Mexico.
2. Construction surveyor(s).

D. RSN 01 71 20-3, Accuracy Check Results:

1. Accuracy check of Government-established primary control.

E. RSN 01 71 20-4, Completed and Reduced Survey Notes:

1. Copy of completed and reduced survey notes (electronic or paper) for a survey or portion of survey. Include ASCII coordinate files.
2. Field records on electronic data collection devices: Include raw data files created during construction process and notes from field books.

F. RSN 01 71 20-5, Original Field Survey Books.

G. RSN 01 71 20-6, Quantity Survey Notes and Computations:

1. Itemized statement for work verified by notes and computations including:

a. Surface comparisons of original topography and earthwork performed for requested progress payment, along with all calculations necessary to demonstrate work completed.

b. Electronic files that support calculations (i.e., dwg, Excel, ASCII, dems, landXML).

2. When progress payment invoice includes unit priced pay items that surveys required for computing quantities, this submittal is part of documentation required for a proper invoice for progress payments in accordance paragraph (a)(2)(xi) of the clause at FAR 52.232-27, Prompt Payment for Construction Contracts.

H. RSN 01 71 20-7, Workday's Survey Notes:

1. Copies when requested by Government.

1.04 PRIMARY CONTROL

A. Government will establish primary control, in grid (state) coordinates, to be used for establishing work lines and grades.

B. Primary control will consist of benchmarks and horizontal control points in work vicinity.

C. Government will provide complete listing and identification of primary control within 15 days after issuance of Notice to Proceed.

D. Check and verify primary control and resolve discrepancies with Government before beginning work.

E. Preserve and maintain primary control points until otherwise authorized. Government may reestablish damaged or destroyed primary control points and back charge reestablishment cost to Contractor.

1.05 QUALIFICATIONS

A. Responsible Professional:

1. Registered Land Surveyor or Professional Engineer.

2. Registered in New Mexico.

3. When GPS/GNSS is utilized, shall have working knowledge of geodesy, GNSS/GPS capabilities.

1.06 COORDINATION MEETING

A. Contractor and Construction Surveyor shall meet with COR, OGR and Government surveyor 14-days before submittal of Surveying Plan to review:

1. Project coordinates and benchmarks.
2. Survey submittals.

PART 2 PRODUCTS

2.01 SURVEYING MATERIALS AND EQUIPMENT

A. Provide surveying instruments and materials required for surveying work, including, but not limited to, stakes, spikes, steel pins, templates, platforms, and tools.

1. Except as required to be incorporated in work or left in place, surveying materials remain property of Contractor.
2. Type and brand of surveying equipment including serial numbers (GNSS Systems, Total Stations, and Data Collectors) to be used onsite.

PART 3 EXECUTION

3.01 GENERAL

A. Construction surveyor shall be onsite during construction activities requiring vertical and horizontal control to provide control of work and assure constructed features meet specified tolerances:

1. Surveyor shall be required for each pipe crew, if multiple crews are utilized, unless waived by CO.
2. Contracted surveyor will use FCCO Survey Group code list for entire duration of the project. Surveyor Chief of FCCO office will provide code list to contracted surveyor.

B. Cultural Resources:

1. Obtain COR approval before entering work site with a vehicle.
2. If vehicular travel through an archaeological site is required, an archaeologist shall flag a route that avoids features within the site.
3. Refer to Section 01 57 90 – Preservation of Historical and Archeological Data if cultural resources are encountered.

3.02 LAYOUT OF WORK SURVEYS

A. Establish lines and grades for work layout from Government-established primary control points.

B. Establish measurements required for work execution to specified tolerances.

C. Provide stakes, markers, and other survey controls necessary to control, check, and guide construction. Place and mark controls so OGR can monitor progress without the use of survey equipment.

1. ROW staking:

a. Labels: Front and back with stationing and offset.

b. Flagging: Orange and pink.

c. Turn inward towards centerline.

2. Centerline staking:

a. Labels: Front and back with stationing.

b. Flagging: Orange.

3. Install staking a minimum of 6-inches in ground or substantially secure to prevent movement from weather, livestock, and similar.

D. Stations and distances shown on drawings are based on ground coordinates.

E. Northings and eastings shown on drawings are based on grid (state plane) coordinates.

F. Perform GPS/GNSS work using North American Datum 1983 (NAD 83) State Plane New Mexico West FIPS 3003.

G. Perform work using North American Vertical Datum of 1988 (NAVD 88) in vertical units of U.S. Survey Feet.

H. Georeferencing shall employ Geoid 09 (GEOID09).

I. All ground-to-grid conversions, where necessary, shall be performed utilizing site ground-to-grid conversation factor as shown on drawings. Independent site conversion factors will be provided and also appear on Construction Plan and Profile drawings as needed.

J. Collect survey data in grid coordinate format to remain in and be delivered in New Mexico West 3003 State Plane grid coordinates (NAD 83, NAVD 88).

3.03 QUANTITY SURVEYS

A. Perform surveys and computations to determine quantities of work performed or placed during each progress payment period.

B. Perform surveys necessary for Government to determine final quantities of work in place. Final payment quantities will be based on Government's original terrain data and submitted survey notes and computations.

C. Perform quantity surveys in presence of authorized Government representative, unless specifically waived. Notify Government at least 24 hours before performing a quantity survey.

3.04 SURVEY REQUIREMENTS

A. Alignment, ROW and Entry/Exit Pit Staking: Each 50-feet on tangent, each 25-feet on curves and each corner.

1. A licensed PLS or Surveyor under direction and supervision of a PLS shall survey and stake ROW boundaries.

B. Cross-Sections: Original, final, and intermediate as required, for structure sites and other locations as necessary for quantity surveys. Survey borrow areas before and after removal of materials, but before final shaping as necessary.

C. Slope Staking: Each 50-feet on tangent and each 25-feet on curves, stake every 10-feet in elevation on slopes.

D. Structures: Stake out of structures and checkouts before and during construction.

E. Roads: Blue tops each 50-feet on tangent and 25-feet on curves.

F. As-builts: As required for structures and other features of work.

G. Set additional stakes as required by COR.

3.05 ACCURACY

A. Degree of Accuracy:

1. Alignment of Tangents and Curves: Within 0.1 foot.
2. Structure Points: Set within 0.01 foot, except where installation or operation considerations require tighter tolerances.
3. Cross-Section Points: Locate within 0.1 foot, horizontally and vertically.
4. Blue Tops: Set within 0.1-foot.
5. Vertical Control Surveys: Close within 0.05-foot times the square root of circuit length in miles.

B. Include check measurement on known survey point(s) at the beginning and ending of each survey.

3.06 FIELD RECORDS

A. Record field notes, computations, and other surveying data on electronic data collection devices or in fieldbooks. Field records shall be complete and accurate record of survey.

1. Include:

a. Names of all survey crew members.

b. Type (GNSS Systems, Total Stations, and Data Collectors) and brand of surveying equipment including serial numbers.

B. Record survey data in accordance with recognized professional surveying standards:

1. Notes or data not in accordance with standard formats will be rejected.

2. Fieldbooks:

a. Illegible notes or data or erasures on any page of a fieldbook will be sufficient cause for rejection of part or all of fieldbook.

b. Corrections by ruling or lining out errors will be permitted.

c. Copied notes or data will not be permitted.

d. Rejection of part or all of a fieldbook may necessitate resurveying.

C. Data and notes may be collected on electronic data collection devices:

1. Electronic files of notes: In approved format.

2. File structure: Day/Month/Year/Method/Crew Chief Initials.

a. Example: 02062025 RTK FML for survey performed February 6, 2025, via Real Time Kinematic method by Crew Chief named First Middle Last.

3. Download raw data files from survey equipment at least once per week.

4. Include electronic files and paper copies of notes in submittals.

END OF SECTION

SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as specified.
2. Cost of environmental site assessments are Contractor's responsibility.

1.02 DEFINITIONS

A. Hazardous waste: Defined as hazardous by 40 CFR 261.3; or by other Federal, Tribal, State, or local laws or regulations.

1.03 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions, available at https://www.usbr.gov/safety/rshs/index.html

B. Code of Federal Regulations (CFR)

1.	40 CFR 261.3	Definition of Hazardous Waste
2.	49 CFR 171-179	Transportation - Hazardous Materials Regulations

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 74 00-1, Waste Production and Disposal Plan:

1. For each type of waste, list estimated quantity and planned disposal location.

C. RSN 01 74 00-2, Waste Production and Disposal Records:

1. For each type of waste, list quantity and disposal location.
2. Certification waste was properly disposed.
3. Recycled waste materials verification.
4. Hazardous wastes manifests.

D. RSN 01 74 00-3, Environmental Consultant Resume:

1. Describe experience on similar project.

E. RSN 01 74 00-4, Environmental Site Assessment.

1.05 QUALIFICATIONS

A. Environmental consultant: Minimum 2 years' experience in conducting environmental site assessments for similar construction.

1.06 REGULATORY REQUIREMENTS

A. Comply with Federal, Tribal, State, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

1.07 PROJECT CONDITIONS

A. Report waste materials discovered at jobsite to COR.

1. Cease work in areas where waste may be hazardous until waste materials are investigated by Government.
2. Have Environmental Consultant investigate waste materials and make recommendations for continuing work. Government will review and approve of investigation and recommendations.
3. If waste is hazardous, CO may order delays in time of performance or changes in work, or both.
4. If such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. Keep work and storage areas free from accumulations of waste materials and rubbish.

3.02 FINAL CLEANUP

A. Remove temporary facilities, buildings, rubbish, unused materials, and other similar materials which are not part of permanent work.

3.03 DISPOSAL

A. Nonhazardous waste materials:

1. Dispose by removal from jobsite. Reuse or recycle waste materials whenever possible.
2. Dispose of nonhazardous waste materials that are not reused or recycled at appropriately permitted disposal facilities.

B. Hazardous Waste Disposal:

1. Dispose by removal from jobsite.
2. Recycle hazardous waste whenever possible.
3. Dispose of hazardous waste materials that are not recycled at appropriately permitted treatment or disposal facilities.
4. Transport hazardous waste in accordance with 49 CFR 171-179.

C. Certify that wastes are disposed of in accordance with Federal, Tribal, State, and local regulations.

3.04 SITE ASSESSMENT

A. Upon completion of work, perform site assessment at following areas for work done under these specifications:

1. Hazardous waste accumulation areas.
2. Petroleum dispensing and storage areas where aggregate storage of petroleum at jobsite was over 110 gallons.
3. Hazardous material storage areas.

B. Employ qualified environmental consultant to perform assessments.

C. Demonstrate and document by appropriate analytical sampling that site contamination is less than State action cleanup levels. Submit written report with sampling locations, findings, manifests, photos, and other pertinent information.

3.05 RECORDS

A. Keep records of types and amounts of waste materials produced.

B. Keep records of waste material disposal.

END OF SECTION

SECTION 01 78 30
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. As-Built Drawings Reach 2:

1. Payment: Lump-sum price offered in Price Schedule 1.

B. As-Built Drawings Reach 3:

1. Payment: Lump-sum price offered in Price Schedule 2.

C. Final Drawings Reach 2:

1. Payment: Lump-sum price offered in Price Schedule 1.

D. Final Drawings Reach 3:

1. Payment: Lump-sum price offered in Price Schedule 2 .

1.02 DEFINITIONS

A. As-Built Drawings (Also known as "Red-line" Drawings):

1. Set of full size, hard-copy drawings, that contain both Government informational drawings supplied with the Specifications and Contractor produced drawings that have been submitted for approval.
2. Update progress as-built drawings to document work or services performed for progress payments in accordance with the clauses at FAR 52.232-27, Prompt Payment for Construction Contracts. The COR will retain from progress payments if project drawings are not updated.
3. At a minimum, meet monthly with OGR to review and approve progress made to full-sized record drawings prior to the submittal for progress payment. Meeting location to be approved by OGR.
4. Verify with the OGR that mark-ups to the drawings are current with the progress of the work prior to submitting invoice for progress payment.

B. Final Drawings:

1. Complete electronic set of drawings produced by Contractor updated to reflect all changes made in the field through installation of each item requiring drawings.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 01 78 30-1, Electronic Media Release Form, Upon Request.

1. Refer to Article 1.04 Electronic Drawings below.

C. RSN 01 78 30-2, Progress As-Built Drawings:

1. Copies of as-built drawings maintained on site. Colored copies are not required.
2. Submit to OGR monthly for review and approval prior to the submittal for progress payment.
   a. Certify as being up to date and accurate as shown in the description of work.

D. RSN 01 78 30-3, Final As-Built Drawings:

1. Certified marked sets. As-built drawings that have been certified by Contractor as being up to date and accurate in the description of work.
2. Submit to COR for approval prior to Government possession.
3. For Information Only (FIO) Drawings: Revision date and details.

E. RSN 01 78 30-4, Final Drawings:

1. Submit to COR for Government approval no later than 14 calendar days following approval of RSN 01 78 30-3, Final As-Built Drawings.
2. Updated with all changes as marked on as-built drawings to reflect approval comments.

1.04 ELECTRONIC DRAWINGS

A. AutoCAD Files, will be distributed upon request, after:

1. Notice to Proceed.
2. Contractor signs form in Section 51 00 50 – Electronic Media Release.

1.05 AS-BUILT DRAWINGS

A. Maintain 2 sets of full-size prints of contract drawings marked to show accurate and complete records of as-built conditions. Keep drawings at jobsite and mark as work progresses:

1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents:
   a. Include buried or concealed construction and utilities.
   b. Include existing items, topographic features, and utility lines revealed during construction which differ from those shown on contract drawings.
2. Mark to define construction actually provided where choice of materials or methods is permitted in specifications, or where variations in scope or character of work from that of the original contract are authorized.

B. Use standard drafting practice to represent changes and include supplementary notes, legends, and details necessary to clearly portray progress as-built construction.

C. Mark drawings in the following colors:

1. Red: Additions to original drawings.
2. Green: Deletions to original drawings.
3. Blue: Notations necessary for explanation of as-built markings.

D. Allow Government to review drawings during weekly construction meetings and be available at all other times.

E. Upon completion of work and prior to Government acceptance, submit for review and acceptance:

1. One set will be made available to the Government:
   a. For maintenance of changes to Government provided information drawings.
   b. For verification of Final Drawings.
2. Sign marked prints as certified correct:
   a. Sign and date each drawing as certified correct. Do not include or certify Information Only drawings.
   b. If no revisions were necessary to illustrate as-built conditions, mark drawing with "No Changes."
   c. Provide as-built drawings as outlined in Section 01 33 00 – Submittals and as required in other sections.

1.06 FINAL DRAWINGS

A. Update all drawings and diagrams either generated by Contractor or impacted by Contractor-performed work with all modifications made during design and construction process, including all modifications made during testing. Include all as-built drawing modifications.

B. Drawings shall represent final installed condition of pipelines at project completion.

C. Drawings supplied as Final Drawings shall meet requirements of Final Drawings included in Section 01 33 00 – Submittals.

D. Computer drafted drawings provided in electronic file format, compatible with AutoCAD, 2018 or later.

E. Upon completion, sign prints as certified correct:

1. Sign and date each drawing as certified correct.

2. If no revisions were necessary, mark drawing with "No Changes."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONSTRUCTION DOCUMENTATION

A. Provide and maintain at least 2 copies of as-built drawings and manufacturer's installation instructions at jobsite upon equipment shipment:

1. Drawings shall be in as-built condition at time of equipment shipment and shall reflect Government approval comments.

B. Mark drawings with changes and revisions made during installation and checkout of equipment following as-built marking procedures:

1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents.
2. Mark to define construction actually provided:
   a. Where choice of materials or methods is permitted in specifications.
   b. Where variations in scope or character of methods is permitted in specifications.
   c. Where variations in scope or character of work from that of original contract are authorized.

C. Upon completion of work:

1. Sign marked prints as certified correct.
2. Submit Final As-Built Drawings for approval within 28 days of Government issued substantial completion of work :
   a. One set to be retained by COR.
   b. One set to be used in preparation of Final Drawings for each unit:
      1) Due no later than 14 calendar days following approval of Final As-Built Drawings.

END OF SECTION

SECTION 03 11 10
CONCRETE FORMING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of concrete formwork in prices offered in Price Schedules, for items of work requiring concrete formwork.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 318-19 — Building Code Requirements for Structural Concrete and Commentary

B. APA - The Engineered Wood Association (APA)

1. APA PS 1-09 — Structural Plywood

C. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions posted at: https://www.usbr.gov/safety/rshs/

D. Western Wood Products Association (WWPA)

1. WWPA WLGR-11 — Western Lumber Grading Rules

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 03 11 10-1, Formwork Design and Drawings:

1. Include design and drawings for:
   a. all elements requiring formwork
2. Designed and stamped by registered professional engineer.
3. Design Calculations, stamped by a registered professional engineer.
4. Include product data for any alternative formwork materials.

1.04 DESIGN

A. Design formwork in accordance with RSHS.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 FORM MATERIALS

A. Sheathing or Lining: Conform to Table 03 11 10A - Form Sheathing or Lining Materials, or provide other materials which will produce equivalent results.

Table 03 11 10A - Form Sheathing or Lining Materials

Finish	Wood sheathing or lining	Steel sheathing or lining
F1	Any grade common board or plywood	Steel sheathing permitted Steel lining permitted
F2	No. 2 common or better, shiplap, or plywood	Steel sheathing permitted Steel lining permitted if approved

B. Steel sheathing is steel sheets not supported by wood backing. Steel lining is thin sheets supported by wood backing.

C. Wood Sheathing or Lining: Softwood or plywood of such kind and quality and treated or coated so that deterioration or discoloration of formed concrete surfaces due to chemical action, contamination, or uneven absorption of water from concrete is prevented.

D. Plywood: APA PS 1, Exterior, Grade B-B Concrete Form, Class I, mill oiled and edge sealed.

E. Softwood Lumber:

1. Meet requirements of WWPA WLGR for dressed lumber or worked lumber of specified grade.
2. Use common boards surfaced on both edges (S2E) in accordance with WWPA WLGR.
3. Use 6- or 8-inch wide lumber for shiplap forms.
4. Use same lumber width in forms for F2 finishes.

F. Aluminum sheathing or formwork is not permitted to be in contact with fresh concrete.

3.02 INSTALLATION

A. Construct forms to confine and shape concrete to required lines so that completed work meets specified structural deviations, surface tolerances, and finish requirements.

B. Construct forms with sufficient strength to withstand pressure from placing and vibrating concrete. Maintain in proper position.

C. Adjust formwork design and concrete placing rate to compensate for hydraulic pressures exerted on forms by concrete with high fluidity.

D. Where form vibrators are to be used, construct forms with sufficient rigidity to effectively transmit energy from form vibrators to concrete without damaging formwork or altering form position.

E. Seal surfaces and joints of forms to prevent absorption of water into forms or loss of mortar from concrete.

F. Place chamfer strips in corners of forms and at tops of wall placements to bevel edges of permanently exposed concrete surfaces. Do not bevel interior angles of intersecting concrete surfaces and edges of construction joints except as indicated on drawings.

G. Install sufficient plumb and string lines to monitor formwork positions before concrete placement. Monitor plumb and string lines during concrete placement and correct deficiencies in formwork.

H. F2 Finish:

1. Use 1 type of form sheathing or lining material for exposed F2 surfaces.
2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
3. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
4. For forms constructed of plywood form lining or shiplap panels, make vertical form marks continuous for entire height of surface.
5. For forms constructed of shiplap which is not paneled, cut boards square, stagger vertical joints in boards, and place vertical joints at studs.

I. Form Ties and Anchors:

1. Embed ties for holding forms.
2. Terminate ties not less than 2 diameters or twice minimum dimension of tie, whichever is greater, from formed surface of concrete, except where F1 finish is permitted.
3. Install ties so ends or end fasteners can be removed without causing spalling at face of concrete.
4. Provide form anchors as required to ensure that concrete surfaces will meet specified tolerances. Replace form anchors embedded in concrete which are loosened before placement of adjoining concrete with other supports firmly embedded in hardened concrete.

J. Cleaning and Oiling Forms:

1. Clean form surfaces of encrustations of mortar, grout, or other foreign material.
2. Coat form surfaces with a form oil which will prevent sticking and will not soften or stain concrete surfaces or cause concrete surface to become chalky or dust producing.

3.03 REMOVAL

A. Remove forms within 24-hours after concrete has gained sufficient strength to prevent damage by form removal:

1. Non-supporting forms such as sides of beams, walls, columns, and similar items: Remove after cumulatively curing at not less than 50 degrees F for 24-hours from time of concrete placement when:
   a. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
   b. Curing protection is maintained.
2. Forms for elevated structural slabs or beams:
   a. Remove in accordance with ACI 318, Chapter 6.
   b. Do not remove forms until concrete has reached compressive strength of at least 80 percent of specified 28-day compressive strength, as determined by test cylinders.
3. Forms on upper sloping faces of concrete, such as forms on waterside of warped transitions: Remove as soon as concrete has attained sufficient stiffness to prevent sagging.
4. Wood forms for wall openings: Loosen as soon as loosening can be accomplished without damage to concrete to prevent excessive stress in concrete from swelling of forms. Construct forms for openings to facilitate loosening.

B. Do not remove forms until concrete strength is such that form removal will not result in perceptible cracking, spalling, or breaking of edges or surfaces, or other damage to concrete.

C. Remove forms in a manner which prevents damage to concrete.

D. Repair damaged concrete in accordance with Section 03 30 00 – Cast-in-Place Concrete.

E. Begin required repair and curing immediately after form removal.

END OF SECTION

SECTION 03 15 12
PVC WATERSTOP

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks as applicable.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D638-14	Tensile Properties of Plastics
2.	ASTM D746-14	Brittleness Temperature of Plastics and Elastomers by Impact
3.	ASTM D747-10	Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
4.	ASTM D1203-10	Volatile Loss from Plastics Using Activated Carbon Methods

B. United States Army Corps of Engineers (USACE)

1.	USACE CRD-C-572-74	Polyvinylchloride Waterstop

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 03 15 12-1, Purchase Orders:

1. Copies of purchase orders for waterstop.

C. RSN 03 15 12-2, Samples:

1. Two-foot-long sample of each size and type of waterstop to be used.
2. Certification that samples are representative of waterstop to be used.
3. Samples shall show manufacturer's standard imprinted identification.

D. RSN 03 15 12-3, Certification:

1. Manufacturer's certification of physical property data for PVC compound used to fabricate waterstop:

a. Perform tests by manufacturer or other laboratory no more than 18-months before submittal.

E. RSN 03 15 12-4, Drawings:

1. Details of waterstops, including dimensions, shapes, and details of intersections, changes of direction, and splices.

F. RSN 03 15 12-5, Instructions:

1. Manufacturer's recommendations for installing and splicing waterstop.

1.04 QUALIFICATIONS

A. Use skilled workmen to make splices.

B. Demonstrate to OGR that workmen are sufficiently skilled to fabricate required splices.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store waterstop to protect, from oil, dirt, and sunlight.

PART 2 PRODUCTS

2.01 PVC WATERSTOPS

A. PVC Compound:

1. Domestic virgin PVC with additional resins, plasticizers, stabilizers, or other materials required to meet specified requirements.

2. Do not use reclaimed PVC or manufacturer's scrap.

B. Meet physical characteristic requirements specified in Table 03 15 12A - PVC Waterstop Physical Characteristics.

Table 03 15 12A - PVC Waterstop Physical Characteristics

Property	Test Method	Requirement
Tensile strength, minimum	ASTM D638, specimen type IV, speed 20 inches per minute (500 mm per minute)	2,000 pounds per square inch

Table 03 15 12A - PVC Waterstop Physical Characteristics

Property	Test Method	Requirement
Ultimate elongation, minimum	ASTM D638, specimen type IV, speed 20 inches per minute (500 mm per minute)	300 percent
Stiffness in flexure, minimum	ASTM D747	600 pounds per square inch
Low temperature brittleness at -35 degrees F	ASTM D746	No cracking or chipping
Volatile loss, change in weight, maximum	ASTM D1203, method A, 0.08-inch-thick specimen	0.50 percent
Tensile strength after accelerated extraction test, percent of tensile strength before extraction test, minimum	USACE CRD-C-572	80 percent
Ultimate elongation after accelerated extraction test, percent of ultimate elongation before extraction test, minimum	USACE CRD-C-572	80 percent
Change in weight after effect of alkalies test	USACE CRD-C-572	plus 0.25 percent minus 0.10 percent
Change in Shore durometer hardness after effect of alkalies test	USACE CRD-C-572	plus or minus 5 percent

C. Prepare test specimens in accordance with USACE CRD-C-572.

2.02 FABRICATION

A. Mold or extrude so that cross section will be dense, homogeneous, and free from porosity and other imperfections.

B. Conform to detail dimensions and tolerances indicated on standard drawing 40-D-6463.

C. Metal grommets may be installed through flange between outer 2 ribs. When metal grommets installed, space at 12-inches on center.

D. Fittings:

1. Intersections and changes of direction: Factory fabricated as recommended by manufacturer.

2. Splices required between waterstops of different sizes: Factory fabricate splices as recommended by manufacturer.

E. Circular hoops:

1. Furnish waterstop for joints in barrel or box portion of cast-in-place concrete siphons, culverts, or other pressure conduits in continuous hoops.
2. Only 1 factory splice allowed per hoop.
3. Hoop length tolerance: Plus, or minus 2-inches from design circumference of hoop.

2.03 ACCESSORIES

A. Provide metal hog rings recommended by waterstop manufacturer when metal grommets are not factory installed in waterstop.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install waterstops at locations shown on drawings.

B. Install in accordance with manufacturer's recommendations.

C. Position waterstop so that a continuous watertight diaphragm will be formed in joint:

1. Position waterstop so that one-half of waterstop width will be embedded on each side of concrete joint.

D. Protect waterstop during work:

1. Do not nail, puncture, or cut waterstop.
2. Protect waterstop from dirt, form release oil, oil, grease, and curing compound.

E. Secure and support waterstop to prevent movement during concrete placement:

1. When waterstop is not furnished with factory installed metal grommets, attach hog rings through waterstop flange between outer tow ribs. Hog ring spacing along waterstop: 12-inches.
2. Attach waterstop to rebar with wire ties connected to waterstop through metal grommets or hog rings. Attach waterstop to rebar on both sides of waterstop at each metal grommet or hog ring.

F. Concrete Placement:

1. Remove large pieces of aggregate near waterstop by hand so that complete contact is achieved between waterstop and surrounding concrete.

2. Apply additional vibration to concrete surrounding waterstop so that waterstop is completely embedded in concrete, and concrete fills spaces between waterstop ribs.

3.02 FIELD SPLICES

A. Limited to straight butt joint splices.

B. Use a miter-box guide and portable saw to make cuts.

C. Make neat splices with waterstop ends joined in true alignment and contact maintained between joined surfaces.

D. Splice by heat sealing adjacent surfaces in accordance with manufacturer's recommendations:

1. Use a thermostatically controlled electric heat source.
2. Use correct temperature to melt material.
3. Do not char material.

E. Make splice so that cooled splice shows no sign of separation when bent by hand to as sharp an angle as possible.

END OF SECTION

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SECTION 03 15 18
HYDROPHILIC WATERSTOPS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks as applicable.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D412-06a(2013)	Vulcanized Rubber and Thermoplastic Elastomers-Tension
2.	ASTM D624-00(2012)	Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
3.	ASTM D2240-05(2010)	Rubber Property-Durometer Hardness

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 03 15 18-1, Product Data:

1. Manufacturer’s product data.

C. RSN 03 15 18-2, Certification:

1. Manufacturer's certification that compound used to fabricate waterstop meets specified requirements.

D. RSN 03 15 18-3, Instructions:

1. Manufacturer’s recommendations for installing waterstop, sealant, and attachment hardware.

E. RSN 03 15 18-4, Samples:

1. Two-foot-long sample of each size and type to be used in work.

PART 2 PRODUCTS

2.01 WATERSTOP

A. HYDROTITE profile style number CJ-1020-2K manufactured by Greenstreak, 3400 Tree Court Industrial Boulevard, St. Louis, MO 63122, 800-325-9504, www.greenstreak.com; or equal, having the following essential characteristics:

1. Fabricated of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties (hydrophilic rubber).
2. Co-extruded profile to control directional expansion.
3. Coated with delay coating to inhibit initial expansion due to moisture in fresh concrete.
4. Approximate Dimensions:
   a. Height: 0.4 inches.
   b. Width: 0.8 inches.
5. Conforming to Table 03 15 18A - Physical Properties of Hydrophilic Waterstop.

Table 03 15 18A - Physical Properties of Hydrophilic Waterstop

Property	Test Method	Requirement	
		Chloroprene Rubber	Hydrophilic Rubber
Tensile Strength, psi minimum	ASTM D412	1300	350
Ultimate Elongation, percent minimum	ASTM D412	400	600
Hardness (Shore A)	ASTM D2240	50 plus or minus 5	52 plus or minus 5
Tear Resistance, pounds per inch minimum	ASTM D624	100	50
Expansion Ratio, minimum	Volumetric change, distilled water at 70 degrees F	---	3 to 1

2.02 ADHESIVE FOR SPLICES

A. Cyanoacrylate (Super-Glue) adhesive or other approved adhesive recommended by waterstop manufacturer for application of waterstop to concrete.

2.03 HYDROPHILIC SEALANT

A. LEAKMASTER manufactured by Greenstreak, 3400 Tree Court Industrial Boulevard, St. Louis, MO 63122, 800-325-9504, www.greenstreak.com; or equal, having the following essential characteristics:

B. Single component hydrophilic sealant or another approved sealant recommended by waterstop manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare contact surfaces in accordance with manufacturer's recommendations.

B. Clean contact surfaces to remove foreign materials for a minimum of 3 inches on each side of waterstop location.

3.02 INSTALLATION

A. Install waterstop in concrete joints at locations indicated on drawings.

B. Install waterstop, sealant, and adhesive in accordance with manufacturer's recommendations.

C. Attach waterstop to concrete per waterstop manufacturer's instructions. Do not apply adhesive to area wider than waterstop.

D. Cut coil ends square, or at proper angle for mitered corners, using shears or sharp blade.

1. Fit splices together without overlap.

E. Splice lengths of waterstop including mitered corners with cyanoacrylate adhesive.

F. Use hydrophilic sealant to dress splices, penetrations, irregular joints, and seal exposed cells in hydrophilic waterstop.

G. Secure waterstop to vertical or overhead surfaces with concrete nails approximately 2-foot on center.

H. Install waterstop in continuous contact with concrete with no bridging or gaps.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of concrete reinforcement in prices offered in Price Schedules for items of work requiring concrete reinforcement:

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 315R-18 — Details and Detailing of Concrete Reinforcement (Part of SP-66-04 ACI Detailing Manual)

B. ASTM International (ASTM)

1. ASTM A615/A615M-24 — Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2. ASTM A996/A996M-24 — Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 03 20 00-1, Reinforcement Diagrams and Lists:

1. Bar-placing diagrams, bar lists, and bar-bending diagrams required for reinforcement fabrication and placement:
   a. Prepare bar-placing diagrams, bar lists, and bar-bending diagrams in accordance with ACI 315 and drawings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid rusting.

B. Protect from contaminants such as grease, oil, and dirt.

C. Furnish identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.01 STEEL REINFORCING

A. Reinforcing Bars:

1. ASTM A615, Grade 60; or ASTM A996, Type A, Grade 60.
2. Deformed steel bar.

B. Dowel Bar System:

1. Smooth Dowel Bars: ASTM A615, Grade 50, plain round.
2. Speed Dowel System, as manufactured by Greenstreak, Inc. www.greenstreak.com or equal having the following essential characteristics:
   a. Manufactured to accept smooth bars.
   b. Two component system, including a closed end sleeve to allow for axial movement and a reusable attachment base.
   c. Compressibility of the system shall exceed 4,500 lbs/in^2.

2.02 ACCESSORIES

A. Chairs, hangers, spacers, and other supports:

1. Material: Concrete, metal or other approved material:
   a. Compressive strength of precast concrete blocks: Equal to or greater than surrounding concrete.
2. Exposed portions of supports on concrete surfaces designated to receive F2 or F3 finish:
   a. Galvanized, plastic coated, or corrosion-resistant material.
   b. Concrete supports not allowed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Clean reinforcement surfaces of heavy, flaky rust; loose mill scale; dirt; grease; and other foreign substances before placement.

B. Field bending not allowed unless approved by COR:

1. Do not use heat to bend.

C. Do not use torch to cut.

D. Accurately place reinforcement:

1. Place reinforcement as shown on standard drawing 40-D-60003, unless otherwise shown on reinforcement design drawings.
2. Unless otherwise prescribed, placement dimensions shall be to the centerline of the bars.
3. Place reinforcement with a clear distance of 1-inch, minimum, between reinforcement and anchor bolts, form ties, or other embedded metalwork unless otherwise shown on drawings.

E. Splices:

1. Locate where shown on drawings, unless otherwise approved by COR.
2. Reinforcement may be spliced at additional locations for convenience of Contractor, subject to approval of COR.

F. Do not weld or tack weld reinforcing bars.

G. Secure reinforcement in place so that it will not be displaced during concrete placement.

H. Do not disturb reinforcement in concrete that has been placed.

I. Tolerances:

1. Maintain concrete cover over reinforcement within 1/2-inch of specified cover where specified cover is greater than 2 1/2-inches.
2. Maintain concrete cover over reinforcement within 1/4-inch of specified cover where specified cover is 2 1/2-inches or less.
3. Maintain spacing of reinforcing bars within 1-inch of required spacing.

J. Embedded Dowels:

1. Place dowels at locations shown on drawings.
2. Position dowels parallel to each other and to concrete surface as shown on drawings.
3. Maintain dowels accurately in position during concrete placement.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of concrete for cathodic protection and corrosion monitoring systems in prices offered in Price Schedules for Cathodic Protection Systems.

B. Cost:

1. Include cost of concrete for chain link fence in prices offered in Price Schedules for Chain Link Fence.

C. Cost:

1. Include cost of concrete for line pipe in prices offered in Price Schedules for Line Pipe, as applicable:
   a. Includes:
      1) Thrust Blocks and Collars.

D. Cost:

1. Include applicable cost of concrete for guard posts in Price Schedules for:
   a. 42-Inch Sectionalizing Valve Assemblies.
   b. 48-Inch Sectionalizing Valve Assemblies.
   c. 6-Inch Diameter Blowoff Assemblies.
   d. 6-Inch Diameter Blowoff with Manhole Assemblies.
   e. 6-inch Diameter Air Valve Assemblies.
   f. 6-Inch Diameter Air Valve with Manhole Assemblies.
   g. Valves and Equipment.

E. Cost:

1. Include cost of concrete slabs in prices offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.

1.02 ACRONYMS

A. NRMCA: National Ready Mixed Concrete Association.

1.03 DEFINITIONS

A. Supplementary Cementitious Materials (SCM): Cementitious materials other than Portland cement.

1.04 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 117-10(2015)	Tolerances for Concrete Construction and Materials
2.	ACI 201.2R-16	Guide to Durable Concrete
3.	ACI 301-20	Structural Concrete
4.	ACI 304R-00(2009)	Guide for Measuring, Mixing, Transporting, and Placing Concrete
5.	ACI 305.1-14	Hot Weather Concreting
6.	ACI 306.1-90(2002)	Cold Weather Concreting

B. ASTM International (ASTM)

1.	ASTM C31/C31M-25b	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C33/C33M-24a	Concrete Aggregates
3.	ASTM C39/C39M-24	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C42/C42M-20	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5.	ASTM C94/C94M-24d	Ready-Mixed Concrete
6.	ASTM C114-24	Chemical Analysis of Hydraulic Cement
7.	ASTM C117-23	Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
8.	ASTM C136-19	Sieve Analysis of Fine and Coarse Aggregates
9.	ASTM C138/C138M-24a	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
10.	ASTM C143/C143M-20	Slump of Hydraulic-Cement Concrete
11.	ASTM C150/C150M-24	Portland Cement
12.	ASTM C157/C157M-24e1	Length Change of Hardened Hydraulic-Cement Mortar and Concrete
13.	ASTM C171-20	Sheet Materials for Curing Concrete

14.	ASTM C231/C231M-24	Air Content of Freshly Mixed Concrete by the Pressure Method
15.	ASTM C260/C260M-24	Air-Entraining Admixtures for Concrete
16.	ASTM C295/C295M-19	Petrographic Examination of Aggregates for Concrete
17.	ASTM C309-19	Liquid Membrane-Forming Compounds for Curing Concrete
18.	ASTM C494/C494M-24	Chemical Admixtures for Concrete
19.	ASTM C566-19	Total Evaporable Moisture Content of Aggregate by Drying
20.	ASTM C595/C595M-25	Blended Hydraulic Cements
21.	ASTM C618-25a	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
22.	ASTM C920-18(2024)	Elastomeric Joint Sealants
23.	ASTM C989/C989M-25	Slag Cement for Use in Concrete and Mortars
24.	ASTM C1064/C1064M-23	Temperature of Freshly Mixed Hydraulic-Cement Concrete
25.	ASTM C1260-23	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
26.	ASTM C1293-23ae1	Determination of Length of Change of Concrete Due to Alkali-Silica Reaction
27.	ASTM C1315-19	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
28.	ASTM C1567-25	Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
29.	ASTM C1602/C1602M-22	Mixing Water Used in the Production of Hydraulic Cement Concrete
30.	ASTM D1751-23	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
31.	ASTM D1752-18(2023)	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

C. U.S. Army Corps of Engineers (USACE)

1.	USACE CRD-C 662-10	Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

D. International Concrete Repair Institute (ICRI)

1.	ICRI 310.2-13	Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays (formerly No. 03732)

E. Bureau of Reclamation (USBR)

1.	USBR M-47	Standard Specifications for Repair of and Maintenance of Concrete, August 2015 (Part 2 of "Guide to Concrete Repair, Second Edition" available at: www.usbr.gov/tsc/techreferences/mands/mands-pdfs/Guide2ConcreteRepair2015_Final.pdf
2.	USBR Concrete Manual	Concrete Manual, Eighth Edition, Revised Reprint, 1981

F. National Sanitation Foundation International (NSF)

1.	NSF/ANSI 61-13	Drinking Water System Components - Health Effects

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 03 30 00-1, Approval Data:

1. Mix Design: For each concrete mix:
   a. Mixture proportion.
   b. Material sources:
      1) Name and manufacturer of each cementitious material.
         a) Cementitious Materials Certification and Test Reports:
            i. Less than 3-months old.
      2) Name of aggregate source(s).
      3) Product name and manufacturer of admixtures to be used in mix. Certify that admixtures:
         a) Contain no purposefully added chlorides.

b) Chloride ion limits in accordance with ACI 201.2R.

4) Government reserves the right to require submission of samples of concrete materials for testing before or during use in concrete.

c. Physical properties:

1) Compressive strength:

a) Test data: ACI 301, paragraph 4.2.3.4.

b) Field test data: Performed within past 24-months.

c) Trial mixtures:

i. Incorporate admixtures that will be used in production mixes into trial mixes.

ii. Results from trial batches made within past 6-months.

iii. Trial mix test results, three 6-inch diameter cylinders each at 7- and 28-days.

iv. Average compressive strength of trial batch cylinders at specified design age.

d. Resubmit mix design for change in material source or type.

2. Name and manufacturer of curing compounds, and joint filler.

a. Include application instructions for curing compound.

3. Aggregate and Water Certifications and test reports:

a. Sealed by Professional Engineer.

b. Less than 12-months old.

c. Certifications and test reports:

1) Aggregate producer for:

a) ASTM C33 physical properties

b) ASR testing reports for each aggregate source.

2) Mixing water: ASTM C1602.

d. Submittal of certifications and test reports shall not relieve Contractor of responsibility for furnishing materials meeting specified requirements.

4. Name and manufacturer of any proposed finishing aid.

a. Include data sheet and manufacturer's application instructions.

C. RSN 03 30 00-2, Concrete Placement Schedule:

1. Complete, detailed concrete placement schedule showing Contractor's plan for individual placements including placement of reinforcement and embedded items.

2. Detail as necessary to show location, sequence, and date of concrete placements scheduled for each item of concrete work.

3. Show submittal schedule for placement and reinforcement drawings.

D. RSN 03 30 00-3, Certifications:

1. NRMCA Certification of Production Facilities. NRMCA certification shall be current and include automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures. NRMCA certification shall be maintained throughout duration of project.
2. ACI Aggregate Testing Technician certification(s).
3. ACI Concrete Field-Testing Technician certification(s).
4. ACI Concrete Strength Testing Technician certification(s).

E. RSN 03 30 00-4, Test Reports.

1. Aggregate test results as required by Table 03 30 00B – Contractor Batch Plant Quality Testing.
2. Concrete test reports as required by Table 03 30 00E – Contractor Field Quality Testing.

1.06 QUALIFICATIONS

A. Ready mix plant: Currently certified by NRMCA. NRMCA certification shall include automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures. NRMCA certification shall be maintained throughout duration of project.

B. ACI Aggregate Testing Technician: Currently certified ACI Aggregate Testing Technician - Level 1.

C. Flatwork foreman, minimum 5-years' experience with similar type placements.

D. ACI Concrete Field-Testing Technician: Currently certified ACI Concrete Field-Testing Technician - Grade I.

E. ACI Strength Testing Technician: Currently certified ACI Strength Testing Technician.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Furnish legible and digitized batch ticket with each batch of concrete in accordance with ASTM C94. Deliver ticket to OGR at jobsite during batch delivery.

B. Sponge rubber joint filler storage:

1. Store in protected area at temperature of 70 degrees F (21 degrees C) or less.
2. Do not expose to direct sun.

1.08 PRE-PLACING MEETING

A. At least 14-days before first concrete placement, meet with COR for pre-placement meeting.

B. Coordinate time and place of meeting with COR at least 14-days before meeting.

C. Contractor attendees shall be at least the following:

1. Contractor onsite supervisor.
2. Concrete forming, placing, and finishing onsite supervisor(s); Contractor or subcontractor(s) employee as applicable.
3. Technical specialist from ready-mix supplier.
4. Concrete pump subcontractor onsite supervisor, if applicable.
5. Testing agency onsite supervisor(s).

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

A. Portland cement:

1. ASTM C150, Type V:
   a. Meet equivalent alkalies ($Na_2O + 0.658K_2O$) of 0.60% maximum:
      1) Low-alkali limitation for Portland cement may be waived when tests of concrete aggregate source show that low-alkali cement is not required for ASR mitigation. See Concrete Aggregate Materials article (2.03).
   b. Meet early stiffening requirements of ASTM C150 - Table 4.

B. Blended hydraulic cement:

1. ASTM C595, Type IL (MS), IS (MS) or IP (MS).
2. Meet equivalent alkalies (Na2O + 0.658K2O) of 0.60% maximum. Meet equivalent alkali's requirement of ASTM C595, Table 2, Option G or Table 3.

C. SCM:

1. Pozzolan:
   a. ASTM C618, Class F or N :
      1) Except:
         a) Sulfur trioxide, maximum: 4.0 percent.
         b) Loss on ignition, maximum: 2.5 percent(Class F) or 3.0 percent (Class N). .
      2) In addition:
         a) Calcium oxide, maximum: 8.0 percent.

b) Pozzolan "R" factor less than 2.5. Pozzolan with this "R" factor shall not decrease sulfate resistance of concrete.

i. R: (C-5)/F

ii. C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C114.

iii. F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C114.

2. Slag Cement:

a. ASTM C989, Grade 100 or 120.

2.02 WATER

A. ASTM C1602, including optional requirements of Table 2.

2.03 AGGREGATE MATERIALS

A. Fine aggregate: ASTM C33:

1. Percent material passing No. 200 sieve: Less than 3 percent.

B. Coarse aggregate: ASTM C33, Class 4S, Size No. specified in Table 03 30 00A – Concrete Mixes.

C. Alkali Silica Reaction (ASR):

1. Test fine and coarse aggregates in accordance with ASTM C1260 for potential deleterious ASR:

a. For ASTM C1260, and other tests when required, continue readings for 28-days after the zero readings.

b. Acceptance criteria specified below are based on 28-day readings after the zero readings.

c. Expansion is no greater than 0.10 percent: Aggregates are acceptable.

d. Expansion is greater than 0.10 percent:

1) Test aggregates according to ASTM C1567 using components (e.g. coarse aggregate, fine aggregate, cementitious materials, and ASR inhibiting admixtures) in proportions proposed for mixture design. Continue readings for 28 days:

a) For mixes using lithium admixtures use test procedure USACE CRD-C 662.

b) Expansion of proposed mixture design test specimens, tested in accordance with ASTM C1567 does not exceed 0.10 percent:

i. Aggregates are acceptable.

c) Expansion of proposed mixture design test specimens is greater than 0.10 percent:

i. Aggregates are not acceptable unless adjustments to mixture design can reduce expansion to less than 0.10 percent or testing by ASTM C1293 indicates aggregates will not experience deleterious expansion.

2) Use tested materials. Materials may be rejected if they do not match tested materials.

2. ASTM C1293 test results may be substituted for ASTM C1260 test results:

a. Average ASTM C1293 concrete prism expansion less than 0.04 percent at one year: Aggregates acceptable.

D. Appropriate for use in accordance with ASTM C295.

2.04 ADMIXTURES

A. Air-entraining admixture: ASTM C260.

B. Chemical admixtures:

1. Do not use chemical admixtures which contain more than 0.1 percent chloride, by weight.

2. Admixtures shall be compatible with each other.

3. Allowable chemical admixtures:

a. ASTM C494, Type A, D, F, G, or S.

b. ASTM C494, Type C and E, provided they do not contain chlorides.

C. Specialized chemical admixtures:

1. When batch plant has not previously used a specialized chemical admixture, admixture manufacturer shall provide on-site representative to assist with mix design and to train batch plant personnel in dispensing and mixing operations.

2. Do not use specialized chemical admixtures which contain more than 0.1 percent chloride, by weight.

3. Alkali Silica Reaction (ASR) Inhibiting Admixture:

a. Lithium Nitrate Admixture for ASR mitigation of reactive aggregates having the following characteristics:

1) Meets NSF/ANSI 61.

2) Nominal 30 percent aqueous solution of Lithium Nitrate:

a) Density: 10 pounds/gallon (1.2 kg/L).

b) Approximate chemical constituents (percent by mass):

i. LiNo3 (Lithium Nitrate): 30 plus or minus 0.5.

ii. SO4-2 (Sulfate Ion), maximum: 0.1.

iii. Cl- (Chloride Ion), maximum: 0.2.

iv. NA+ (Sodium Ion), maximum: 0.1.

v. K+ (Potassium Ion), maximum: 0.1.

b. Coordinate with manufacturer regarding Lithium Nitrate dosage.

c. Do not use Lithium Nitrate Admixture for concrete in continuous or nearly continuous contact with water.

4. Extended set control admixture:

a. MasterSet Delvo hydration controlling admixture manufactured by Master Builders Solutions. https://www.master-builders-solutions.com/en-us; or equal, with the following essential characteristics:

1) Meets ASTM C494, Type B.

2) Retards setting.

3) Does not reduce concrete strength.

b. Use within manufacturer's time limits.

c. Include admixture on batch ticket.

d. Admixture quantity required to stabilize concrete shall be pre-determined using jobsite materials. Initial concrete setting time shall be monitored and adjusted during project by qualified concrete technician.

2.05 CURING MATERIALS

A. Water: ASTM C1602, including optional requirements of Table 2.

B. Curing compound: Per Table 03 30 00F and 03 30 00G:

1. Capable of meeting moisture retention at manufacturer's application rate.

2. Meet Federal, State, Tribal and local regulations for VOCs.

C. Sheet materials:

1. Polyethylene film: ASTM C171, white opaque.

2. White burlap-polyethylene sheeting: ASTM C171.

2.06 ACCESSORIES

A. Sponge rubber joint filler:

1. ASTM D1752, Type I, except:

a. Test specimen compression load: 50 to 150 pounds per square inch.

2. Joint filler adhesive: Non-bituminous adhesive recommended by filler manufacturer.

B. Bituminous joint filler: ASTM D1751.

C. Elastomeric sealant: ASTM C920, polyurethane, Use M, Grade NS, Class 25.

D. Evaporation control:

1. MasterKure ER 50 manufactured by Master Builders Solutions. https://www.master-builders-solutions.com/en-us; or equal having the following essential characteristics:

a. Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

b. For application after finishing and prior to applying curing compound.

c. For use when the evaporation rate is high.

2. Do not use as finishing aid.

2.07 MIX

A. Contractor shall design and adjust concrete mix.

1. Government reserves the right to adjust mix proportions when need for adjustment is indicated by results of materials testing.

a. When required, adjustment of mix proportions by Government will be in accordance with USBR Concrete Manual.

B. Cementitious materials options:

1. Specified Portland cement plus specified pozzolan by percent weight specified in Table 03 30 00A – Concrete Mixes.

2. Specified Portland cement plus specified slag cement by percent weight specified in Table 03 03 00A – Concrete Mixes.

3. Blended Hydraulic: ASTM C595 provided, specified Portland cement with percent of specified pozzolan or specified slag cement specified in Table 03 30 00A – Concrete Mixes.

C. Design concrete mixes in accordance with Table 03 30 00A – Concrete Mixes. General concrete mix shall be used for concrete unless otherwise specified.

1. Net water-cementitious materials ratio (w/c) is maximum, by weight. Cementitious material weight is cement plus SCM.

2. Slump at point of placement: In accordance with ASTM C143.

3. Air Entrainment: Percent air by volume of concrete as discharged at point of placement, in accordance with ASTM C231.

Table 03 30 00A – Concrete Mixes

* Maximum water/cementitious materials ratio.
Nominal Maximum Size Aggregate. * SCM as percent of total cementitious material, by weight.

Mix No	Feature	f'c (lb/in^2)	Max w/c*	NMSA**	Percent SCM*** A: Class F Pozzolan B: Slag Cement	Slump (inches)	Air Content (percent)	Notes
1	General Concrete and other not specified	4500 at 28-days	0.45	57, 67	A: 20 plus or minus 5	2 to 4	4.5 to 7.5	1
2	High Slump Structural Concrete	4500 at 28-days	0.45	57, 67	A: 20 plus or minus 5	4 to 7	4.5 to 7.5	1, 2
3	Pipe Encasement / Thrust Blocks / Collars	4500 at 28-days	0.45	57, 67	A: 20 plus or minus 5	2 to 4	4.5 to 7.5	1,2

NOTES:
1. Ternary blended cementitious materials which meet the specifications may be submitted for approval.
2. Concrete with ASTM C1017, Type I or II plasticizing admixtures, ASTM C494 Type F high-range water-reducing admixtures, or Type G high-range water-reducing and retarding admixtures:
   - i Admixture shall be incorporated into trial batch or historical data.
   - ii. Use slump appropriate for placing conditions.
   - iii. On-Site additions of high-range water reducers to be done by concrete supplier's QC personnel only .

D. Submit design mixes for each type and strength of concrete substantiated by either laboratory trial batch or field performance methods as specified in ACI 301. For trial batch method, mix shall be proportioned and stamped by a professional engineer.

E. Concrete trial mixes:

1. Average compressive strength of trial batch cylinders at design age: Design strength plus 1,200 pounds per square inch for concrete between 3,000 and 5,000 psi.
2. Admixtures to be used in mix shall be incorporated into mix design submitted for approval.
3. Air content: Within 1 percent of top of specified range.
4. Slump: Within 1-inch of top of specified range.

2.08 BATCHING, MIXING, AND TRANSPORTING

A. Batch plant: NRMCA certified with automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures.

B. Manufacture and deliver in accordance with ASTM C94 and ACI C304R:

1. Prepare batch ticket in accordance with ASTM C94 for every batch of concrete.

C. Cold weather: When air temperature has fallen to or is expected to fall below 40 degrees F, prepare ingredients and mix in accordance with ACI 306.1:

1. Do not use frozen materials or materials containing ice or snow.

2. Uniformly heat water and aggregates before mixing to obtain concrete mixture temperature of not less than 50 degrees.

D. Hot Weather: When precautions are necessary, prepare ingredients and mix in accordance with ACI 305.1:

1. Cool ingredients before mixing to maintain specified maximum concrete temperature at time of placement.

2. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Ice replacing batch water shall be melted prior to discharge.

3. Using liquid nitrogen to cool concrete is Contractor's option.

E. Prevent appreciable segregation of ingredients.

F. Place concrete within 90-minutes from introduction of cement to water or aggregates:

1. For placing times exceeding 90-minutes, extended set control admixtures may be used when approved by COR.

2.09 CONCRETE TEMPERATURE

A. Concrete temperature at placing:

1. 50 to 85 degrees F (10 to 29 degrees C).

2.10 CONTRACTOR SOURCE QUALITY TESTING

A. Perform sampling, testing, and reporting as required in Table 03 30 00B – Batch Plant Testing:

1. Independent testing agency shall meet requirements specified in Section 01 46 20 – Testing Agency Services.

2. Personnel conducting tests: Qualified as ACI Aggregate Testing Technician, Level 1; or equal.

B. Perform tests at least as often as frequencies specified in Table 03 30 00B – Batch Plant Testing.

C. Notify OGR immediately of test results showing failure of materials to meet specifications. Provide passing test results to COR within 24-hours. Submit reports of test results as specified.

2.11 BATCH PLANT TESTING

Table 03 30 00B – Batch Plant Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	REQUIREMENT	TESTING FREQUENCY
Aggregate Gradation	ASTM C136	Sieve Analysis of Fine and Coarse Aggregates	Fine and Coarse Aggregate meets sizing requirements per ASTM C33.	At beginning of placing each mix. At change in mix design. At least every 500 yd^3 of placing a mix.
Aggregate Fines content	ASTM C117	Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing	Fine aggregate meet specified allowable fines content (material passing No. 200 sieve)	At beginning of placing each mix. At change in mix design. At least every 500 yd^3 of placing a mix.
Aggregate moisture content	ASTM C566	Total Evaporable Moisture Content of Aggregate by Drying	Verify that moisture meter at batch plant is accurate with the material batched.	At beginning of placing each mix. At change in mix design. At least every 500 yd^3 of placing a mix.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove standing water, mud, and debris from foundation surfaces to be covered by concrete.

B. Prepare rock surfaces free from oil, objectionable coatings, and loose, semidetached, and unsound fragments. Immediately before placement of concrete, wash rock surfaces with air-water jet and dry to uniform surface-dry condition.

C. Prepare earth foundations free from frost or ice.

D. Thoroughly moisten surfaces of absorptive foundations to be covered with concrete so that moisture will not be drawn from fresh concrete. Keep subgrade moisture uniform without puddles or dry areas.

E. Clean, roughen, and surface dry surfaces of construction joints to be covered with fresh concrete:

1. Remove laitance, loose or defective concrete, coatings, and sand, curing compound, and other foreign material.
2. Sandblast, steel shotblast, or high-pressure water jet surfaces, or use other method approved by COR to create a surface equivalent to or larger than CSP 5 in accordance with ICRI 310.2.
3. Wash surface thoroughly, and surface dry immediately before placement of adjoining concrete.

3.02 PLACING

A. Notify OGR at least 24-hours before placing concrete.

B. Provide placement checkout cards in a watertight container. OGR will approve placement card format:

1. Sign each line item indicating work is completed in accordance with specifications.
2. Obtain OGR signature after each line item.
3. Do not place concrete without required signatures.
4. Use of placement checkout cards shall be required by OGR.
5. Placement card shall be stored in a watertight container located at the placement area.

C. Do not place concrete without approval of OGR.

D. Place concrete in presence of OGR.

E. Placing concrete shall be performed under direct supervision of a qualified flatwork foreman.

F. Allow at least 7-days between adjacent placements, or as approved by OGR.

G. Do not use aluminum pipes and chutes for placing or pumping concrete.

H. Adding water to concrete batch at site will be allowed only once and only when approved by OGR:

1. Add additional water before concrete is discharged.
2. Do not exceed specified water to cement ratio.
3. After water is added, concrete shall be mixed for at least 30 revolutions of mixer drum at mixing speed.
4. Record added water on the batch ticket to nearest gallon.

I. Adding air entraining admixtures to concrete batch at site will be allowed only once when approved by OGR:

1. After air entraining admixture is added, concrete shall be mixed for minimum of 30 revolutions of mixer drum at mixing speed.
2. Take slump and air content after air-entraining admixture addition and additional revolutions.
3. Record added air entraining admixture on batch ticket to nearest ounce.

J. Adding high range water reducer to concrete batch at site shall only be performed by concrete supplier's technical specialist.

1. After high range water reducer admixture is added, concrete shall be mixed for minimum of 30 revolutions of mixer drum at mixing speed.
2. Take slump and air content after high range water reducer addition and additional revolutions.
3. Record added high range water reducer admixture on batch ticket to nearest ounce.

K. Furnish legible and digitized batch ticket with each batch of concrete in accordance with ASTM C94. Ticket shall include additions made to the load after batching (water, air adjustment, admixtures). Deliver ticket to OGR at jobsite during batch delivery.

L. Do not use concrete which has become so stiff that concrete cannot be properly placed.

M. Place formed concrete in continuous, approximately horizontal layers. Do not exceed 20-inches in depth of layers.

N. Vibrate concrete until concrete has been consolidated to maximum practical density, is free from pockets of coarse aggregate, and closes snugly against surfaces of forms and embedded materials.

O. Hot Weather:

1. Place concrete in accordance with ACI 305.1.
2. Protect reinforcing steel so that steel temperature does not exceed ambient air temperature immediately before placing concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

P. Cold weather:

1. Place concrete in accordance with ACI 306.1.
2. Do not place concrete on frozen subgrade or subgrade containing frozen materials.

3.03 FINISHING

A. Notify OGR before finishing concrete.

B. Finish concrete in presence of Government inspector unless inspection is waived in each specific case.

C. Perform concrete finishing under the direct supervision of a qualified flatwork foreman.

D. Finish surfaces as specified in Table 03 30 00F – Formed Surfaces and Table 03 30 00G – Unformed Surfaces.

E. Where finishes are not specified or shown on drawings for a particular surface, finish concrete as specified for similar work.

F. Formed surfaces:

1. Finish class is designated by symbols F1, F2.
2. Finish F1:
   a. Applies to formed surfaces to be covered by fill material, grout, or concrete, and construction joint surfaces as specified in Table 03 30 00F – Formed Surfaces.
   b. Protect form tie rod ends on surfaces in contact with fill material from moisture where they will be below water table or waterline:
      1) Recess tie rod ends and fill recess with dry pack or other material approved by OGR.
   c. Cut off flush with formed surface form tie rod ends on surfaces in contact with concrete or fill material and above maximum water table or waterline elevation.
3. Finish F2:
   a. Applies to exposed formed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish F4, and to contraction joint surfaces and expansion joint surfaces as specified in Table 03 30 00F – Formed Surfaces:
      1) Recess tie rod ends and fill recess with dry pack or other material approved by OGR.

G. Unformed surfaces:

1. Do not use dry portland cement or additional water during finishing.
2. Do not use “jitterbugs” or other tools to force coarse aggregate away from surface.
3. Finish class is designated by symbols U1, U2, or broom finish.
4. Finish U1 (Screeded Finish):

a. Applies to unformed surfaces to be covered by fill material, grout, or concrete as specified in Table 03 30 00G – Unformed Surfaces.

b. Use as first stage of finish U2.

c. After concrete is placed and consolidated, strike off and level concrete to produce even uniform surface.

5. Finish U2 (Floated Finish):

a. Applies to unformed surfaces not permanently concealed by fill material, grout, or concrete, as specified in Table 03 30 00G – Unformed Surfaces.

b. Begin floating as soon as screeded surface has sufficiently stiffened and bleed water sheen has disappeared.

c. Use hand- or power-driven equipment.

d. Finish surface with minimum floating necessary to produce surface that is free of screed marks and is uniform in texture.

6. Finish U3 (troweled finish):

a. Applies to unformed surfaces where appearance and porosity is considered by Government to be of special importance as specified in Table 03 30 00G – Unformed Surfaces.

b. Begin steel troweling after bleed water has disappeared and floated surface has sufficiently hardened to prevent an excess of fine material from being drawn to surface.

c. Trowel with firm pressure to flatten sandy texture of floated surface.

d. Trowel to a dense uniform surface free from blemishes and trowel marks. Do not excessively trowel surface.

7. Broomed finish:

a. Apply broom finish immediately after concrete receives U2 finish.

b. Edge transverse joints before brooming.

c. Produce a scored surface by brooming with fiber-bristle brush in direction transverse to that of traffic with adjacent strokes slightly overlapping.

d. Finished surface shall have uniform appearance and be free of abrupt corrugation exceeding 1/8-inch in depth.

e. Brooming shall eliminate flat surface left by the surface face of the edger.

8. Slope interior surfaces for drainage where shown on drawings or as directed by COR. Slope surfaces exposed to weather for drainage as directed by COR.

9. Slope narrow surfaces, such as tops of walls and curbs, approximately 3/8-inch per foot of width, unless use of other slopes or level surface is indicated on drawings or is directed by COR.

10. Slope broader surfaces; such as walks, platform, and decks; approximately 1/4-inch per foot unless use of other slopes or level surfaces is indicated on drawings or is directed by COR

3.04 JOINTS AND EDGES

A. Construction joints (CJ):

1. Construction joints are joints which are purposely placed in concrete to facilitate construction, reduce initial shrinkage stresses and cracks, allow time for installation of embedded metalwork, or allow for subsequent placing of other concrete.
2. Bond is required at construction joints regardless of whether or not reinforcement is continuous across joint.
3. Locate construction joints where shown on drawings. Relocation, addition, or elimination of construction joints will be subject to approval by COR.
4. Clean, roughen, and surface dry surfaces of construction joints to be covered with fresh concrete. See Preparation article.
5. Do not use a mortar layer on construction joints.

B. Control joints (Ct.J):

1. Control joints are joints placed in concrete to provide for control of initial shrinkage stresses and cracks of monolithic units.
2. Construct control joints so no bond exists between concrete surfaces forming the joint:
   a. Construct control joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.
   b. Coat surface of concrete first placed at control joint with curing compound that prevents bond before placing concrete on other side of joint.
3. Reinforcement is continuous across tooled or saw cut control joints.

C. Partial Contraction Joints, (Partial Cr. J):

1. Construct partial contraction joints so no bond exists between concrete surfaces forming the joint:
   a. Construct partial contraction joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.
   b. Coat surface of concrete first placed at partial contraction joint with curing compound that prevents bond before placing concrete on other side of joint.
2. At partial contraction joints, discontinue every other reinforcement bar perpendicular to the joint; i.e. 1/2 of perpendicular reinforcement shall cross the joint. End discontinued bars 2-inches from face of joint.

D. Contraction joints (Cr.J):

1. Contraction joints are joints placed in concrete to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units.
2. Construct contraction joints so no bond exists between concrete surfaces forming the joint:
   a. Construct contraction joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.
   b. Coat surface of concrete first placed at contraction joint with curing compound that prevents bond before placing concrete on other side of joint.
3. Except as provided for dowels, reinforcement is not continuous across a contraction joint.

E. Expansion joints (EJ):

1. Cut sponge rubber joint filler to size and shape of joint surface to receive filler.
2. Adhere filler to concrete in accordance with adhesive manufacturer's recommendations.
3. Butt sections of filler with tight-fitting butt joints to prevent mortar from seeping through joint.

F. Expansion joints (EJ):

1. Form joint in concrete.
2. Fill joint with bituminous joint filler.
3. Butt sections of filler with tight-fitting butt joints.

G. Edges:

1. Permanently exposed concrete, except slabs and top edges of curbs: Chamfer edges with 45-degree bevel 3/4-inch by 3/4-inch; unless otherwise shown on drawings.
2. Exposed edges of slabs and top edges of curbs: Tool to radius of 1/4-inch.

H. Preformed joints consisting of plastic or metal strips not allowed.

3.05 STRUCTURAL DEVIATIONS AND SURFACE TOLERANCES

A. Structural deviations are defined as allowable variations from specified lines, grades, and dimensions.

B. Surface tolerances are defined as maximum allowable magnitude of surface irregularities.

C. Specified structural deviations and surface tolerances are consistent with modern construction practice and governed by effects that permissible variations may have upon a structure. COR reserves right to diminish specified structural deviations and surface

tolerances where such variations impair structural action, operational function, or architectural appearance of structure or portion of structure.

D. Construct concrete within stated variations even though more than one may be specified:

1. Specified variation for one element of structure will not apply when it will permit another element of same structure to exceed its allowable variation.
2. Where variations are not specified or shown on drawings for structure, variations shall be those specified for similar work. As exception to clause at FAR 52.236-21 "Specifications and Drawings for Construction", specific tolerances shown on drawings in connection with dimension governs.

E. Structural Deviations:

1. Check variations from specified lines, grades, and dimensions in hardened concrete to determine that structures are within tolerances specified in Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions.
2. Variation is distance between actual position of structure or element of structure and specified position in plan for structure or element:
   a. Plus, or minus variations indicate a permitted actual position up or down and in or out from specified position in plan.
   b. Variations not designated as plus or minus indicate maximum deviation permitted between designated successive points on completed element of construction.
3. Specified position in plan is defined as lines, grades, and dimensions described in this section, shown on drawings, or prescribed by COR.

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

A. MANIFOLD PIPING STRUCTURES		
1. Footings:		
	(a) Variation in length and width dimensions from those specified.....	minus 1/2-inch plus 2-inches
	(b) Horizontal misplacement or eccentricity:	2 percent of footing width in direction of misplacement, but not more than 2-inches
	(c) Reduction in thickness from that specified.....	5 percent of specified thickness, not to exceed 1-inch

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

2.	Variation from plumb or specified batter for lines and surfaces of walls:		
	(a)	When overall height of line or surface is:	
		Less than 10-feet	plus, or minus 1/4-inch
		10-feet or more	plus, or minus 3/8-inch
	(b)	For any 2 successive intermediate points on the line or surface separated by:	
		10- to 20-feet, inclusive	1/4-inch
		More than 20-feet	3/8-inch
3.	Variation from level or specified grades for slabs:		
	(a)	When overall length of line or surface is:	
		Less than 10-feet	plus, or minus 1/4-inch
		10- to 20-feet, inclusive	plus, or minus 3/8-inch
		More than 20-feet	plus, or minus 3/4-inch
	(b)	For any 2 successive intermediate points on the line or surface separated by:	
		10- to 20-feet, inclusive	1/4-inch
		More than 20-feet	3/8-inch
4.	Variation in cross-sectional dimensions from those specified and in thicknesses of slabs and walls from those specified		minus 1/4-inch plus 1/2-inch
5.	Variation from specified elevation for top of concrete for foundations		plus, or minus 1/2-inch
6.	Variation from specified grade or alignment for trenches:		
	(a)	When overall length is:	
		Less than 10-feet	plus, or minus 1/4-inch
		10- to 20-feet, inclusive	plus, or minus 3/8-inch
		More than 20-feet	plus, or minus 3/4-inch
	(b)	For any 2 intermediate points separated by:	
		10- to 20-feet, inclusive	1/4-inch
		More than 20-feet	3/8-inch

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

B. STRUCTURES AND OTHER BUILDINGS		
1.	Footings:	
	(a) Variation in length and width dimensions from those specified.....	minus 1/2-inch plus 2-inches
	(b) Horizontal misplacement or eccentricity:	2 percent of footing width in direction of misplacement, but not more than 2-inches
	(c) Reduction in thickness	5 percent of specified thickness
2.	Variation of horizontal dimensions at floor and roof levels from specified position in plan:	
	(a) Overall building dimensions	plus, or minus 1/2-inch per 100foot length with maximum for entire length of plus or minus1-inch
	(b) Overall bay dimensions limited by (c)below, but not to exceed	plus, or minus 3/8-inch
	(c) Intermediate dimensions for column, wall, and partition locations:	
	For dimensions less than 10-feet.....	plus, or minus 1/4-inch
	For dimensions equal to or greater than 10-feet but less than 20-feet	plus, or minus 3/8-inch
	For dimensions 20-feet or more.....	plus, or minus 1/2-inch

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

3.	Variation of vertical dimensions from specified position in plan:		
	(a)	Overall building dimensions	plus, or minus 1/2-inch
	(b)	Overall story height limited by (c) below, but not to exceed	plus, or minus 3/8-inch
	(c)	Intermediate dimensions:	
		Less than 10-feet	plus, or minus 1/4-inch
		10- to 20-feet, inclusive	plus, or minus 3/8-inch
		20-feet or more.....	plus, or minus 1/2-inch
4.	Variation from plumb or specified batter for lines and surfaces of columns, piers, walls, and for arrises:		
	(a)	When overall height of line or surface is:	
		Less than 10-feet	plus, or minus 1/4-inch
		10- to 20-feet, inclusive	plus, or minus 3/8-inch
		More than 20-feet, but less than 40-feet	plus, or minus 1/2 -inch
		40-feet or more	plus, or minus 1-inch
	(b)	For any 2 successive intermediate points on the line or surface separated by:	
		10- to 20-feet, inclusive	1/4-inch
		More than 20-feet	3/8-inch

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

5.	Variation from plumb for lines and surfaces of corner columns, control joint grooves, and other conspicuous lines:		
	(a)	When overall height of line or surface is:	
		Less than 10-feet	plus, or minus 1/4-inch
		10- to 20-feet, inclusive	plus, or minus 3/8-inch
		More than 20-feet	plus, or minus 1/2-inch
	(b)	For any 2 successive intermediate points on the line or surface separated by:	
		10- to 20-feet, inclusive	1/4-inch
		More than 20-feet.....	3/8-inch
6.	Variation from level or established grades for floors, roof decks, ceilings, beam soffits, and arrises:		
	(a)	When overall length of line or surface is:	
		Less than 10-feet.....	plus, or minus 1/4-inch
		10- to 20-feet, inclusive	plus, or minus 3/8-inch
		More than 20-feet, but less than 40-feet	plus, or minus 1/2-inch
		40-feet or more.....	plus, or minus 3/4-inch
	(b)	For any 2 successive intermediate points on the line or surface separated by:	
		10- to 20-feet, inclusive	1/4-inch
		More than 20-feet.....	3/8-inch

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

7.	Variation from level or specified grades for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:	
	(a) When overall length of line or surface is:	
	Less than 10-feet	plus, or minus 1/4-inch
	10- to 20-feet, inclusive	plus, or minus 3/8-inch
	More than 20-feet	plus, or minus 1/2-inch
	(b) For any 2 successive intermediate points on the line or surface separated by:	
	10- to 20-feet, inclusive	1/4-inch
	More than 20-feet	3/8-inch
8.	Variation in location from specified position in plan of sleeves and wall openings	plus, or minus 1/2-inch
9.	Variation in sizes from those specified for sleeves, floor openings, and wall openings, except wall openings for swinging doors and louvers without tubular frames	plus, or minus 1/4-inch
10.	Variation in sizes from those specified for wall openings for swinging doors and louvers without tubular frames	minus 0-inch plus 1/4-inch
11.	Variation in cross-sectional dimensions from those specified for columns and beams and in thicknesses from those specified for slabs and walls	minus 1/4-inch plus 1/2-inch
12.	Variation in rise and tread of steps from that specified:	
	(a) Flight of stairs:	
	Rise	plus, or minus 1/8-inch
	Tread	plus, or minus 1/4-inch
	(b) Consecutive steps:	
	Rise	1/16-inch
	Tread	1/8-inch

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

C. PIPELINE STRUCTURES			
1.	Footings:		
	(a)	Variation of length and width dimensions from those specified.....	minus 1/2-inch plus 2-inches
	(b)	Misplacement or eccentricity:.....	2 percent of footing width in direction of misplacement, but not more than 2-inches
	(c)	Reduction in thickness from that specified.....	5 percent of specified thickness not to exceed 1-inch
2.	Culverts:		
	(a)	Departure from established alignment.....	plus, or minus 2-inches
	(b)	Departure from established profile grade	plus, or minus 2-inches
	(c)	Variation from specified thickness	minus 2.5 percent of specified thickness or minus 1/4-inch, whichever is greater; or plus, 5 percent of specified thickness or plus 1/2-inch, whichever is greater
	(d)	Variation from specified inside dimensions	plus, or minus 0.5 percent of inside dimensions

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

3.	Checks, overchutes, drops, turnouts, inlets, chutes, and similar structures:		
	(a)	Departure from established alignment.....	plus, or minus 1-inch
	(b)	Departure from established grade	plus, or minus 1-inch
	(c)	Variation from plumb or specified batter for lines and surfaces of columns, piers, walls, and for arrises:	
		(1) When overall length of line or surface is:	
		Less than 10-feet.....	Exposed: plus, or minus 3/8-inch Buried: plus, or minus 3/4-inch
		10-feet or more	Exposed: plus, or minus 1/2-inch Buried: plus, or minus 1-inch
		(2) For any 2 successive intermediate points on the line or surface separated by:	
		10- to 20-feet, inclusive	Exposed: 3/8-inch Buried: 3/4-inch
		More than 20-feet.....	Exposed: 1/2-inch Buried: 1-inch

Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions

4.	Variations from level or specified grades for slabs, beams, and horizontal grooves:	
	(a) When overall length of line or surface is:	
	Less than 10-feet	Exposed: plus, or minus 3/8-inch Buried: plus, or minus 3/4-inch
	10-feet or more	Exposed: plus, or minus 1/2-inch Buried: plus, or minus 1-inch
	(b) For any 2 successive intermediate points on the line or surface separated by:	
	10- to 20-feet, inclusive	Exposed: 3/8-inch Buried: 3/4-inch
	More than 20-feet	Exposed: 1/2-inch Buried: 1-inch
5.	Variation in cross-sectional dimensions of columns, piers, slabs, walls, beams, and similar parts of structure(s) in 3 above from those specified	minus 1/4-inch plus 1/2-inch
6.	Variation in sizes and locations from those specified for slab and wall openings	plus, or minus 1/2-inch
7.	**Variation from plumb or level for sills and sidewalls for radial gates and similar watertight joints _____ ** Dimensions between sidewalls for radial gates: No more than shown on drawings at sills and not less than shown on drawings at top of walls.	Not greater than a rate of 1/8-inch in 10-feet
8.	Variation from plumb of pipe erected vertically in any length of 10-feet	plus, or minus 1/2-inch

F. Surface irregularities:

1. Bulges, depressions, and offsets are defined as surface irregularities or roughness.
2. Surface irregularities are classified as “abrupt” or “gradual” and allowable tolerances are specified in Table 03 30 00D – Surface Tolerances:

a. Surface tolerance designated by capital "T" followed by number 1 through 5.

b. Surface tolerance designations are separate from surface finishes and structural deviations.

3. Abrupt surface irregularities:

a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms in which maximum dimension of irregularity perpendicular to surface is greater than maximum dimension of irregularity in plane of surface.

b. Abrupt surface irregularities include isolated surface irregularities which exceed specified gradual irregularities.

4. Gradual surface irregularities:

a. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on surface.

b. Gradual surface irregularities are further defined as isolated undulations on surface. Maximum dimension of undulation perpendicular to surface is small relative to maximum dimension of undulation in plane of surface.

5. Check magnitude of surface irregularities of formwork and finished surfaces to ensure that surfaces are within specified tolerances.

G. Surface tolerances:

Table 03 30 00D – Surface Tolerances

Concrete surface	Maximum allowable surface irregularity tolerance	
	Abrupt	Gradual
T1	1-inch	1/4-inch/inch
T2	1/2-inch	1/8-inch/inch
T3	1/4-inch	1/16-inch/inch
T4	1/8-inch	1/32-inch/inch
T5	1/32-inch	1/120-inch/inch

H. Repair of hardened concrete not within specified tolerances:

1. Repair hardened concrete which is not within specified tolerances to bring it within those tolerances.

2. Perform repair after consultation with Government inspector regarding method of repair. Notify COR as to time when repair will be performed.

3. Repair concrete which will be exposed to view in manner which will result in concrete surface with uniform appearance:

a. When grinding surfaces exposed to view, limit depth of grinding such that no aggregate particles are exposed more than 1/16-inch in cross section at finished surface.

b. Where grinding has caused or will cause exposure of aggregate particles greater than 1/16-inch in cross section at finished surface, repair concrete by excavating and replacing concrete.

I. Field verification of surface tolerances:

1. Determine compliance of surface with specified surface tolerances.

2. Evaluate surface roughness:

a. Measure roughness height or depth and check for compliance with values specified in Table 03 30 00D – Surface Tolerances and Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions.

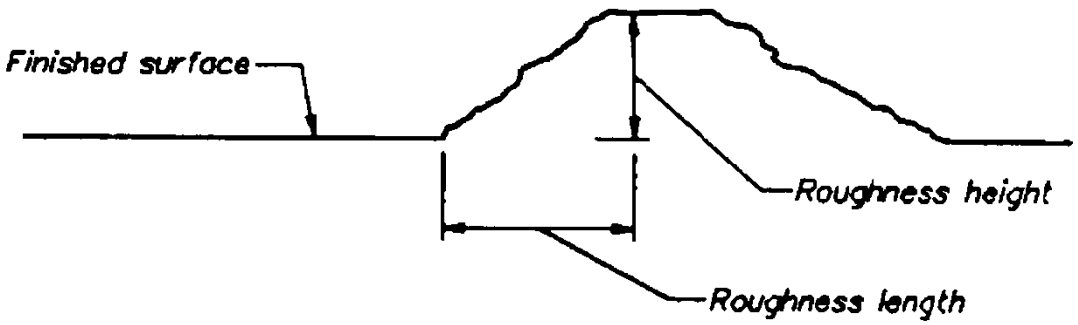
b. When measured height or depth of roughness is less than value in abrupt tolerance specification and height or depth of roughness does not cause structure to exceed applicable value specified in Table 03 30 00C – Deviations from Specified Lines, Grades, and Dimensions, surface roughness is acceptable.

c. When roughness height or depth exceeds abrupt tolerance specification, determine roughness slope for comparison to gradual tolerance specification:

1) Measure roughness length and determine roughness slope by dividing roughness height or depth by roughness length (see Figure 1).

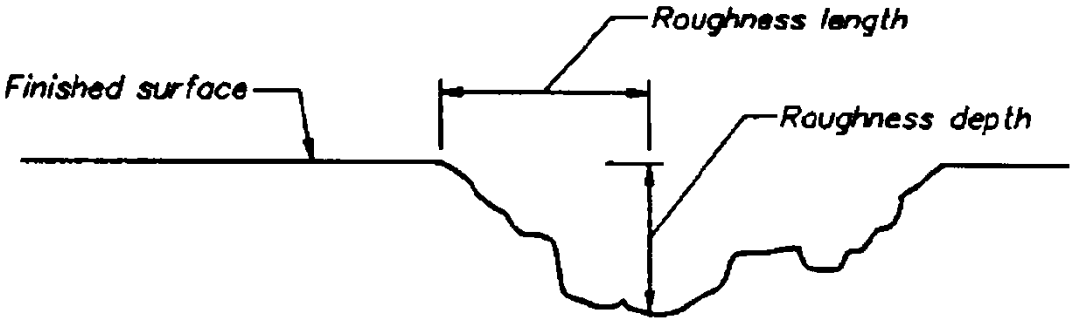
2) When roughness slope is greater than slope specified by gradual tolerance specification, surface roughness is unacceptable.

3) When roughness slope is less than gradual slope specified and gradual roughness does not cause structure to exceed allowable structural deviations, surface roughness is acceptable.



$$\text{Roughness slope ratio} = \frac{\text{Roughness height}}{\text{Roughness length}}$$

CASE 1 = Offset on the Surface



$$\text{Roughness slope ratio} = \frac{\text{Roughness depth}}{\text{Roughness length}}$$

CASE 2 = Offset into the Surface

FIGURE 1

J. Measuring surface roughness:

1. Examples below illustrate how to make necessary surface measurements for typical roughness.

2. Case 1 - Roughness Protruding above Surface:

   a. Measure roughness protruding above surface with straightedge that is at least 20 times longer than roughness height being measured.

   b. Position straightedge with one end resting on top of roughness, as shown in Figure 2 (case 1).

   c. Determine roughness height by measuring maximum gap that occurs normal to straight edge.

   d. Note position on the straightedge from which normal distance is measured.

   e. To determine roughness length, measure distance along straightedge from point where the height was measured to point of contact between straightedge and top of roughness.

   f. Roughness slope is defined as ratio of roughness height to roughness length.

   g. As roughness is seldom symmetric, moving position of straightedge about roughness may be necessary to locate point where maximum height and slope exists.

3. Case 2 - Roughness Extending below the Surface:

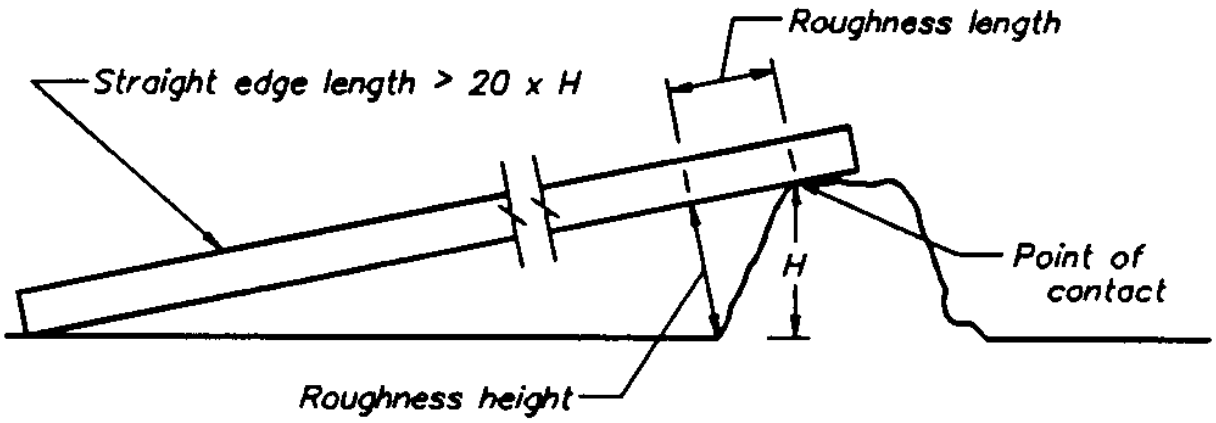
   a. A roughness occurring as an indentation to surface is measured by placing straightedge across indentation, as shown in Figure 2 (case 2).

   b. Measure maximum gap between straightedge and surface and note location of measurement on straightedge.

   c. From point of depth measurement, measure along straightedge in both directions to point of contact with surface.

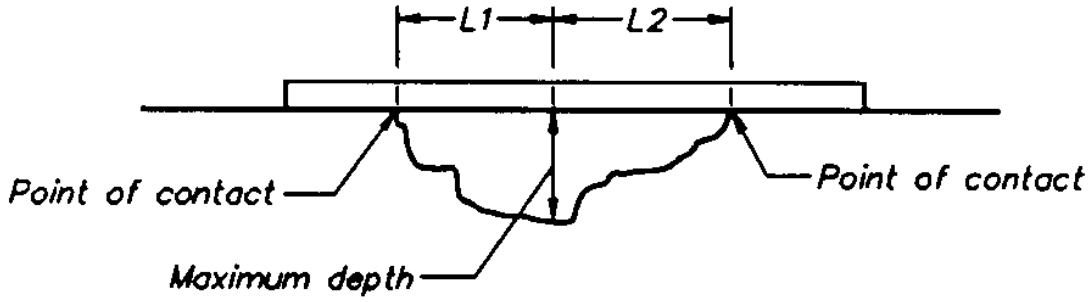
   d. Use shortest length measured as roughness length.

   e. Divide roughness depth by roughness length to determine roughness slope.



CASE 1

$$\text{Roughness slope} = \frac{\text{Roughness depth}}{\text{The shortest distance L1 or L2}}$$



CASE 2

FIGURE 2

K. Prevention of repeated failure to meet tolerances:

1. When concrete placements result in hardened concrete which does not meet specified tolerances, submit to COR an outline of preventive actions such as modifications to forms, modified procedure for setting screeds, and different finishing techniques to be implemented to avoid repeated failures. Submit when requested by COR.

2. Government reserves the right to delay concrete placements until preventive actions which have been approved by COR are implemented.

3.06 CURING

A. Water Curing:

1. Keep concrete surface wet for 14-days, minimum, from time concrete has attained enough set to prevent detrimental effects to surface.

2. Cure methods:

a. Water-saturated material.

b. System of perforated pipes, mechanical sprinklers, or porous hose.

c. Other methods which will keep surfaces wet.

d. Subject to approval by COR.

B. Curing with Curing Compound:

1. Apply to concrete surface to provide water-retaining film. Reapply as necessary to maintain continuous, water-retaining film on surface for 28-days.

2. Thoroughly mix compound and spray apply in one coat to provide continuous, uniform film over surface.

3. Do not exceed coverage rate recommended by curing compound manufacturer. Decrease coverage rate on rough surfaces as necessary to obtain required continuous film.

4. Ensure ample coverage on edges, corners, and rough surfaces.

5. Use spray equipment recommended by curing compound manufacturer.

C. Sheet Material Curing:

1. Thoroughly moisten concrete surface by lightly spraying with water as soon as concrete has hardened sufficiently to prevent damage.

2. Completely cover concrete surface with sheet material to provide airtight, water-retaining film over entire surface.

3. Lap edges of sheet material to seal adjacent sheets.

4. Place tightly against concrete surface at extreme edge of curing area.

5. Secure sheet material to withstand wind and prevent circulation of air inside sheet material.

6. Keep surface covered for 14-days, minimum.

3.07 CONTRACTOR FIELD QUALITY TESTING

A. Perform sampling, testing, and reporting as required in Table 03 30 00E – Field Testing.

1. Independent testing agency shall meet requirements specified in Section 01 46 20 – Testing Agency Services.

2. Personnel conducting plastic concrete field tests: Qualified as ACI Concrete Field-Testing Technician, Grade 1; or equal.

3. Personnel conducting concrete specimen tests: Qualified as ACI Concrete Strength Testing Technician; or equal.

B. Perform tests at least as often as frequencies specified in Table 03 30 00E – Field Testing.

C. Notify COR immediately of test results showing failure of materials to meet specifications. Notify COR within 2-hours of test results showing materials meet specifications. Submit reports of test results as specified.

3.08 FIELD QUALITY ASSURANCE

A. In addition to specified Contractor Quality Field Testing, Government may also perform tests listed in Table 03 30 00E – Field Testing.

Table 03 30 00E – Field Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	TESTING FREQUENCY
Fresh Concrete Properties - tests performed at site	ASTM C143	Slump of Hydraulic-Cement Concrete	1 set of tests per load for first 2 loads. When tested concrete meets specifications, 1 set of tests each day of placement for each mixture for first 50 or less cubic yards, and 1 set of tests for each additional 100 cubic yards of concrete. Minimum of 1 set of tests per hour during placements. When concrete does not meet specifications, test each load until 2 consecutive loads meet specifications, then resume testing frequency specified above.
	ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method (alternative to ASTM C138 gravimetric method)	
	ASTM C1064	Temperature of Freshly Mixed Hydraulic-Cement Concrete	
	ASTM C138	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete	

Table 03 30 00E – Field Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	TESTING FREQUENCY
Compressive Strength	ASTM C31 ASTM C39	Making and Curing Concrete Test Specimens in the Field Compressive Strength of Cylindrical Concrete Specimens	1 set of samples (6- by 12-inches for each day of placement for each mixture for first 50 or less cubic yards, and 1 set of samples for each additional 100 cubic yards of concrete. Minimum of 5 samples for strength testing shall be made each time strength samples are collected. 2 additional field cured test cylinders during placement in adverse (hot or cold) weather. Cure samples on jobsite under same conditions as concrete cylinders represent for minimum 7 days, then transfer to testing laboratory until testing at strength design days. Test 2 cylinders each at 7-days age and 2 cylinders at strength design age. Maintain last cylinder for testing in event strength design age test results fall below required strength.
Concrete Cores	ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	At discretion of Government when cylinder strengths fail to meet minimum requirements. Contractor shall obtain core specimens in accordance with ASTM C42 at locations directed by COR, at no additional cost to Government. Contractor shall repair core holes in accordance with USBR M-47 as directed by COR

B. Acceptance criteria:

1. Cylinder compressive strength:

   a. In accordance with ASTM C94, except as follows:

      1) 90 percent of test cylinders exceed specified compressive strength at design age.

      2) Average compressive strength of six consecutive test cylinders exceeds specified compressive strength at design age.

      3) No individual strength test falls below specified compressive strength by more than 500 pounds per square inch.

2. Drilled concrete cores:

   a. Concrete in placement represented by core tests will be considered structurally adequate when average compressive strength of three cores is equal to at least 85 percent of specified compressive strength and no single core has compressive strength of less than 75 percent specified compressive strength.

3.09 PROTECTION

A. Protect concrete from damage until final acceptance by Government:

1. Do not load, remove forms or shoring, or backfill against concrete until concrete has gained sufficient strength to safely support its weight and imposed loads.
2. Protect fresh concrete against erosion from rain, hail, sleet, or snow; contamination from foreign materials; and damage from foot traffic until the concrete has hardened.
3. Protect concrete from heavy foot traffic and other construction activities by covering with plywood or other suitable material. Remove and dispose of temporary covering when no longer required.

B. Protect concrete when freezing temperatures are imminent:

1. Maintain concrete at a temperature of 50 degrees F (10 degrees C) or greater for 72-hours, minimum, after placement. Vent heater and prevent concrete from drying where artificial heat is employed.
2. Protect concrete from freezing during water curing. After discontinuance of water curing, maintain at a temperature of 50 degrees F (10 degrees C) or greater for next 72-hours.
3. Discontinue protection against cold weather such that the drop in temperature of the concrete will be gradual and will not exceed 5 degrees F per hour and 40 degrees F in 24-hours for thin sections and 5 degrees F per hour and 20 degrees F in 24-hours for massive sections greater than 36-inches.

3.10 REPAIR

A. Repair concrete in accordance with USBR M-47.

B. Use repair or replacement method directed by COR.

3.11 FINISH, SURFACE TOLERANCES, AND CURING SCHEDULES

Table 03 30 00F – Formed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces upon or against which fill material will be placed	F1	T1	Water, White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces.
Surfaces not permanently concealed by fill material or concrete where appearance is not critical	F2	T2 and T3	Water, White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces.
Interior walls and ceilings of vaults, sumps, pullboxes, and entry boxes	F2	T4	White ASTM C309, Class B curing compound
Indoor and outdoor curbs	F2	T4 T5	Polyethylene film or White Burlap-polyethylene, ASTM C309 Class A or B curing compound
Pedestals and equipment foundations	F2	T5	ASTM C1315 Class A Clear curing compounds, water-emulsified resin-base if outdoors, Polyethylene film
Construction joints and surfaces to be covered by grout	F1	T 4	Water White, ASTM C309 Class A curing compound
Expansion joints	F2	T 4	Water White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces
Contraction joints	F2	T 4	White ASTM C309 Class A curing compound

Table 03 30 00G - Unformed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces to be covered by fill material or concrete	U1	T1	White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces
Outdoor entrance slabs, and walks and stoops	U2	T3	ASTM C1315 Class A Clear curing compounds, water-emulsified resin-base, Polyethylene film or White Burlap-polyethylene sheet
Outdoor curbs and gutters	U2	T3	White ASTM C309 Class A or B curing compound Polyethylene film or White Burlap-polyethylene sheet
Outdoor decks and roofs	U2	T5	White ASTM C309 Class A or B curing compound Polyethylene film or White Burlap-polyethylene sheet
Outdoor equipment slabs and foundations	U2	T3	White ASTM C309 Class A or B curing compound, Polyethylene film or White Burlap-polyethylene sheet
Tops of walls not prominently exposed to public view	U2	T4	White ASTM C309 Class A or B curing compound Polyethylene film or White Burlap-polyethylene sheet
Tops of walls prominently exposed to public view	U2	T5	ASTM C1315 Class A Clear curing compounds, water-emulsified resin-base
Floors of vaults, sumps, pullboxes, and entry boxes	U2	T4 T5	White wax-base or white water-emulsified resin-base curing compound
Subfloor surfaces not otherwise listed	U2	T4	Water, Polyethylene film or White Burlap-polyethylene sheet

END OF SECTION

SECTION 03 48 00
PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of precast concrete structures in prices offered in Price Schedules for applicable items of work listed in Section 33 12 15 - Valves and Equipment for Line Pipe Installations, Article 1.01, Paragraphs A through F, and Section 35 22 14 – Valves and Equipment.

   a. Includes, but not limited to all materials, components, products and installation.

1.02 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1.	AASHTO HB-17	Highway Bridges, Seventeenth Edition

B. ASTM International (ASTM)

1.	ASTM A123/A123M-24	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2.	ASTM C33/C33M-24a	Concrete Aggregates
3.	ASTM C443/C443M-21	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
4.	ASTM C478/C478M-22	Circular Precast Reinforced Concrete Manhole Sections
5.	ASTM C857-19	Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
6.	ASTM C858-19	Underground Precast Concrete Utility Structures
7.	ASTM C877-21	External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
8.	ASTM C920-18(2024)	Elastomeric Joint Sealants
9.	ASTM C923/C923M-20(2025)	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

10.	ASTM C990/C990M-24	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
11.	ASTM C1478/C1478M-20(2025)	Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes, and Laterals
12.	ASTM D751-19	Test Methods for Coated Fabrics
13.	ASTM D2136-19e1	Test Method for Coated Fabrics – Low-Temperature Bend Test

C. Code of Federal Regulations (CFR)

1.	29 CFR 1910.27	Fixed Ladders

D. National Precast Concrete Association (NPCA)

1.	NPCA QC Manual	Quality Control Manual for Precast Concrete Plants

1.03 SUBMITTALS

A. Submit the following in accordance with 01 33 00 – Submittals.

B. RSN 03 48 00-1, Certificates:

1. Quality control procedures in accordance with NPCA QC Manual or verification of current NPCA Plant Certification.

C. RSN 03 48 00-2, Shop Drawings:

1. Precast Structure:
   a. Indicate design assumptions.
   b. Show conformance to project drawings and requirements.
   c. Details of steel reinforcement size and placement.
   d. Details of joint sealant placement.
   e. Details of pipe entry connectors.
   f. Installation and construction information.
   g. Signed and sealed by engineer registered in one of 50 States of the United States or District of Columbia.

D. RSN 03 48 00-3, Product Data:

1. Delivery, storage, and handling instructions.
2. Anchorage, Lifting Inserts and Devices:
   a. Product data sheets and installation instructions

b. Indicate unit dimensions and safe working loads.

3. Accessory Items:

a. Including, but not limited to sealants, gaskets, pipe entry connectors, steps, racks, and other items installed before or after delivery.

b. Installation instructions and relevant product data upon request.

4. Test Reports:

a. Upon request, precast concrete producer shall supply copies of material certifications and/or laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolans, ground granulated blast-furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

b. Upon request, precast concrete producer shall submit copies of test reports showing that mix has been successfully tested to produce concrete with properties specified and will be suitable for project conditions. Such tests may include compressive strength, flexural strength, plastic or hardened air content, freeze-thaw durability, abrasion and absorption. Special tests for precast concrete items shall be clearly detailed in the specifications.

c. Upon request, precast concrete producer will supply copies of in-plant QA/QC inspection reports.

1.04 QUALIFICATIONS

A. NPCA Plant Certification: Prior to and during production of products.

B. Producer Qualifications:

1. Minimum 5-years business experience producing similar products.

2. Maintain permanent quality control department or retain independent testing agency on continuing basis. Agency shall issue a report, signed by a licensed PE, detailing ability of precast concrete producer to produce quality units meeting requirements.

1.05 DELIVERY, STORAGE AND HANDLING

1. Per producers' recommendations.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Plan view showing locations of precast concrete vaults, manholes, are shown on the drawings.

2.02 DESIGN REQUIREMENTS:

A. Standard Precast Concrete Unit:

1. Structure and covers and/or grating: Withstand HS 20-44 as defined in AASHTO HB and ASTM C857.
2. Consider stresses induced during handling, shipping, and installation
3. Indicate design loads on shop drawings
4. Provide block-outs and pipe entry connectors as required.

B. Non-Standard Precast Concrete Unit Design:

1. Design calculations and drawings of non-standard precast units: Prepared and signed by licensed professional engineer registered in State of New Mexico and submitted for approval prior to fabrication.
2. Calculations shall include the analysis of units for lifting stresses and sizing of lifting devices.
3. Provide block-outs and pipe entry connectors as required.

C. Blowoff Enclosure Lid Design:

1. Support design live load of 100 psf.

D. Joints and Sealants:

1. Meet specified design requirements.
2. Show on shop drawings.

2.03 PRECAST CONCRETE MANHOLE

A. Precast Reinforced Concrete Manhole Sections: ASTM C478.

B. Joints and Joint Sealant: ASTM C990

2.04 MATERIALS

A. Concrete and Reinforcement: ASTM C858.

B. Inserts and Embedded Metal:

1. Refer to Section 05 50 00 – Metal Fabrications.
2. Proprietary Items: In accordance with manufacturers published literature.

C. Joint Sealants and Joint Gaskets:

1. Rubber gaskets for circular concrete: ASTM C443.
2. External sealing bands for noncircular pipe: ASTM C877.
3. Preformed flexible joint sealants: ASTM C990.

4. Elastomeric joint sealants: ASTM C920.

D. Pipe Entry Connectors:

1. ASTM C923.
2. ASTM C1478.

E. Nonshrink grout in accordance with Section 03 62 20 – Nonshrink Grout for Equipment and Metalwork.

F. Cementitious Grout: Suitable mix design for intended use, consisting of portland cement, sand, and water.

2.05 VAULT SECTIONS

A. Conform to ASTM C858.

B. Bell and spigot joints.

C. No elliptical reinforcement allowed.

D. Joint Sealant: As recommended by manufacturer.

E. Vault for manifold access as shown on drawings.

F. Prefabricated lids as shown on drawings.

G. Ladder and ladder accessories in accordance with Section 05 50 00 – Metal Fabrications.

2.06 PRECAST CONCRETE MANHOLE

A. Precast Reinforced Concrete Manhole Sections:

1. Riser section(s) and slab top lid as shown on drawings:
   a. Size: As indicated on drawings.
2. Concrete manhole conforming to ASTM C478, and design requirements indicated on drawings:
   a. Bell and spigot joints.
   b. No elliptical reinforcement allowed.

B. Metal Bar Grating: Fabricate in accordance with Section 05 50 00 – Metal Fabrications.

C. Joints and Joint Sealant: ASTM C990.

D. Steps:

1. In accordance with 29 CFR 1910.27.
2. Spacing: 12-inches on centers.

3. Manhole steps shall be made of 1/2-inch steel rod encapsulated with copolymer polypropylene or approved equal and shall conform to ASTM C478.

E. Safety Rail:

1. "Ladder-Up" ladder extensions as manufactured by The Bilco Company, P.O. Box 1203, New Haven CT 06505; or equal, having the following essential characteristics:
   a. High-strength galvanized steel.
   b. Tubular section that provides upward and downward movement and locks automatically when fully extended in up position.
   c. Upward and downward movement controlled by stainless steel springs.
   d. Operates in corrosive environment.
   e. Extend a minimum of 42-inches.
2. Attaches securely to steps.

F. Pipe to Manhole Connectors:

1. Flexible pipe to manhole connector shall be used whenever a pipe penetrates a precast concrete manhole.
2. "X-CEL" connector as manufactured by A-LOK Product, Inc., 697 Main Street, Tullytown, PA 19007; or equal, having the following essential characteristics:
   a. Design of the connector shall provide a flexible, watertight seal between the pipe and concrete structure.
   b. Provide seal between connector and structure wall by casting connector integrally with structure wall during manufacturing so seal does not pull-out during pipe coupling.
   c. Centrally located within structure wall and perpendicular to the pipe when cast into a round structure, with no loss of seal or deflection of pipe entering a concrete structure.
   d. Seal between connector and pipe: Made by compression of connector between pipe and hole opening of structure.
   e. Connector shall be made from materials that conform to Section 4 of ASTM C-923, and overall design will meet or exceed Section 7 of ASTM C-923.
   f. Connector shall be sized specifically for type of pipe being used and shall be installed in accordance with recommendations of Manufacturer.

2.07 STEEL MANHOLE COVER

A. Fabricate in accordance with Section 05 50 00 – Metal Fabrications.

2.08 PRECAST CONCRETE MANHOLE SECTIONS

A. Concrete manhole and grade rings conforming to ASTM C478:

1. Bell and spigot joints.
2. No elliptical reinforcement allowed.
3. Rubber gasket not required.

B. Precast Concrete Lid: ASTM C478.

C. Joint Sealant: As recommended by manufacturer.

D. Ladder Rungs:
1. In accordance with 29 CFR 1910.27.
2. Cast iron, galvanized steel, stainless steel, or polypropylene coated steel.

E. Furnish concrete manhole for manifold access as shown in drawings.

F. Furnish equivalent size prefabricated lids as shown on drawings.

G. Furnish pipe access manhole frames and covers in accordance with Section 05 50 00 – Metal Fabrications.

H. Furnish ladder safety posts in accordance with Section 05 50 00 – Metal Fabrications.

2.09 COARSE AGGREGATE BASE

A. ASTM C33, coarse aggregate, Size No. 57.

2.10 GUARD POSTS

A. Fabricate in accordance with Section 05 50 00 – Metal Fabrications.

2.11 METAL BAR GRATING

A. Fabricate in accordance with Section 05 50 00 – Metal Fabrications.

B. Galvanize metal bar grating after fabrication.

2.12 BEDDING

A. ASTM C33, coarse aggregate, Size No. 57.

2.13 BATTEN SYSTEM

A. Furnish and install stainless steel anchors in accordance with Section 05 50 00 – Metal Fabrications.

B. Furnish and install stainless steel plate in accordance with Section 05 50 00 – Metal Fabrications.

C. Furnish and install reinforced polypropylene geomembrane, manufactured by Environmental Protection, Inc., www.geomembrane.com or equal with the following essential characteristics:

1. Gauge, Nominal (ASTM D751): 36 +/- 10 percent mils
2. Breaking Strength (ASTM D751, Method A: 250 x 200 pounds (lbs.).
3. Tear Strength (ASTM D751): 100 lbs.
4. Low Temperature (ASTM D2136): -65 degrees F
5. Puncture Strength (FTMS-101 B, Method 2031): 250 lbs.

2.14 GOVERNMENT INSPECTION

A. Government may inspect plant during production. Notify COR 14 days prior production.

PART 3 EXECUTION

3.01 INSTALLATION

A. Site Access:

1. Contractor shall be responsible for providing adequate access to site to facilitate hauling, storage, and proper handling of precast concrete units.

B. Installation:

1. Precast concrete units shall be installed to lines and grades shown in contract documents or otherwise specified.
2. Precast concrete units shall be lifted by suitable lifting devices at points provided by precast concrete producer.
3. Precast concrete units shall be installed in accordance with applicable industry standards. Upon request, precast concrete producer shall provide installation instructions.
4. Field modifications to product shall relieve precast producer of liability, including if such modifications result in failure of precast concrete unit.
5. Place coarse aggregate base below precast concrete manholes as shown on drawings and in accordance with Section 31 23 02 – Compacting Earth Materials.
6. Erect precast concrete structures per Manufacturer's recommendations and as located on drawings.
7. Clean precast concrete manhole section pipe ends with wire brush prior to ends being joined. Place bell end down.
8. Install plumb in accordance with Manufacturer's recommendations.
9. Seal joints between manhole sections.

10. Place and compact backfill materials uniformly about manhole structure to prevent unequal loading and displacement of structure in accordance with Section 31 23 02 – Compacting Earth Materials.

11. Install guard posts in accordance with Section 05 50 00 – Metal Fabrications.

12. Paint exposed interior and exterior surfaces of steel manhole covers in accordance with Section 09 96 20 – Coatings.

C. Watertightness:

1. Where watertightness is a necessary performance characteristic of precast concrete units end use, watertight joints, pipe-entry connectors, and inserts should be used to ensure integrity of entire system.

END OF SECTION

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SECTION 03 62 20

NONSHRINK GROUT FOR EQUIPMENT AND METALWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items of work requiring nonshrink grout.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM C1107/C1107M-20 — Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 03 62 20-1, Packaged Nonshrink Grout Data:

1. Manufacturer's product data.
2. Manufacturer's certification that product meets specifications.
3. Manufacturer's instructions:
   a. Surface preparation, mixing, installation, finishing, curing, and protection recommendations:
      1) Include specific recommendations based on anticipated jobsite temperatures and environmental conditions.
      2) Include manufacturer's recommended methods for float finishing grout.
      3) Include manufacturer's recommended minimum temperature and protection period for protecting grout from freezing and damage after placement.

PART 2 PRODUCTS

2.01 PACKAGED NONSHRINK GROUT

A. Only allowable use for nonshrink grout is pipe penetration and electrical channel bases. All other references in spec to grout shall be epoxy grout in accordance with Section 03 63 00 – Epoxy Grout.

B. Pre-mixed commercial grout mixture:

1. ASTM C1107.

C. Water:

1. Clean.
2. Free of detrimental quantities of silt, organic matters, salts, or other impurities.
3. As recommended by grout manufacturer.

D. Mix: In accordance with manufacturer's instructions to consistency recommended by manufacturer for application.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and prepare base concrete surface to which nonshrink grout will be bonded in accordance with manufacturer's instructions or as directed by COR:

1. Roughen surface.
2. Remove dirt, laitance, loose or defective concrete, curing compound, coatings, and other foreign material.
3. Wash with water.

B. Lubricate concrete surface by washing with water immediately before placing nonshrink grout when delay occurs between washing and placing nonshrink grout.

3.02 PLACING

A. Place nonshrink grout in accordance with manufacturer's instructions to completely fill space to be grouted.

B. Use forms, where required, to confine nonshrink grout.

3.03 CURING

A. Cure exposed surface of packaged nonshrink grout by method recommended by manufacturer.

B. Do not apply loads sooner than 72-hours after placement and only after nonshrink grout has attained compressive strength of at least 3,000 lb/in^2.

END OF CONTENTS

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SECTION 03 63 00
EPOXY GROUT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items requiring epoxy grout.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C579-23	Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
2.	ASTM C580-18(2023)	Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes
3.	ASTM D638-22	Tensile Properties of Plastics
4.	ASTM D696-24	Coefficient of Linear Thermal Expansion of Plastic Between -30 degree C and 30 degree C with a Vitreous Silica Dilatometer

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 03 63 00-1, Approval Data:

1. Grout manufacturer's product data.
2. Grout manufacturer's environmental, product storage, preparation, mixing, installation and curing instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver epoxy materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store epoxy materials in protected area in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 EPOXY GROUT

A. Three part flowable epoxy grout; resin, hardener, and aggregate filler.

1. CHOCKFAST RED manufactured by ITW Polymer Technologies, 130 Commerce Drive, Montgomery PA; or equal, having following essential characteristics:

   a. ASTM C579 Compressive Strength: Minimum of 15,000 psi.

   b. ASTM C579 Compressive Modulus: 2,000,000 psi.

   c. ASTM D696 Coefficient of Linear Thermal Expansion:

      1) 11.2×10^6 degrees F.

   d. ASTM C580 Flexural Strength: Minimum 4,000 psi.

   e. ASTM D638 Tensile Strength: Minimum 1,800 psi.

   f. Service temperature: Up to 140 degrees F.

   g. Pot life: Approximately 3-hours at 70 degrees F.

   h. Shelf life: 2-years in dry storage.

B. Aggregate filler as recommended by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mix and install grout in accordance with manufacturer's instructions to fill space to be grouted:

1. Concrete shall be a minimum of 28-days old.
2. Clean and roughen concrete surfaces.
3. Remove dirt, dust, oil, grease, debris, paint, curing compounds, sealers, and unsound concrete.
4. Mechanically prepare concrete surfaces in accordance with manufacturer's instructions to give surface profile of a minimum of 1/8-inch and expose coarse aggregate of concrete.
5. Concrete shall have an open surface texture.

B. Placement:

1. Place grout at air temperature recommended by manufacturer.
2. Bring surfaces and materials to be epoxied to 70 degrees F minimum before grouting.

3. Do not place grout over frozen concrete.
4. Hold grout in place with forms. Prepare forms to prevent sticking of grout.
5. Minimum 3/4-inch by 3/4-inch, 45 degree chamfer.
6. Mix grout components in accordance with manufacturer's instructions and technical data sheet.
7. Place grout in accordance with manufacturer's instructions.
8. Finish surface of grout in accordance with manufacturer's instructions.
9. Smooth sharp edges.

C. Protection:

1. Protect placed grout from damage during construction.
2. Maintain grout at 50 degrees F or greater for 72-hours, minimum, after placement unless otherwise recommended by manufacturer.
   a. After protection period, discontinue protection against cold weather such that the drop in temperature of the grout will be gradual and will not exceed 5 degree F per hour and 40 degree F in 24-hours.
3. The more stringent of grout manufacturer's recommendation or section shall apply.
4. Initial Loading:
   a. Do not apply loads epoxy grout sooner than 72-hours after placement:
      1) Apply load after epoxy grout has attained a compressive strength of 3,000 psi, minimum.
   b. Time required for epoxy grout used to attain this strength will be determined by OGR.
   c. Take care when applying loads on hardened epoxy grout.
   d. Contractor shall be responsible for damage resulting from impact loads when positioning equipment or metalwork.

D. Protect from movement until grout has fully cured.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules as applicable for the following:
   a. 6-inch Diameter Air Valve Assemblies, 6-inch Diameter Air Valve with Manhole Assemblies, and Valves and Equipment:
      1) Includes:
         a) Guard posts.
         b) Mechanical equipment supports.
         c) Anchors for installation of metal fabrications.
         d) Fasteners for complete installation of metal fabrications.

B. Cost:

1. Include in prices offered in Price Schedules for Complete Electrical System as applicable:
   a. Includes design, fabrication, furnishing, and installation of:
      1) Electrical equipment supports.
      2) Fasteners for complete installation of metal fabrications.

C. Cost:

1. Include guard posts in prices offered in Price Schedules for Cathodic Protection Systems.

D. Cost:

1. Include in prices offered in Price Schedules for Buried Manhole Assemblies as applicable:
   a. Manhole steps.
   b. Manhole frames, covers and lids.
   c. Precast concrete structure batten system.
      1) Fasteners for complete installation of metal fabrications.

E. Cost:

1. Include in prices offered in Price Schedule for San Juan Lateral Water Treatment Plant Regulating Tanks as applicable:
   a. Ladders.
   b. Guardrails.
   c. Fasteners for complete installation of metal fabrications.

1.02 DEFINITIONS

A. Miscellaneous metalwork: Where either shown on the drawings or specified elsewhere in this Section, "miscellaneous metalwork" means metal fabrications.

1.03 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC)

1.	AISC 325-17	Steel Construction Manual, 15th Edition

B. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-2019	Unified Inch Screw Threads (UN, UNR, and UNJ Thread Forms)
2.	ASME B18.2.1-2012(R2021)	Square. Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

C. ASTM International (ASTM)

1.	ASTM A36/A36M-19	Carbon Structural Steel
2.	ASTM A48/A48M-22	Gray Iron Castings
3.	ASTM A53/A53M-22	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4.	ASTM A123/A123M-17	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5.	ASTM A307-21	Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
6.	ASTM A385/A385M-22	Providing High-Quality Zinc Coatings (Hot-Dip)
7.	ASTM A500/A500M-21a	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
8.	ASTM A536-84(2019)e1	Ductile Iron Castings

9.	ASTM A615/A615M-22	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
10.	ASTM F593-22	Stainless Steel Bolts, Hex Cap Screws, and Studs
11.	ASTM F594-22	Stainless Steel Nuts
12.	ASTM F844-19	Washers, Steel, Plain (Flat), Unhardened for General Use

D. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-15	Structural Welding Code – Steel

E. International Code Council (ICC)

1.	IBC – 2021	International Building Code

F. Commercial Item Description (CID)

1.	CID A-A-1923A	Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

1.04 QUALIFICATIONS

A. Qualify welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation, and other types of damage.

B. Store items in an enclosed area free from contact with soil and weather.

C. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.01 MATERIALS

A. Arc-Welding Electrodes:

1. Use filler metal and shielding gases suitable for base materials, positions, and other conditions.
2. Filler metal and required shielding gases or fluxes: AWS D1.1.
3. Use filler metal with a minimum tensile strength of 70,000 pounds per square inch for steel.

B. Bolts, Nuts, and Washers:

1. Bolts: ASTM A307
   a. Length of bolt threads: ASME B18.2.1.
2. Nuts: ASTM A563, Grade A.
3. Unhardened washers for general use: ASTM F844

C. Steel Pipe: ASTM A53, Type E or S, grade B:
1. Unless otherwise shown on drawings, provide standard-weight, black, steel pipe.
2. Government inspection at mill and hydrostatic tests will not be required.

D. Structural Steel:
1. Shapes: ASTM A36.
2. Bars, Plates, and Rods: ASTM A36.

2.01 STAINLESS-STEEL MATERIALS

A. Structural Shapes: ASTM A276, Type 316.

B. Plates: ASTM A666, Type 316.

C. Stainless Steel Fasteners:
1. Bolts: ASTM F593, hexagonal head.
2. Nuts: ASTM F594, hexagonal head.
3. Washers: Type 316, standard flat.Fasteners for Guardrails and Ladders: Stainless steel Type 316 rivets, 18-8 metal.
4. Mechanical grating clips: Stainless steel, Type 316.

2.02 GUARD POSTS

A. Steel Pipe: ASTM A53, Type E or S, Grade B.
1. Unless otherwise shown on drawings, provide standard-weight, black, steel pipe.
2. Government inspection at mill and hydrostatic tests will not be required.

B. Concrete:
1. In accordance with applicable requirements of Section 03 30 00 – Cast-in-Place Concrete.
2. Aggregate: 3/4-inch, maximum.
3. Compressive strength: 2,500 psi at 28-days, minimum.

C. Reinforcing Bars:
1. ASTM A615, Grade 60.

2. Deformed steel bar.

D. Painting: In accordance with Section 09 96 20 – Coatings.

2.03 LADDERS

A. Metal Safety Steps for Ladders:

1. "Tread-Grip" sheet steel ladder rungs as manufactured by Metalex, 700 Liberty Drive, Libertyville, IL 60048; "Traction Tread" ladder rung as manufactured by Eaton, 509 West Monroe Street, Highland, IL 62249; or equal, having the following essential characteristics:

   a. Galvanized steel.

   b. Minimum rung width or diameter: 3/4 inch.

   c. Concentrated design load at center of rung: 250 pounds.

   d. Raised button or serrated-edge.

   e. Deformed concrete reinforcement not permitted.

B. Safety Posts:

1. "Ladder-Up" ladder extensions as manufactured by The Bilco Company, P.O. Box 1203, New Haven, CT 06505; or equal, having the following essential characteristics:

   a. High-strength galvanized steel.

   b. Tubular section that provides upward and downward movement and locks automatically when fully extended in up position.

   c. Upward and downward movement controlled by stainless steel springs.

   d. Operates in corrosive environment.

2. Attach securely to ladder rungs.

3. Extend a minimum of 42 inches above walking surface.

2.04 METAL BAR GRATING

A. Grating:

1. MBG 531, of sizes shown on drawings.

2. Welded grating.

3. Banding bar: Same size as bearing bars.

4. Galvanized.

2.05 MECHANICAL EQUIPMENT SUPPORTS

A. Channels: Unistrut P1000; or equal, having the following essential characteristics:

1. No. 12 gauge steel.
2. Channel: 1 5/8-inch wide by 1 5/8-inch deep with 7/8-inch opening.
3. Galvanized.

B. Bolts, nuts, and washers:

1. Bolts: ASTM A307.
2. Nuts: Spring nuts, suitable for channel attachment.
3. Washers: ASTM F844.
4. With electro-galvanized finish.

C. Steel Expansion Anchors: See Article 2.10.C Expansion Anchors.

D. Fittings: ASTM A36 steel, galvanized.

2.06 MANHOLE COVERS

A. For access as shown on drawing 1695-D-60806.

B. Fabricate as shown on drawings.

C. Do not galvanize.

D. Steel Hinge Pin:

1. Thread rod as shown on the drawings in accordance with ASME B1.1 to accommodate nuts.
2. Thread Class: 2A free-fit, American National coarse-thread.
3. Hinge shall work freely without binding.

E. Padlock Hasp:

1. Heavy duty.
2. Compatible with padlock used by NTUA utility.
3. Match security rating of padlock.

    1)

2.07 MANHOLE STEPS

A. Manhole Step, Model ML-10-NCR, as manufactured by American Step Company, P.O. Box 137, 830 East Broadway, Griffin GA 30224, or equal, having the following essential characteristics:

1. Minimum clear step width: 10 inches.
2. Projection: 5 inches minimum, 7 inches maximum.
3. Constructed of corrosion resistant material.
4. In accordance with 29 CFR 1910.27 and 1910.24.

2.08 AIR VENTS

A. Steel Pipe: ASTM A53, standard weight, galvanized. Diameter shown on drawings.

B. Pipe Fittings: ASTM A53, standard weight, galvanized.

1. Reducer: Size shown on drawings; suitable for butt-welding.
2. 180 degree Return: Long radius; size shown on drawings; suitable for butt-welding.

C. Embed pipe in precast concrete as shown on drawings.

D. Insect Screen:

1. Stainless steel or non-corrodible material.
2. Wire diameter, minimum: 0.014 inches.
3. Mesh size: #24, 24 wires per inch, opening of 0.0277 inches.
4. Tack weld screen to pipe as shown on drawings.

2.09 ELECTRICAL EQUIPMENT SUPPORTS

A. Metal Framing:

1. As shown on drawing 40-D-60001.
2. Combination channels as manufactured by; Unistrut Corporation, 35660 Clinton Street, Wayne, MI 48184; Eaton, 1000 Eaton Boulevard Cleveland, OH 44122; or equal, having the following essential characteristics and accessories:
   a. Combination channels: B-Line B12A, or Unistrut P5501; or equal, having the following essential characteristics:
      1) No. 12 gauge steel.
      2) Channel: 1 5/8-inch wide by 4 7/8-inch deep with 7/8-inch opening.
      3) Hot-dipped galvanized.
   b. Connection plates:
      1) With five holes: B-Line B532, Unistrut P1726, or equal.
      2) With seven holes: B-Line B334, Unistrut P1950, or equal.
      3) Hot-dipped galvanized.

c. Bolts, nuts, and washers:

1) Bolts: ASTM A307.

2) Nuts: Spring nuts, suitable for channel strut attachments.

3) Washers: ASTM F844.

4) With electro-galvanized finish.

B. Fabricated Plates:

1. ASTM A36 steel, galvanized.

C. Concrete: In accordance with the applicable requirements of Section 03 30 00 - Cast-In-Place Concrete.

2.10 FABRICATION

A. Fabricate metalwork in accordance with AISC 325:

1. Perform welding and related work in accordance with AWS D1.1.

2. Grind welds on ladders smooth.

B. If straightening is necessary, use methods that will not injure the metal.

C. After shop work completion and before galvanizing, clean material of rust, loose scale, dirt, oil, grease, and slag from welded areas, and other foreign substances.

D. Fabricate guard posts from standard weight pipe and of sizes shown on drawings.

E. Fabricate electrical equipment supports in accordance with Standard Drawing 40-D-60001. Size to fit electrical panels.

F. Fabricate ladders from standard weight pipe of sizes shown on drawings.

G. Galvanizing:

1. Galvanize items of metalwork as specified or shown on drawings. Use hot-dip galvanizing, where required after fabrication, in accordance with ASTM A385.

2. Fabricator's Galvanizing Repair:

a. Redip material with damaged galvanizing unless damage is local and can be repaired by 2 component epoxy zinc primer as approved by COR.

b. If galvanized coating becomes damaged after being dipped twice, material will be rejected.

c. Where local repair is authorized:

1) Repair damage to galvanizing in accordance with Section 09 96 20 – Coatings.

H. Coatings:

1. Guard Posts: Paint exterior surfaces of exposed concrete fill and pipe in accordance with Section 09 96 20 – Coatings.

PART 3 EXECUTION

3.01 PREPARATION

A. Where locations and dimensions of miscellaneous metalwork shown on drawings are dependent upon existing equipment and/or equipment furnished, confirm locations and dimensions prior to fabrication of miscellaneous metalwork.

3.02 INSTALLATION

A. Embedded Metalwork:

1. Clean surfaces of metalwork to be in contact with or embedded in concrete grout, or mortar in accordance with SSPC-SP 6/NACE No. 3.
2. Locate metalwork to be embedded in concrete. Hold metalwork in correct position and alignment and protect metalwork from damage and displacement during placing and setting of concrete.
3. Unless otherwise specified, use metal braces, supports, and other items to position and align embedded metalwork, which will be embedded in concrete:
   a. Do not use wooden braces, supports, or other items to position and align embedded metalwork if they will also be embedded in concrete.

B. Holes in Metalwork: Drill, or drill and tap as required, holes in metalwork required for installation.

C. Anchors:

1. Drill holes for anchors straight and true and of diameter recommended by anchor manufacturer.
2. Install anchors in accordance with manufacturer's recommendations.
3. Follow manufacturer’s recommendations when embedded steel or reinforcement is encountered during drilling for anchors.
4. When drilling water is used, clean surfaces of concrete to remain exposed immediately to prevent discoloration.
5. Following drilling, clean holes with water to remove cuttings, followed by air to ensure holes are dry.

D. Guard Posts:

1. Install posts plumb in concrete footings as shown on Standard Drawing 40-D-60002.

2. Fill posts with concrete and trowel top of post round for water drainage. Posts may be capped in lieu of filling posts with concrete.

E. Manhole Covers:

1. Tack weld nuts to hinge pin as shown on drawings.

F. Installer's Galvanizing Repair:

1. Repair damage to galvanizing in accordance with Section 09 96 20 – Coatings.

3.03 COATINGS

1. Coat surfaces of miscellaneous metalwork exposed after installation; except aluminum, galvanized steel, and cast iron; in accordance with Section 09 96 20 – Coatings.

END OF SECTION

SECTION 07 21 50

SPRAY-APPLIED POLYURETHANE FOAM INSULATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for applicable air valve and blowoff assemblies.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM C1029-20 — Spray-Applied Rigid Cellular Polyurethane Thermal Insulation

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 07 21 50-1, Approval Data:

1. Manufacturer's product data.

C. RSN 07 21 50-2, Instructions:

1. Manufacturer's product storage, surface preparation, environmental, and application instructions.

   a. Include manufacturer's recommendations for cleaning and preparing each substrate material to be covered by insulation.

D. RSN 07 21 50-3, Documentation:

1. Written evidence that applicator is approved by insulation manufacturer to apply product.

1.04 QUALIFICATIONS

A. Applicator Qualifications: Experienced applicator approved by insulation manufacturer to apply product.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store materials in protected area in accordance with manufacturer's instructions.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Comply with manufacturer's environmental restrictions.

PART 2 PRODUCTS

2.01 SPRAY-APPLIED POLYURETHANE FOAM INSULATION

A. ASTM C1029, Type II.

B. Thickness: To achieve required thermal resistance values.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare clean, dry substrate surfaces in accordance with manufacturer's instructions.

B. Remove dirt, petroleum products, corrosion, loose materials, and other substances which could affect proper adhesion of insulation.

C. Mask and protect adjacent surfaces and equipment not to receive insulation from overspray.

D. Obtain approval of surface preparation, masking, and protection from OGR before proceeding with application of insulation.

3.02 APPLICATION

A. Spray apply insulation in accordance with manufacturer's instructions.

B. Apply to uniform monolithic density without voids.

C. Apply to achieve thermal resistance value of R-7.5.

END OF SECTION

SECTION 07 21 60
INSULATION JACKET

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedule for applicable blowoffs with manholes, and air valves with and without manholes.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 07 21 60-1, Approval Data:

1. Manufacturer's product data.

C. RSN 07 21 60-2, Instructions:

1. Manufacturer's product storage, surface preparation, environmental, and application instructions.
2. Include manufacturer's recommendations for cleaning and preparing each substrate material to be covered by insulation.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store materials in protected area in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 INSULATION JACKET

A. Removable Valve Jacket, manufactured by ThermaXX Jackets, LLC, 16 Hamilton Street, West Haven, CT 06516, Website: www.thermaxxjackets.com or equal with the following essential characteristics:

1. Equivalent R value of 20.
2. Accommodate operation of valve.
3. Removable and replaceable.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare clean, dry substrate surfaces in accordance with manufacturer's instructions.

B. Remove dirt, petroleum products, corrosion, loose materials, and other substances which could affect proper adhesion of insulation.

C. Obtain approval of surface preparation from OGR before proceeding with application of insulation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 08 31 25
ACCESS HATCHES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items of work requiring access hatches.

   a. See drawings.

1.02 REFERENCE STANDARDS

A. Aluminum Association (AA)

1. AA ADM-2020 — Aluminum Design Manual

B. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO SSHB-02 — Standard Specifications for Highway Bridges, Seventeenth Edition

C. American Welding Society, Inc. (AWS)

1. AWS D1.2/D1.2M-20 — Structural Welding Code - Aluminum

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 08 31 25-1, Product Data and Shop Drawings:

1. Product Data: Submit manufacturer's product data.
2. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

1.04 DELIVERY, STORAGE, AND PROTECTION

A. Protect floor access hatches from corrosion, deformation, and other types of damage.

B. Store items in an enclosed area free from contact with soil and weather.

C. Remove and replace damaged items with new items.

1.05 DESIGN REQUIREMENTS

A. Floor Access Hatches:

1. Aluminum floor access hatches of sizes shown on drawings. Sizes shown on drawings are minimum access opening dimensions.
2. Designed to support AASHTO H-20-wheel load with a maximum deflection of 1/150th of the span:
   a. For installation in an off-street location. Not subject to high density, fast moving traffic.
3. Operation of cover shall not be affected by temperature.
4. Operation of cover shall be smooth and easy with controlled operation throughout entire arc of opening and closing.

PART 2 PRODUCTS

2.01 SINGLE LEAF FLOOR ACCESS HATCH

A. Aluminum access hatches of size shown on drawings and meeting the design load criteria in this section.

B. Floor Access Hatch: Type J-AL Floor Access Door, as manufactured by the Bilco Co., PO Box 1203, New Haven CT 06505, www.bilco.com; Model BFDDPA as manufactured by Babcock-Davis Hatchways, Incorporated, 50 Lowell Street, Arlington, MA 02174; or equal, having the following essential characteristics:

1. Aluminum diamond pattern cover.
2. Extruded aluminum channel frame suitable for embedment in concrete with top of cover flush with top of concrete vault.
3. Heavy-forged stainless steel hinges with Type 316 stainless steel pins, suitable for horizontal installation.
4. Drainable channel frame or gutter-type frame with 1 1/2-inch drain coupling.
5. Compression spring operators enclosed in telescopic tubes or torsion springs to provide ease of operation when opening hatch.
6. Automatic hold-open device.
7. Removable exterior turn/lift handle with spring-loaded ball detent to open cover and protected latch release by flush, gasketed, removable screw plug.
8. Mount type 316 stainless steel snap lock with fixed handle on the underside of the cover.
9. Recessed padlocking hasps.
10. Mill finish.

2.02 FABRICATION

A. Fabricate metalwork in accordance with AA ADM and these specifications:

1. Perform welding and related work in accordance with AWS D1.2.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coat frame surfaces that come in contact with concrete or grout with a bituminous coating.

B. Install floor access hatches at locations shown on drawings and in accordance with manufacturer's instructions.

C. Install floor access hatches per manufacturer's instructions to ensure proper drainage:

1. Connect drain coupling to piping in accordance with drawings, manufacturer installation instructions, and Section 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

D. Embedded Metalwork:

1. Accurately locate hatch frame to be embedded in concrete. Hold frame in correct position and alignment and protect frame from damage and displacement during placing and setting of concrete.
2. Unless otherwise specified, use only metal braces, supports, and other items to position and align frame, which will be embedded in concrete. Do not use wooden braces, supports, or other items to position and align embedded metalwork if they will also be embedded in concrete.

3.02 REPAIR

A. Repair finishes damaged during installation.

END OF SECTION

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SECTION 09 96 20
COATINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM):

1.	ASTM A380-17	Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
2.	ASTM A780-20	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
3.	ASTM C920-18	Elastomeric Joint Sealants
4.	ASTM D870-15(2020)	T, Testing Water Resistance of Coatings Using Water Immersion
5.	ASTM D2244-21	Calculation of Color Differences from Instrumentally Measured Color Coordinates
6.	ASTM D2794-93(2019)	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
7.	ASTM D4060-19	Abrasion Resistance of Organic Coatings by the Taber Abraser
8.	ASTM D4214-07(2015)	Evaluating the Degree of Chalking of Exterior Paint Films
9.	ASTM D4285-83(2018)	Indicating Oil or Water in Compressed Air
10.	ASTM D4541-17	Pull-Off Strength of Coatings Using Portable Adhesion Testers
11.	ASTM D4587-11(2019)e1	Fluorescent UV-Condensation Exposures of Paint and Related Coatings
12.	ASTM D5894-21	Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
13.	ASTM G8-96(2019)	Cathodic Dis-bonding of Pipeline Coatings

B. American Water Works Associations (AWWA):

1.	AWWA C104-16	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2.	AWWA C205-18	Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100mm) and Larger – Shop Applied
3.	AWWA C116-16	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
4.	AWWA C 213-15	Fusion-Bonded Epoxy Coatings and Linings For Steel Water Pipe and Fittings
5.	AWWA C222-18	Polyurethane Coatings for the Interior and Exterior of Steel Pipe and Fittings
6.	AWWA C602-17	Cement Mortar Lining of Water Pipelines in Place – 4-inch (100mm) and Larger

C. Bureau of Reclamation (USBR)

1.	USBR M-47	Standard Specifications for Repair of and Maintenance of Concrete, August 2015 (Part 2 of "Guide to Concrete Repair, Second Edition" available at: www.usbr.gov/tsc/techreferences/mands/mands-pdfs/Guide2ConcreteRepair2015_Final.pdf

D. Federal Standards (Fed Std):

1.	Fed Std 595C(1)-08	Colors Used in Government Procurement

E. International Organization for Standardization (ISO):

1.	ISO 8502-3-1992	Assessment of dust on Steel Surface Prepared for Painting (Pressure-Sensitive Tape Method)

F. National Association of Pipe Fabricators (NAPF):

1.	NAPF 500-03-04-06	Abrasive Blast Cleaning of Ductile Iron Pipe
2.	NAPF 500-03-05-06	Abrasive Blast Cleaning of Cast Ductile Iron Fittings

G. Association of Materials Protection and Performance AMPP
(Formerly Society for Protective Coatings (SSPC)/NACE International (NACE)):

1.	SSPC-AB1-19	Mineral and Slag Abrasives
2.	SSPC-AB2-16	Cleanliness of Recycled Ferrous Metallic Abrasives

3.	SSPC-AB3-23	Ferrous Metallic Abrasive
4.	SSPC-PA1-24	Shop, Field, and Maintenance Painting of Steel
5.	SSPC-PA2-22	Measurement of Dry Paint Thickness with Magnetic Gages
6.	SSPC-SP1-16	Solvent Cleaning
7.	SSPC-SP5/NACE 1-07	White Metal Blast Cleaning
8.	SSPC-SP6/NACE 3-07	Commercial Blast Cleaning
9.	SSPC-SP10/NACE 2-24	Near-White Blast Cleaning
10.	SSPC-SP11-20	Power Tool Cleaning to Bare Metal
11.	SSPC-SP13/NACE6-03	Surface Preparation of Concrete
12.	SSPC-VIS1-12	Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning
13.	SSPC-VIS3-01	Visual Standard for Power- and Hand-Tool Cleaned Steel
14.	NACE RP 0287-02	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape
15.	NACE SP 0188-24	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
16.	NACE SP 0274-11	High Voltage Electrical Inspection of Pipeline Coatings

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 09 96 20-1, Approval Data:

1. For each coating material:
   a. Current manufacturer's product data sheet, application sheet, and Safety Data Sheet (SDS).
   b. Identification of "Items to be coated" including sub-letter and sub-number listed in Coating Tabulations.
2. For each caulk and filler:
   a. Manufacturer's product data, application, and SDS sheets.
   b. Identification of areas of use including sub-letter and sub-number listed in Coating Tabulations.

3. For each substituted coating material "equal" to specified product in Coating Tabulation:
   a. List of not less than 5 similar successful material applications:
      1) Project name, location, type of structure, and application dates.
      2) Owner's name, address, and telephone number.
   b. Certification that material meets or exceeds specified requirements:
      1) Manufacturer's certification including technical representative's signature and date of signature.
      2) Independent laboratory's certified test reports.

C. RSN 09 96 20-2, Final Approval Data:
   1. For each coating material:
      a. Purchase orders including order number, date, manufacturer's designated product name, batch number(s), and quantity purchased.
      b. Supplier's name, address, and phone number.

D. RSN 09 96 20-3, Paint Chip Samples:
   1. Color chip samples approximately 4 by 6-inch.
   2. Label each sample to include manufacturer's designated product name, color, and gloss.
   3. Supply paint chip samples to the OGR for selection and approval.

E. RSN 09 96 20-4, Qualifications:
   1. Coating Contractor:
      a. Provide current AMPP-QP1 certification for field coating and AMPP-QP3 certification for shop coating
      b. List not less than 5 comparable completed jobs for each coating type including owner's name, address, and telephone numbers completed within the last five years.
   2. Coating Applicator(s):
      a. List of not less than 5 comparable jobs for each coating type including owner's name, address, and telephone number.
      b. Provide one of the options below indicating personnel are qualified with relevant knowledge of surface preparation, coating materials, mixing, thinning and application practices:
         1) Statement from contractor.
         2) Statement from coating or equipment manufacturer
   3. Coating Contractor Inspector(s):

a. Provide one of the following to document qualifications to inspect specified coating materials:

1) Current certification for NACE Certified Coatings Inspector (CIP) Level 3 or Association for Materials Protection and Performance (AMPP) Senior Certified Coatings Inspector.

2) Letter from contractor listing the personnel performing inspections and current certifications for each.

a) Inspector: certified at a minimum as NACE CIP Level 1 or AMPP Basic Coating Inspector.

b) Supervisor: review and certify inspection results as a NACE CIP Level 3 of AMPP Senior Certified Coatings Inspectors.

4. Contract or Third-Party Inspectors:

a. Current NACE Level 3 or AMPP Certified Coatings Inspector Certified Coatings Inspector.

b. List not less than 5 years of comparable jobs including project description, location, and owner's name, address, and telephone numbers.

c. Provide calibrated inspection equipment and demonstrate the use if required by the COR.

F. RSN 09 96 20-5, Quality Control Plan:

1. Quality Control Manager:

a. Name and title.

2. Quality Control Procedure:

a. Quality control plan.

1) Factory, shop, or field testing procedures shall be in accordance with these specifications, product manufacturer's written instructions, and NACE RP 0288, and ASTM D3276.

b. Procedure for addressing identified non-conformities.

G. RSN 09 96 20-6, Contractor Quality Testing Report:

1. Comprehensive report of daily quality control test reports.

1.04 DELIVERY, STORAGE, HANDLING

A. Deliver materials to jobsite in original, undamaged, unopened containers labeled with manufacturer's name, designated product name, batch number, date of manufacture, and any special instructions.

B. Deliver materials in containers not larger than 5 gallons as packaged by manufacturer unless suitable equipment is provided at jobsite to handle and thoroughly mix materials in larger containers.

C. Store coating materials and thinners in accordance with the manufacturer's recommendations, and as a minimum, store off the ground, under cover, and at 50 to 95 degrees F.

D. Do not use coating material which has exceeded manufacturer's specified storage stability period (shelf life).

1.05 AMBIENT CONDITIONS

A. Maintain environmental conditions to meet coating manufacturer's requirements during surface preparation, coating application, and curing period. Provide heating or cooling, and dehumidification as needed. Complete curing before placing the coating systems into service.

B. Coatings shall be applied when the substrate surface temperature is 5 degrees F or more above the dew point temperature or as recommended by manufacturer, whichever is more stringent and for at least 8-hours after application.

1.06 PROJECT CONDITIONS

A. Galvanic isolation of dissimilar metals shall be required. Coatings in this specification section shall not serve as the primary galvanic isolation.

B. Contractor shall comply with applicable federal, state, and local air pollution and environmental control regulations for surface preparations, blast cleaning, disposal of spent materials and debris, and coatings application.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Surface preparation and spray application equipment:

1. Sized in accordance with coating manufacturer's recommendations.
2. Provide:
   a. Pressure gauges and pressure regulators.
   b. Air supply lines free from oil and moisture.

2.02 ABRASIVES

A. Mineral and slag abrasives: Meets SSPC-AB1, Type I (natural minerals) and Type II (slags), Class A.

B. SSPC-AB2 for recycled cleanliness.

C. SSPC-AB3 Class I (steel) or II (iron) for angular shaped grit. Shot abrasives are not acceptable.

D. Commercially available products or processes to render the hazardous waste stream non-hazardous and not exceeding toxicity threshold limits.

2.03 COATINGS

A. Specified in Coating Tabulations:

1. Apply only one coating system per option in Coating Tabulations.
2. Apply compatible products of same manufacturer for coating system components.

B. Volatile Organic Compounds (VOC): Do not exceed maximum permitted by Federal, State, and local air pollution control regulations as supplied in container or by addition of thinner material.

C. Factory color or tint only. Do not color or tint at jobsite.

D. Use manufacturer's recommended thinners for coating materials.

E. Do not use accelerator products unless approved by COR.

2.04 FILLERS AND CAULKS

A. Caulks:

1. Coating manufacturer's standard or compatible caulk material.
2. Polyurethane, silicone, or silicone acrylic caulk material: Meets or exceeds ASTM C920 Type S or M, Grade NS, Class 25, suitable for water immersion service.

B. Fillers:

1. Apply compatible products of same manufacturer as coating system components.
2. Approved fillers:
   a. Carboguard 501, as manufactured by Carboline, www.carboline.com.
   b. Devmat 142HB, as manufactured by International Paint, www.international-pc.com.
   c. PPG Amercoat 114 A, as manufactured by PPG, www.ppgpmc.com.
   d. Steel Seam FT910, as manufactured by Sherwin Williams, www.sherwin-williams.com.
   e. Surfacing Epoxy Series 215 as manufactured by Tnemec, www.tnemec.com.

2.05 MISCELLANEOUS MATERIALS

A. Deionized Water.

B. Chlor-Rid as manufactured by Chlor-Rid, www.Chlor-rid.com,

C. HoldTight 102 as manufactured by Holdtight, Corrosion Innovations , www.holdtight.com,

D. Aquron 7000, as manufactured by Aquron, www.aquron.com

E. Provide one of the above salt removers, or equal with following essential characteristics:

1. Commercially available additive for soluble salt removal.
2. Water soluble.
3. Biodegradable.
4. Zero volatile organic compounds.

PART 3 EXECUTION

3.01 SHOP PAINTING

A. Shop coated and lined equipment shall be primed and finished in the shop and touched up in the field with identical coating materials after installation and in accordance with the coatings manufacturer's standard surface preparation and application instructions.

3.02 FIELD PAINTING

A. Follow specified information in the Coating Tabulations. When application not specified in Coating Tabulations, follow manufacturer's standard surface preparations and application instructions for field applied coatings.

3.03 GALVANIC AND DIELECTRIC ISOLATION

A. Galvanic isolation of dissimilar metals shall be required.

B. Dielectrically isolated ductile iron pipe, valves, and fittings from other metals.

C. Coatings shall not serve as the primary galvanic isolation.

3.04 COATING OF METAL WORK EMBEDDED IN CONCRETE

A. For atmospheric service exposure with item partially embedded in concrete:

1. Coat exposed surfaces completely.
2. Extend prime coat on steel six inches minimum into concrete embedment measured from face of concrete and along surface of embedded item.

B. For burial or immersion service exposure on either side of concrete faces:

1. Extend primer coat on steel continuously through solid concrete structure.
2. Examples include buried pipe which will be embedded in concrete through anchor blocks, walls, and related concrete structures.

C. For atmospheric service exposure with item partially embedded one side in contact with grout or concrete:

1. Coat exposed side completely.
2. Extend prime coat on steel six inches minimum into concrete embedment measured from surface of concrete and along surface of embedded item.

D. Caulk the concrete/steel interface to seal gaps at exposed faces in accordance with manufacturer's instructions with maximum thickness of 1/2-inch.

3.05 GALVANIC AND DIELECTRIC ISOLATION

A. Galvanic isolation of dissimilar metals shall be required.

B. Dielectrically isolated ductile iron pipe, valves, and fittings from other metals.

C. Coatings shall not serve as the primary galvanic isolation.

3.06 PROTECTION OF ADJACENT SURFACES, EQUIPMENT AND NEWLY COATED SURFACES

A. Remove, mask, or otherwise protect items or surfaces not coated from contamination and damage during cleaning and coating operations.

B. Examples include protecting mating and machined surfaces, mechanical and electrical equipment (open or enclosed), instruction and similar plates, and wet and newly coated surfaces.

3.07 SURFACE PREPARATION FOR FERROUS SURFACES

A. Remove or repair surface irregularities and impart profile as specified:

1. Welds:
   a. Welds: Smooth and continuous.
   b. Weld spatter, protrusions, laminations, slag, buckshot, and slivers: Remove and grind smooth in accordance with NACE SP 0178.
   c. Undercuts and porosity: Fill with weld material and grind smooth.in accordance with NACE-SP 0178.
   d. Projections, sharp edges, high points, fillets, and corners: Grind smooth to a radius of at least 1/16-inch.
2. Substrate defects:

a. Pitting, gouges, scratches, porosity, and similar:

1) Grind smooth.

2) Defects exceeding 20 percent reduction in wall thickness require weld repairs.

3. Grind full length of edges and corners smooth to a radius of at least 1/16-inch.

B. Surface preparation method:

1. See Coating Tabulations:

2. Compare prepared steel surfaces to following visual reference photographs for allowable visible contaminants and stains:

a. SSPC-VIS1 for abrasive blast cleaning.

b. SSPC-VIS3 for power and hand tool cleaning.

3. Assessment of dust contaminants:

a. Perform clear tape test method in accordance with ISO 8502-3.

b. Perform three tests per shift.

c. Acceptance Criteria: Degree of cleanliness shall meet Class 2.

C. Surface profile:

1. Prepare as specified in Coating Tabulations.

2. Where not specified, prepare in accordance with manufacturer's instructions for metallic substrates or existing coating surfaces and service environment.

3. Where manufacturer's instructions do not specify a surface profile, prepare blasted surfaces to following profile:

a. Atmospheric Service Environments: 1.5 mil or greater angular profile and less than specified millage of first applied coat.

b. Burial and Immersion Service Environments: Angular profile 2.5 mil or greater and less than specified millage of first applied coat.

4. Inspect surface profile in accordance with NACE RP 0287:

a. Use replica tape suitable for surface profile depth range.

b. Perform at least two tests per 1,000 square feet.

D. Assessment of dust contaminants:

1. Perform clear tape test method in accordance with ISO 8502-3.

2. Perform three tests per shift.

E. Acceptance Criteria: Degree of cleanliness shall meet Class 3.Soluble salts:

1. Measure concentration of chlorides, nitrates and sulfates in accordance with SSPC Guide 15.
2. Perform at least two tests per [1,000-square feet of surface area or per item]. Include corrosion pit areas.
3. Acceptance criteria: Do not exceed 3-micrograms per square centimeter for chlorides and 5-micrograms per square centimeter for nitrates and sulfates.]
4. Re-clean or perform additional surface preparation of contaminated surfaces before coating application.

F. Heat cast iron components to between 140- and 180-degrees F to evaporate moisture for 2-hour minimum.

3.08 SURFACE PREPARATION FOR CONCRETE SURFACES

A. Before surface preparation and coating application, cure cementitious materials for 28-days, minimum.

B. Before coating application, repair cementitious defects greater than 3/4-inch in depth by one of following:

1. In accordance with USBR M47.
2. In accordance with manufacturer's product instructions.

C. Specific surface preparation:

1. See Coating Tabulations:
   a. SSPC-SP13/NACE 6, except as specified:
   b. Section 4.3.3: Fractures and microcracks caused by impact tools are to be repaired in accordance with ASTM D4259.
2. Following methods are not permitted:
   a. Section 4.3.3: Scabbling impact tool.
   b. Section 4.4: Chemical surface preparation.
3. Section 4.5: Flame (Thermal) cleaning and blasting.

D. Concrete surface profile:

a. Prepare in accordance with manufacturer's instructions for cementitious materials and service environment.
b. Where manufacturer's instructions do not specify a surface profile, prepare surfaces to appearance of medium (80 to 100) abrasive paper, minimum or:
   i. Atmospheric Service Environments: 1 mil or greater angular profile and less than specified millage of first applied coat.

3.09 COMPRESSED AIR EQUIPMENT

A. Keep air compressor and spray application equipment lines free of oil and moisture during work.

B. Compressed air quality:

1. Perform tests in accordance with ASTM D4285.
2. Perform test at the beginning of every shift.

3.10 FILLERS AND CAULK APPLICATION

A. Caulk areas including crevices, gaps, plate seams, skip welds, and conduit penetrations.

B. Fill areas including plate seams, and gaps at bolts and rivets.

C. Apply in a uniform texture, neatness, and color matched appearance.

D. Apply in accordance with manufacturer's instructions and achieve tight bond to substrate or previous coats.

3.11 COATING APPLICATION

A. Stripe coat:

1. Brush apply stripe coat.
2. Apply stripe coat prior to spray application of the primer, when practical.
3. Apply to edges, corners, interior angles, pits, plate seams, crevices, rivets, nuts, threads, bolts, washers, welds, and similar features.

B. Apply number of coats and coating thickness specified in Coating Tabulations.

1. Alternate coat colors to differentiate between coats.
2. Apply in accordance with manufacturer's instructions.
3. Apply in accordance with SSPC PA1.

C. Prevent overspray or dry spray. When such conditions occur, clean surfaces prior to application of subsequent coats.

D. Re-clean contaminated surfaces between coats.

E. Dry Film Thickness (DFT):

1. After an individual coat has cured, measure DFT in accordance with SSPC PA2.
   a. Acceptance Criteria:
      1) Each area measurement must fall within specified DFT range.
         a) One area is the average of 5 spot measurements.

2) Each spot measurement must fall within 80-120 percent of the specified DFT range.

a) One spot measurement is the average of three gauge measurements within 1.5-inch diameter area.

F. Discontinuity (Holiday) Testing:

1. Inspect in accordance with NACE SP 0188:

a. Use maximum test voltage for DFT as recommended by coating manufacturer to prevent coating damage.

2. Inspect pipeline coatings in accordance with NACE SP 0274:

a. Use maximum test voltage for any DFT as recommended by coating manufacturer to prevent coating damage.

G. Coating Adhesion:

1. Test in accordance with ASTM D4541 at the direction of COR.

3.12 CONTRACTOR QUALITY TESTING

A. Inspection Equipment:

1. Calibrate inspection devices and equipment in accordance with the manufacturer's instructions.

2. Verify calibration prior to every use.

B. Qualified personnel shall conduct tests and sign reports.

1. Perform tests in presence of OGR:

2. Provide rigging for OGR to observe inspections.

C. Make daily reports for review by OGR, including:

1. Date of work.

2. Description of areas or items and work performed.

3. Datasets clearly labeled with corresponding Tabulation number, item number, coating system, and coat.

4. Environmental conditions.

a. Measurements to be collected near area of work

1) Air temperature

2) Surface temperature

3) Dew point

4) Relative humidity

5. Results from the following quality control tests:

a. Soluble salt.

b. Surface profile.

c. Visual comparison of prepared surfaces.

d. Assessment of dust contaminants.

1) Provide photo of test results or confirmation of test completion.

e. Compressed air quality.

f. Dry film thickness (DFT).

1) Provide spot measurements, as defined per SSPC PA 2, for each coat of each selected coating system.

2) Each dataset shall be clearly labeled with corresponding Tabulation number, item number, coating system, and coat.

3) Provide DFT data organized sequentially by Tabulation number .

g. Discontinuity (Holiday) testing.

h. Coating adhesion testing (when directed by OGR).

D. Final inspection will take place after repairs, but before placing into service.

3.13 REPAIR AND REMEDIAL WORK

A. Repair defective or damaged areas of coatings in accordance with coating manufacturer's recommendations.

3.14 COATING TABULATIONS

Tabulation No. 01		
Items to be coated - Commercial or manufactured items with a factory applied color finish: a) Valve actuators and motors b) Interior and exterior ferrous surfaces of butterfly valves c) Interior and exterior ferrous surfaces of ball valves d) Interior and exterior ferrous surfaces of air valve assemblies e) Interior and exterior ferrous surfaces of blowoff valve assemblies f) Interior and exterior surfaces of steel manhole covers or lids g) Interior and exterior ferrous buried manifold piping and fittings not mortar lined h) Fittings for PVC and HDPE piping i) Split sleeve restrained flexible couplings		
Coating materials	Number and thickness of coats	Surface preparation method
Commercial or manufactured applied permanent coating system: 1. Commercial or manufactured standard surface preparation and permanent coating system. 2. Items subject to sunlight shall be top-coated with ultraviolet (UV) stable materials. 3. Permanent coating system shall have 10-year corrosion-free protection without significant defects stored in atmospheric exposure. 4. Color and gloss: Manufacturer's standard color unless a specific color is otherwise specified in the color schedule. 5. Buried valves shall be coated with coating system rated for burial service. 6. Unless otherwise specified, unexposed surfaces that require coatings, such as interior of cabinets, enclosures, and equipment, shall be given the manufacturer’s standard permanent coated finish.		
Field Repair: Repair damaged areas of coated surfaces with compatible materials to equal thickness and color match of undamaged areas, unless otherwise tabulated herein.		

Tab AE-05.DOC

Tabulation No. 02		
Items to coated: a. Cathodic protection test station bollards		
1.		
Coating materials – Option 1 Alkyd/Silicone Alkyd	Number and thickness of coats	Surface preparation method
Carboline: Carbocoat 115VOC/ Carbocoat 30 International Paint: Devguard 4160/ Devshield 877 Sherwin Williams: Kem Kromik Universal Primer/ Steel Master 9500 Tnemec: Chem-Prime HS Series 37H/ Versatone Series 82HS Color and gloss: See color schedule	1 or more prime coats for uncoated or repair of damaged surfaces apply at 2 to 3 mils DFT, per coat, plus stripe coats. 2 or more compatible manufacturer's finish coats apply at 2 to 3 mils DFT, per coat. Total system excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	SSPC-SP1 followed by: SSPC-SP6 2.5 - 4.0 mil surface profile Follow manufacturer's surface preparation instructions and application instructions to apply subsequent coats.
Coating materials - Option 2 Water-borne acrylic	Number and thickness of coats	Surface preparation method

Tabulation No. 02		
Prime coat for ferrous surfaces Carboline: Carbocrylic 3358 / Carbocrylic 3359 International Paint: Devflex 4020PF DTM/ Devflex 4216HP Sherwin Williams: Pro Industrial Pro-Cryl/ Pro Industrial Multi Surface Acrylic Tnemec: Uni-Bond DF Series 115/ Enduraton Series 1028 Color and gloss: see color schedule	1 or more prime coats for uncoated or repair of damaged surfaces apply at 2 to 3 mils DFT, per coat, plus stripe coats. 2 or more compatible manufacturer's finish coats apply at 2 to 3 mils DFT, per coat. Total system excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	SSPC-SP1 followed by: SSPC-SP6 2.5 - 4.0 mil surface profile Follow manufacturer's surface preparation instructions and application instructions to apply subsequent coats.

PERFORMANCE REQUIREMENTS:

Testing Protocol	Acceptance Criteria
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Alkyd/silicone alkyd: 250 milligram loss or less Acrylics: 250 milligram loss or less
Direct impact, ASTM D2794	Alkyd/silicone alkyd: 40 milligram loss or less Acrylics: 40 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, Type II tester:	Alkyd/silicone alkyd: 250 psi or greater Acrylics: 250 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4-inch or less undercutting at 3,000-hours
QUV accelerated weathering test, ASTM D4587:	Passes 3,000-hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244.

Tab AE-04.DOC

Tabulation No. 03

Items to be coated for Atmospheric exposure:

a. Exterior of guard posts
b. Exterior of barrier post and rail
c. Interior and exterior ferrous surfaces 6-inch vault ventilation pipe
d. Exterior surfaces of exposed outdoor steel water storage tanks and associated appurtenances (for steel tank option)
e. Surfaces of accompanying metalwork for tank to be coated and not left galvanized: Ladders, stairs, walkways, hatches, balconies, safety cages, handrail, safety railings, platforms, and catwalks.
f. Exterior ferrous surfaces of exposed piping
g. Exterior surfaces of exposed blow off piping
h.
i. Tank air vent

Notes:
1. Do not coat stainless steel, bronze, or non-metallic surfaces.
2. Do not coat mating surfaces, machine surfaces, seals, and surfaces that would be functionally impaired by the coating.
3. Coat exposed machined surfaces after assembly.
4. Coat all associated fasteners to include nuts, bolts, washers, and anchors after installation.

Coating materials – Option 1 Zinc Primer/Epoxy/ Polyurethane	Number and thickness of coats	Surface preparation method
For ferrous surfaces - Carboline: Carbozinc 859/Carboguard 891/Carbothane 134 HB, HG, or VOC PPG: Amercoat 68HS or Amercoat 68HS VOC/Amerlock 400 or Amerlock 2/Amercoat 450H or Amershield VOC Sherwin Williams: Zinc Clad III HS or Zinc Clad III HS 100/ Duraplate 235 or Macropoxy 646/ Hi solids polyurethane or Hi solids polyurethane 250	1 or more prime coats apply at 3 to 5 mils DFT, per coat, plus stripe coats. 1 or more intermediate coats apply at 6 to 8 mils DFT, per coat, plus stripe coats. 1 or more compatible manufacturer's finish coats apply at 3 to 5 mils DFT, per coat. Total system excluding stripe coats: 12-mil DFT, minimum 18-mil DFT, maximum	SSPC-SP1 followed by: For steel: SSPC-SP10/NACE 2 or SSPC-SP11 where abrasive blasting is impractical For ductile iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2.5-4.0 mil surface profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Tabulation No. 03		
Tnemec: Tneme-zinc 90-97/ Epoxoline Series N69 or Epoxoline Series V69/ Endura-shield 175 Color and gloss: As selected by OGR (see RSN 09 96 20-3)		
Coating materials – Option 2 Zinc Primer/Epoxy/ Polysiloxane	Number and thickness of coats	Surface preparation method
Carboline: Carbozinc 859/ Carboguard 691/ Carboxane 2000 PPG: Amercoat 68HS or Amercoat 68HS VOC/ Amerlock 2 or 400/ PSX 700 Sherwin Williams: Zinc Clad III HS or 4100/ Duraplate 235/ Sherloxane 800 Color and gloss: see color schedule	1 or more prime coats, apply at 3 to 5 mils DFT per coat, plus stripe coats. 1 or more intermediate coats, apply at 5 to 7 mils DFT per coat. 1 or more finish coats, apply at 3 to 7 mils DFT per coat. Total system excluding stripe coats: 11-mil DFT, minimum 19-mil DFT, maximum	SSPC-SP1 followed by: For steel: SSPC-SP10/NACE 2 or SSPC-SP11 where abrasive blasting is impractical For ductile iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2.5-4.0 mil surface profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

PERFORMANCE REQUIREMENTS:

Testing Protocol	Acceptance Criteria
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Epoxy/Polyurethane: 100 milligram loss or less Epoxy/Polysiloxane: 120 milligram loss or less
Direct impact, ASTM D2794	Epoxy/Polyurethane: 30 inch-pounds Epoxy/Polysiloxane: 40 inch-pounds

Tabulation No. 03	
Pulloff adhesion, ASTM D4541, annex A2, Type II tester:	Epoxy polyurethane: 800 psi or greater Epoxy/Polysiloxane: 1000 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4-inch or less undercutting at 3,000-hours
QUV accelerated weathering test, ASTM D4587:	Passes 3,000-hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244.

Tab AE-08.DOC

Tabulation No. 04

Items to be coated for immersion service:

a. Interior ferrous surfaces of buried line pipe and fittings mortar lined
b. Interior ferrous surfaces of field welded joints of buried line pipe and fittings
c. Interior ferrous surfaces of 6-inch and 24-inch riser
d. Interior ferrous surfaces of buried piping and fittings not tabulated herein
e. Manhole cement mortar lining

Notes:

a. Steel pipe shall have a minimum holdback of 4-inches from welding areas.
b. Fill or butter all cement mortar lined pipe joints.
c. Fill inside joint recess of cement mortar lined pipe with cement mortar per AWWA C205.
d. Do not coat seals, mating surfaces, and machined surfaces where paint could interfere with proper operation or fit.

Coating materials - Cement-mortar lining and repairs	Surface preparation method
For ferrous surfaces: Apply in accordance with following standards: AWWA C104 or C205, shop applied.	In accordance with AWWA C104 or C205
For girth welds and damaged areas: Apply in accordance with AWWA C602, in-place method. Cement mortar material for patching and grith welds shall be the same material as the mortar for the original machine lining.	In accordance with AWWA C602

Tabulation No. 05		
Items to be coated for burial service: a. Exterior surfaces of buried steel line pipe and fittings b. Exterior surfaces of steel buried field welded joints c. Exterior ferrous surfaces of 6-inch and 24-inch riser d. Exterior and interior ferrous surface of valve boxes e. Exterior surfaces 48-inch to 42-in concentric reducer f. Exterior surfaces 42-inch wye connection g. Exterior surfaces carrier pipe (for bored crossings) h. Exterior surfaces of line pipe and filling line pipe for N.A.P.I. turnout i. Exterior surfaces of buried steel piping and fittings not tabulated herein		
Notes: 1. Steel pipe shall have a minimum holdback of 3-inches from welding areas. 2. Do not paint aluminum-brass, bronze, and stainless-steel metalwork. 3. Do not coat seals, flange faces, mating surfaces, and machined surfaces where paint could interfere with proper operation or fit. 4. Coat exposed machined surfaces after installation. 5. Coat all associated fasteners to include nuts, bolts, washers, and anchors. 6. Pipe bedding and trench backfill will be installed to avoid abrasion or other damage to coatings. 7. Use manufacturer's standard color. 8. Repair damaged and defective areas in accordance with manufacturer's recommendations.		
COATING OPTIONS		
OPTION 1 - Polyurethane exterior in accordance with AWWA C222.		
OPTION 2 - Fusion bonded epoxy in accordance with either AWWA C213 interior and exterior of steel pipe and/or fittings or AWWA C116 interior and exterior of ductile iron or grey-iron pipe and/or fittings.		
OPTION 3 - Coating materials Epoxy	Number and thickness of coats	Surface preparation method

Tabulation No. 05		
Carboline: Carboguard 690 Sherwin Williams: Duraplate 235 Tnemec: Epoxoline Series N69 or V69 PPG: Amercoat 235 International: Bar Rust 235 Color and gloss: see Color Schedule	3 or more base coats apply at 6 to 8 mils DFT per coat, plus stripe coats. Total base coat system excluding stripe coats: 18-mil DFT, minimum 24-mil DFT, maximum	SSPC-SP1 followed by: For steel: SSPC-SP10/NACE 2 For ductile iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2.5-4.0 mil profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
OPTION 4 – 100% Solids Epoxy	Number and thickness of coats	Surface preparation method
Carboline Plasite 4500 Tnemec: Series 431 Duromar: HPL-2510 PPG Amercoat 113 International Paint: Enviroline 376F-30LT NSP Products: NSP 120 Sherwin Williams: Dura-Plate UHS	Follow coating manufacturer's instructions for number of coats and thickness per coat. Total coating system excluding stripe coats: 20-mil DFT, minimum 40-mil DFT, maximum	SSPC-SP1 followed by: For steel: SSPC-SP10/NACE 2 For ductile iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2.5-4.0 mil profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Tabulation No. 05	
PERFORMANCE REQUIREMENTS	
Testing Protocol	Acceptance Criteria
Fresh/deionized water immersion test, ASTM D870:	passes, 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Dilute Harrison immersion test, Modified ASTM D870:	passes, 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	100 milligram or less
Direct impact, ASTM D2794:	30 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	1000 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs
Cathodic disbondment, ASTM G8:	1/4 inch or less disbondment at 120-day test

Tabulation No. 06

Items to be exterior coated for burial service:

a. Girth weld field application
b. Uncoated sections for other pipe connections (i.e. bell and spigot)

Notes:

a. Do not paint aluminum-brass, bronze, and stainless-steel metalwork.
b. Do not coat seals, flange faces, mating surfaces, and machined surfaces where paint could interfere with proper operation or fit.
c. Coat exposed machined surfaces after installation.
d. Pipe bedding and trench backfill will be installed to avoid abrasion or other damage to coatings.

Coating Material:	Surface Preparation Method
For girth weld area - Option 1: Materials: Aqua-Shield AQW; as manufactured by: Canusa-CPS www.canusacps.com	Follow manufacturer's surface preparation and application instructions to apply sleeve and any subsequent repairs.

Tabulation No. 06	
For bell and spigot connections use AquaSeal Mastic Filler paired with Aqua-Shield AQW Application: Follow manufacturer's recommendations and instructions to apply heat shrink sleeve. Repair: Repair damage or defective sleeve areas per manufacturer's instructions. Replace sleeve for areas exceeding 6-square inches.	
For girth weld area Option 2: Category: Liquid applied girth weld coating, compatible and approved by pipe coating manufacturer. Application: Follow manufacturer's recommendations and instructions to apply girth weld coating. Repair: Repair damage or defective areas per manufacturer's instructions.	Follow manufacturer's surface preparation and application instructions to apply girth weld coating and any subsequent repairs.

Tabulation No. 07		
Items to be coated: Steel and Concrete: a. Exterior surfaces of concrete tanks		
Notes: 1. Do not coat stainless-steel, bronze, or non-metallic surfaces. 3. Do not coat mating surfaces, machine surfaces, seals, and surfaces where the coating could interfere with proper operation or fit. 4. Coat exposed machined surfaces after assembly.		
Exterior Coating Materials Waterproof Coating	Number and Thickness of Coats	Surface Preparation Method
Cement based, heavy duty waterproof coating. Fills and seals concrete pores and voids while resisting hydrostatic pressure: Waterproof coating: BASF Thoroseal or equivalent	Apply at manufacturer's recommended thickness per coat.	SSPC-SP13/NACE 6

Tabulation No. 07		
Finish coats: Water Borne Light Industrial Coatings for specified exterior service exposure and gloss, use: Exterior No. 163, semigloss Exterior No. 164, gloss Color s: As selected by OGR (see RSN 09 96 20-3)	2 or more compatible manufacturer's finish coats. Follow manufacturer's instructions for thickness per coat. Total system: 6 to 10-mil DFT	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Approved Materials: Materials from MPI APL		

Tabulation No. 08
Damaged galvanized items to be repaired: a. Combination channels and connection plates b. Chain link fence c. W-Beam guard rail d. Corrugated steel pie and couplings e. Anchors. f. Gratings. g. Metal bar grating. h. Ladders and rungs. i. Platforms. j. Guardrails. k. Damaged galvanized surfaces not otherwise tabulated.
Repair damaged galvanized surfaces in accordance with ASTM A780, except repair materials containing cadmium and lead are not permitted.

Tab AE-11.DOC

Tabulation No. 09
Items not to be coated and to receive a uniform passivation layer - Damaged Stainless Steel: a. 6-inch orifice plate b. Stainless steel surfaces not otherwise tabulated herein.
Note: a. Do not coat stainless steel items listed above. Stainless steel surfaces to receive uniform passivation. b. Do not damage attached parts, adjacent parts, or materials by field cleaning and passivation methods of stainless steel.
Clean, restore, and inspect uniform passivation layer on damaged, contaminated, or depassivated stainless steel surfaces in accordance with ASTM A380.

Tab AE-14.DOCX

Tabulation No. 10
Items to be coated or repaired: a. 6-inch and 24-inch flange connections for air valve and blow off assembly b. 24-inch flange c. Interior and exterior ferrous surfaces of the overflow piping and flap valve for both the concrete and steel tanks.

Tabulation No. 10

Notes:
1. Do not coat stainless steel, bronze, or non-metallic surfaces.
2. Coat all fasteners to include nuts, bolts, washers, and exposed anchors.
3. Fast dry curing agents are allowed as a substitute.

Coating materials – Option 1 Epoxy/ polysiloxane topcoat	Number and thickness of coats	Surface preparation method
Carboline: Carboguard 635/ Carboxane 2100 Duromar: HPL-1510/ HPL-6700PSX PPG: Amerlock 400 or 2/ PSX 700 PPG Sigmashield 880/ PSX 700 Sherwin Williams: Duraplate 235/ Sher-loxane 800 Sherwin Williams: Macropoxy 646/ Sher-loxane 800 Color: Manufacturer's standard light color and gloss	2 base coat apply at 4-8 mils DFT per coat, plus stripe coats. 1 or more topcoats, apply at 3-7 mils DFT per coat Total system measured to steel substrate: 11-mil DFT, minimum 23-mil DFT, maximum	SSPC SP-1 followed by: For steel: SP10/NACE 2 2.5 to 4 mil surface profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

PERFORMANCE REQUIREMENTS:

Testing Protocol	Acceptance Criteria
Fresh/deionized water immersion test, ASTM D870:	passes, 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Dilute Harrison immersion test, Modified ASTM D870:	passes, 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Polysiloxane: 80 milligram or less

Tabulation No. 10	
Direct impact, ASTM D2794:	40 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	1500 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs.
Cathodic disbondment, ASTM G8:	1/4 inch or less disbondment 120 day test

Tab IE-19.DOCX

Tabulation No. 11		
Items to be coated: a. Damp proofing and moisture barrier of the exterior of below grade concrete manholes and vaults. b. Coating aluminum in contact with concrete surfaces		
Coating Materials	Number and Thickness of Coats	Surface Preparation Method
Exterior Bituminous coating, MPI No. 25 Color and gloss: Black	2 or more heavy coats. Follow manufacturer's instructions for dry or wet film thickness per coat.	SSPC SP-13/NACE 6
Approved Materials: Materials from Master Painters Institute – Approved Products List (www.paintinfo.com)		

Tab NM-02.DOCX

Tabulation No. 12
Items to be coated - Shop or field applied interior linings for immersion exposure: a) Interior ferrous surfaces of 6-inch line pipe and fittings for N.A.P.I. turnout b) 6-inch blind flange for N.A.P.I. turnout c) Interior ferrous surfaces of 4-inch filling line and fittings for N.A.P.I. turnout d) Interior surfaces 48-inch to 42-in concentric reducer e) Interior surfaces 42-inch wye connection f) Interior surfaces carrier pipe (for bored crossings)

Notes:

1. Do not paint aluminum-brass, bronze, and stainless-steel metalwork.
2. Do not coat seals, mating surfaces, and machined surfaces where paint could interfere with operation or fit. Coat exposed machined surfaces after installation.
3. Coat miscellaneous metalwork not otherwise tabulated.
4. Coat all associated fasteners to include nuts, bolts, washers, and exposed anchors.

LINING OPTIONS

OPTION 1 – Fusion Bonded Epoxy in accordance with either AWWA C213 interior and exterior of steel pipe and/or fittings or AWWA C116 interior and exterior of ductile iron or grey-iron pipe and/or fittings.

OPTION 2 - 100% Solids Epoxy	Number and thickness of coats	Surface preparation method
Carboline: Plasite 4500 S Duromar: HPL-2510 International Paint: Enviroline 230 Raven Linings: AquataPoxy A6 Sherwin Williams: Sherplate PW Epoxy or Dura-plate UHS Tnemec: Series 22 Epoxoline or Series Epoxoline FC Color and gloss: manufacturer's standard color and gloss	1 or more base coats apply at 20 to 40 mils DFT per coat, plus stripe coats. Total base coat system: 20-mil DFT, minimum 40-mil DFT, maximum	SSPC-SP1 followed by: For steel: SSPC SP-5/NACE 1 For ductile iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2.5-4.0 mil profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
OPTION 3 - Epoxy	Number and thickness of coats	Surface preparation method

Carboline: Carboguard 891 PPG: Amerlock 2 or 400 or Amercoat 235 Sherwin Williams: Duraplate 235 Tnemec: Epoxoline Series N69 or V69 Color and gloss: see color schedule	3 or more base coats, apply at 4 to 8 mils DFT per coat, plus stripe coats. Total base coat system excluding stripe coats: 12-mil DFT, minimum 24-mil DFT, maximum	SSPC-SP1 followed by: For steel: SSPC SP-5/NACE 1 For ductile iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2.5-4.0 mil profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

PERFORMANCE REQUIREMENTS	
Testing Protocol	Acceptance Criteria
Fresh/deionized water immersion test, ASTM D870:	passes, 2 years test with water at ambient temperature, no blisters on scribed or unscribed sides.
Dilute Harrison immersion test, Modified ASTM D870:	passes, 2 years test with water at ambient temperature, no blisters on scribed or unscribed sides.
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Epoxy: 100 milligram loss or less
Direct impact, ASTM D2794:	30 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	1000 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs
Cathodic disbondment, ASTM G8:	1/4 inch or less disbondment 120-day test

Tab IE-01.DOCX

3.15 COLOR SCHEDULE

A. Colors and glosses of finished coats:

1. To be selected and approved by COR.
2. Meet requirements of schedule 3.15 – Color Schedule.

B. Color and gloss to meet one or more of following:

1. Munsell Color.

2. Manufacturer's standard color.

C. Gloss abbreviations:

a. SG-Semi Gloss

b. G--Full Gloss.

D. Color schedule table:

1. Numbers listed in the "Tabulation No." column correspond to "Items to be coated" listed in Coating Tabulations.

Schedule 3.11 – Color Schedule.

Tabulation No.	Item Surface	Color	Color No.	Gloss
2	a. Guard posts b. Barrier post and rail	Safety Yellow	Fed Std. 13591	G
2	a. Cathodic protection test station bollards.	NTUA Blue	N/A	G
2	a. Exterior surfaces of exposed air vent piping and blow off piping. Cathodic protection test station bollards..	NTUA Blue	N/A	G

END OF SECTION

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SECTION 10 14 26
UTILITY MARKERS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for applicable Line Pipe.

1.02 REFERENCE STANDARDS

A. Navajo Tribal Utility Authority NTUA

1. NTUA Color Codes NTUA Blue

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 10 14 26-1, Utility Marker Plan:

1. Show proposed locations of utility markers.

PART 2 PRODUCTS

2.01 UTILITY MARKERS

A. CRM3007, Utility Marker, manufactured by Carsonite, www.carsonite.com; or equal, with the following essential characteristics:

1. Catalog # RPH3-66-U Hybrid 3-Rail Marker Post.
   a. Durable.
   b. UV resistant.
   c. T-cross section with support rubs along each edge.
   d. Resistant to impact, ozone and hydrocarbons.
   e. Service Temperature Range: Minus 40 degrees F to 140 degrees F.
   f. Width: 4-inches.
   g. Length: 66-inches minimum.
   h. Anchor Barb.
2. Color: NTUA Blue.

3. Label: NTUA Potable Water Pipeline, phone number and logo as shown in Section 51 00 40 – NTUA Markers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Use manual driving tool drive per manufacturer's recommendations.

B. Install in locations approved by OGR. At a minimum install every 2,000-feet and at:

1. Fabricated horizontal pipe bends.
2. High points in existing ground.
3. Each side of road crossing.
4. Buried manholes.
5. Buried gas line crossings.

END OF SECTION

SECTION 25 00 01
SYSTEM CONTROL AND MONITORING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. System Control and Monitoring:

1. Payment: Lump sum prices offered in Price Schedule 2.

1.02 DEFINITIONS

A. AI: Analog Input.

B. DI: Discrete Input.

C. DNP: Distributed Network Protocol.

D. GFE: Government Furnished Equipment.

E. I/O: Input/Output.

F. MB: Modbus.

G. NGWSP: Navajo-Gallup Water Supply Project.

H. NIP: Network Interface Panel.

I. NTUA: Navajo Tribal Utility Authority.

J. OIT: Operator Interface Terminal.

K. PAC: Programmable Automation Controller.

L. P&ID: Piping and Instrumentation Diagram.

M. PLC: Programmable Logic Controller.

N. RTU: Remote Terminal Unit.

O. SCADA: Supervisory Control and Data Acquisition.

P. SJLWTP: San Juan Lateral Water Treatment Plant.

Q. TCP: Transmission Control Protocol.

1.03 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C2-23	National Electric Safety Code (NESC)
2.	IEEE C62.41.1-08	IEEE Guide on the Surge environment in Low-Voltage (1,000 V or less) AC Power Circuits
3.	IEEE C62.42-05	Guide for the Application of Component Surge-Protective Devices for Use in Low-Voltage (Equal to or Less Than 1,000-V(AC) or 1,200 V(DC) Circuits
4.	IEEE C62.43-2005	Guide for the Application of Surge Protectors Used in Low-Voltage (Equal to or Less than 1,000 Vrms or 1,200 Vdc) data, Communications, and Signaling Circuits
5.	IEEE 802.3-15	Ethernet
6.	IEEE 1815-15	Distributed Network Protocol (DNP3)

B. Electrotechnical Commission (IEC)

1.	IEC 61131-3-2013	Programmable Controllers – Part 3: Programming Languages

C. International Society of Automation (ISA)

1.	ISA 101.01-2015	Human Machine Interfaces for Process Automation Systems

D. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-20	Enclosures for Electrical Equipment (1,000-Volts Maximum)
2.	NEMA FU1-12	Low Voltage Cartridge Fuse
3.	NEMA ICS1-15	General Standards for Industrial Control and Systems

E. National Fire Protection Association, Inc. (NFPA)

1.	NFPA 70-23	National Electrical Code (NEC)

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data.

B. Drawings and data shall be sufficient in detail to demonstrate full compliance with these specifications and applicable codes prior to fabrication, programming, procurement, or installation.

C. Submittals shall include all information necessary for the Owner to independently evaluate system architecture, control logic, hardware selection, network configuration, interlocks, alarm functions, fail-safe design, and operational performance.

D. RSN 25 00 01-1, Qualifications:

1. Contractor, Designer, Programmer, and Installer work summary, include:

a. Description of projects and experience intended to be used to meet experience requirements listed in Article 1.06.

1) Include name, date, and location of projects.

E. RSN 25 00 01-2, System Description Documentation:

1. Functional System Description:

a. Describe and document the proposed Control System, its features and limitations, compliance with the requirements, operation, software algorithms, display screens, and software configuration.

2. System overview:

a. Overview of hardware, software, control functions, interfaces, and general data flow associated with entire system.

b. Include software block diagram of entire system.

F. RSN 25 00 01-3, Approval Drawings and Data:

1. Drawings:

a. Instrumentation Loop Diagrams, Schematic Diagrams, and Wiring Diagrams:

1) Show all wiring and cable connections for supplied components, including all connections made inside cabinets, panels, or other enclosures.

2) Include external connections showing all connections to Control System components, including components required under other Specifications. Identify the remote end of the cable connections on the drawings including identifying the name and tag of the connected device as well as the terminals used for the connection.

b. Networking Diagram.

1) Show all communications links, including, but not limited to servers, network switches, media converters, and communication links between the PLC, OIT, and other field devices.

c. Provide in accordance with the requirements for Computer drafted drawings in Section 01 33 00 – Submittals.

2. Bill of Materials.

3. Manufacturer's product data and catalog sheets on proposed system components.

a. Identification of model or catalog number proposed, equipment capabilities, and electrical characteristics.

4. Uninterruptible power supply calculations to meet requirements found in Article 2.10.

5. Spare part list.

G. RSN 25 00 01-4, Layout Drawings:

1. Dimensioned drawings showing relative positions of components. Includes component identification and layout information.

2. Enclosure and Control Panel Layout Drawings. Exterior and interior arrangements.

3. Include nameplate information.

4. Provide in accordance with the requirements for Computer drafted drawings in Section 01 33 00 – Submittals.

H. RSN 25 00 01-5, Software Development Documentation.

1. Include the following for the Programmable Controller:

a. I/O List, including at a minimum the following information:

1) Point designation.

2) Point description.

3) Card location.

4) Type and rating information.

5) Termination data.

b. Data points list for soft data points internal to programmable controller.

1) Includes information on logical and calculated datapoints, as well as datapoints that are communicated between components.

2) Point designation.

3) Point description.

4) Type and rating information.

5) Address

c. Communication link information.

d. Graphic display drawings (proposed LCD display and OIT touch panel) for each screen available on the LCD or OIT displays.

e. Logic diagrams: Functional and binary logic drawings for the entire Control System.

f. Manufacturers data on all software used and any software licenses provided for the project. Includes all software applications used on or for the OIT, PLC, etc.

I. RSN 25 00 01-6, Final Drawings, Documentation, and Operations and Maintenance Manuals:

1. Final drawings:

a. Includes final versions of all previously submitted diagrams and drawings with as-built changes incorporated into them.

b. Layouts, schematic diagrams, and wiring diagrams including "as-built" changes.

2. Final version of approved software documentation including "as-built" changes.

3. Operations and Maintenance Manuals:

a. Include operation of following system features and hardware items:

1) Screen displays and control operations.

2) General description of all control actions.

3) Limit and trend settings.

4) Manual status entry.

5) Report generation.

6) Control access methods.

4. Final I/O point list.

5. Final uninterruptible power supply calculations to meet requirement found in Section 2.10.

6. Final spare parts list.

7. Handwritten updates or any updates that do not meet the requirements for computer drafted drawings in Section 01 33 00 – Submittals are not acceptable. All drawing modifications must be made in the program originally used to generate the drawing and modifications made by a pdf editing program, like Adobe Acrobat or Bluebeam, are not acceptable.

1.05 DESIGN REQUIREMENTS

A. General:

1. Provide a complete and fully operational Control System for the SJLWTP Regulating Tank Site.

2. The Control System shall be the primary control, automation, and monitoring system for all tanks, instruments, and equipment located at the SJLWTP Regulating Tank Site and NAPI Turnout:
    a. Provide the Control System with all associated equipment, software, terminations, and wiring at SJLWTP Regulating Tank site and the NAPI Turnout to implement control and monitoring functions described in these Specifications.
    b. Design Control System with functional bi-directional data links to other systems, components, PLCs, PACs, and networks as required.
    c. Control System shall provide support for the following minimum communication protocols:
        1) DNP 3.0 per IEEE 1815
        2) Modbus Serial (RTU and ASCII)
        3) Modbus Network (TCP)
        4) HART Communications Protocol.
    d. Fully integrated system, including the following minimum features:
        1) Processing units, I/O components, network and communication components, power supplies, and other miscellaneous control components.
        2) Graphic displays observable from OIT.
            a) Show monitoring feedback and status of all components and system processes tied into control and monitoring system.
        3) At minimum, I/O identified in the I/O Table in Article 3.01 of this Specification, and the P&IDs shown in drawings 1695-D-62498 through 1695-D-62501.
    e. Provide Control System programming, control logic, and macros:
        1) Includes development of logic diagrams, flow charts, and OIT graphical displays.
        2) Provided documentation and descriptions listed within software, including descriptions for each rung, block, or line of ladder diagrams, function block diagrams, and structured text logic.
    f. Provide interface design:
        1) Include development of schematics, datalinks, and other applicable items, required for interfaces between components.
3. Software packages used in the installation and for development of system graphics, control logic, etc. shall be up-to-date and compatible with the most recent version of major operating systems, including Microsoft Windows.

4. Provide Programmable Controller with required I/O and local control at the SJLWTP Regulating Tank Site:
   a. The contractor shall furnish and install optical fiber in the tank yard per Section 26 05 10 – Conductors and Cables.
   b. Provide media converters, network switches, and fiber optic patch panels as required to complete installation.
5. Drawing 1695-D-62484 gives a network and communications overview and shows GFE and non-GFE equipment arrangement and communication interconnections.
6. Provide software not mentioned specifically, but essential for system to meet all functional requirements. Determine what additional information may be required to complete configuration tasks; obtain information via COR.
7. I/O components, communication components, backplanes, and other components utilized in the Control System shall be of the same manufacturer. Minimize number of different types and models utilized.
8. Failure of remote I/O hardware or network communications link must be individually alarmed at the OIT at the SJLWTP Regulating Tank Site.
9. Provide additional equipment not specified in this section but necessary to make system complete and operational at no cost to Government.

B. Control System Function:
1. Utilize the NTUA long haul optical fiber network delivered to site by the NTUA Utility Pole shown on drawing 1695-D-62485 Site Electrical Plan to communicate telemetry and monitoring data from the Control System to the SJLWTP SCADA System and Pumping Plant #1 Control System.
2. Monitoring and Alarming:
   a. Monitor the SJLWTP Regulating Tanks and the NAPI Turnout and record and display local telemetry and monitoring information.
   b. Display all information from devices or systems on graphic displays. Display information in units of process measurement where applicable.
   c. Monitor and provide alarming for all instruments and devices shown on the supplied P&ID drawings 1695-D-62498 through 1695-D-62501, the I/O Table of Article 3.01 of this Specification, and where the Specifications reference interfaces with PLCs, facility control, or SCADA system:
   d. Status alarms for Control System equipment malfunctions.
   e. Where Flow Indicator Transmitter (FIT) devices are shown on Piping and Instrumentation Diagram (P&ID) display the following minimum information on graphic displays:
      1) Flow Direction.

2) Flow.

3) Total Flow.

C. Remote Interface

1. The NTUA provided optical fiber transmission system will be primary means of long-haul communications networking between San Juan Lateral features.

a. Consists of an aerial cable (provided by Others, Contractor to coordinate with COR).

b. Connection to optical fiber transmission line:

1) As shown on 1695-D-62484.

c. Primary communication system utilized for transmission of the following signals:

1) SCADA/Control Data:

a) Transmission of Control Data shall utilize Modbus TCP communication protocol.

2. Design and provide communication link between the Network Interface Panel and Contractor supplied equipment.

3. Contractor is responsible for all programming, setup, and testing required for Contractor supplied equipment, including the Contractor supplied PLC to support the communication link. The SJLWTP Contractor will program the Network Interface Panel communication equipment.

4. Control data leaving and entering the SJLWTP Regulating Tank site shall be secured utilizing IPSec VPN tunneling. Control data includes any data passed through Programmable Controllers. The IPSec VPN will be implemented by the network interface switch located in the Network Interface Panel.

D. Graphic displays observable from OITs.

1. Show monitoring feedback and status of all components and system processes tied into Control System.

E. Site Security:

1. Provide magnetic contacts to monitor site entrance gate, tank hatches, vault hatches, and electrical panel doors at the SJLWTP Regulating Tank site and NAPI Turnout locations in accordance with the I/O Table found in Article 3.01 of this Specification.

F. Power:

1. Provide power distribution system to all Control System components, including protection, to support full operation of system. This distribution system shall include analog loop power supplies and contact interrogation voltages for dry contact inputs.

2. Provide a UPS with battery backup for programmable controller and all network and fiber optic equipment located inside Control System Enclosure & Network Interface Panel. Components located on same site shall share a common UPS system.

3. Provide power distribution to the Network Interface Panel.

G. Install GFE at the SJLWTP Regulating Tank site, GFE equipment includes the following:

1. Network Interface Panel

a. Network Interface Panel includes an installed network interface switch and a fiber bypass unit. Network Interface Panel to be designed and fabricated by the SJLWTP Contractor and used for SJLWTP Regulating Tank site remote communication back to the SJLWTP SCADA System and Pumping Plant #1 Control System.

b. Coordinate with SJLWTP Contractor and Government to receive, store, handle, and install the Network Interface Panel.

c. Network Interface Panel is the point of connection between the site Control System and the NTUA optical fiber transmission system.

d. Provide all cable connections to the Network Interface Panel, these include power and network connections, including all optical fiber connections shown on supplied drawings.

e. Do not make any modifications or alterations to the prefabricated internal components of the Network Interface Panel.

f. Preliminary 'For Information Only' drawing of the Network Interface Panel layout and power distribution schematic are included in the drawing package for Contractor's design, construction, and testing planning. The drawing numbers are as follows:

1) 085-N-1100 NIP Layout

2) 085-N-1101 NIP Power Distribution.

g. Where other Specifications or electrical drawings refer to a 'Service Entrance Enclosure,' this shall be understood to mean the Network Interface Panel. Contractor shall use the name 'Network Interface Panel' in all design and construction documentation.

1.06 QUALIFICATIONS

A. Contractor:

1. Minimum 7-years' experience with similar projects including systems with programmable controllers.

2. Completed at least 5 projects of similar size, type, application, and complexity. At least three projects must have included using proposed Schnieder Electric programmable controller product line, software, and graphics package

B. Designers and Programmers:

1. Minimum 5-years' experience programming systems of similar size and complexity containing programmable controllers.
2. Completed at least 2 projects of similar size and complexity using proposed Schnieder Electric programmable controller product line, software, and graphics package
3. Completed at least 3 projects including systems of similar size and complexity containing programmable controllers.

C. Installer:

1. Minimum 5-years' experience installing control panels and control equipment.
2. Minimum 5-years' experience performing any testing or commissioning activity installer is expected to perform.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle and store hardware in accordance with manufacturer's instructions. Include copy of manufacturer's instructions with equipment at time of shipment.

B. Coordinate with Government regarding GFE delivery schedule.

1.08 DESIGN COORDINATION MEETINGS

A. In accordance with Section 01 31 19 – Project Management and Coordination.

1.09 EXTRA MATERIALS

A. Spare Parts:

1. Furnish minimum 20 percent spare parts for the following:
   a. Fuses.
   b. Disconnecting terminal blocks.
   c. Transient protection modules.
   d. Power Supplies.
2. I/O Cards: Minimum of 20 percent spare of each type used for project no less than one (1) of each size and type used.
3. Network and Communication Cards: Minimum of one (1) spare of each type used.
4. Back planes: Minimum of one (1) spare of each type used.
5. Communications Converters: Minimum of one (1) spare of each type of communications converter used.
6. Spare parts:

a. Identical and interchangeable with similar parts furnished under this specification.

b. Packed in containers suitable for long-term storage.

c. Display labels clearly designating contents of equipment or components for which they are intended.

7. Manufacturer's recommended spare parts list applicable to equipment furnished in this section. Include name of each part, component, module, or printed circuit card; item part number, manufacturer's name and address, quantity recommended, and approximate price (current at time list is prepared) of each item.

8. Replace spare parts used during installation, testing, and commissioning process to provide a complete set of spare parts at completion of project.

PART 2 PRODUCTS

2.01 PROGRAMMABLE CONTROLLER

A. Modicon M340 programmable logic controller with accessories, ruggedized for outside atmospheric conditions, shall meet the following requirements:

1. Network card(s) for harsh environment, Modbus and Ethernet capable.

2. DIN rail:

a. Chassis.

3. 24 VDC Power Supply.

4. Ethernet capable.

5. Provide with a minimum of 40 percent spare capacity, including memory utilization, processing capacity, and other functions.

2.02 I/O

A. Provide I/O as required to meet specified functionality.

B. Provide I/O cards intended for use with the Modicon M340 product line, manufactured by Schneider Electric http://www.schneider-electric.com.

C. Provide 10 percent spare installed I/O of each size and type at each I/O location.

D. Discrete and Analog Input and Output modules as required to implement monitoring and control functions described.

E. Provide capability to install 20 percent additional future I/O cards at each I/O location. Includes connection capability, space on backplanes and sufficient margin in power and operating capacity for a true 'plug and play' installation of additional I/O cards.

2.03 PROGRAMMING CONTROL LOGIC

A. Provide capability of programming control logic in Control System using the following programming languages, in accordance with IEC 61131-3:

1. Ladder Diagram.
2. Function Block Diagram.
3. Structured Text.

B. Implement majority of control logic in Control System using Ladder Diagram or Function Block Diagram, with only select areas implemented using other methods if necessary.

C. Emphasize readability and maintainability in control logic implementation.

D. Fully document all control logic.

2.04 GRAPHIC DISPLAYS

A. At a minimum, provide graphic displays for Control System in accordance with requirements and recommendations in ISA 101.01 and requirements included in this Specification.

B. OIT software: As required.

C. Control System graphic displays are subject to approval by COR.

D. Spare capacity for an increase of up to 20 percent in the number of graphic pages.

E. Designed to support user situational awareness, intuitive navigation, and intuitive system status and condition information.

F. Designed to support all types of tasks and activities required of the operator. Control of system and modification of operational setpoints shall normally be accomplished through OIT.

G. Separate graphic display screens for different functions and locations.

H. Use consistent design philosophy across graphic displays, however the specific functions desired for the individual screens may require unique arrangements of graphics and information.

I. Control System graphic displays shall incorporate a hierarchy of displays that provide progressive exposure to detail. The following list provides a general guideline for the hierarchy of displays:

1. Highest level display shall show entire system within operator's control. Intended to act as an overall indicator as to how the site is running, by tracking key performance indicators.
2. Displays shall consist of detailed information on system operations.
3. Equipment operation if not included in system operation.

J. User interaction techniques:

1. Clear, consistent graphics presenting similar information.
2. Graphic functions: Standardized, intuitive, straight forward with minimal user manipulation.
3. Error tolerance in user interaction for critical devices shall be included, with simple notification of error and effective methods for recovery.

K. Develop a color scheme for graphic displays for approval by COR:

1. Grey backgrounds for graphics, with minimal use of color in graphics.
2. Utilize color specifically and consistently.
3. Color alone shall not be the sole differentiator of an important condition or status.

L. Include analog representation of important measurements, indicating their value relative to normal, abnormal, and alarm conditions.

M. Include visual indication of an Operator input field, or other operator-initiated control function, has been disabled.

N. Response time requirements for the graphic displays:

1. Graphic displays shall take no longer than 3-5 seconds to appear when called up.
2. Update live information on display every 2-seconds unless critical nature of process information displayed requires more frequent updating.

O. Provide feedback on the completion of an action and/or of the failure to complete an action.

P. Component Depiction:

1. Utilize standard shapes for components. Use simple shapes and avoid unnecessary detail.
2. Show status of components clearly and consistently.
3. Include operating hours on operating and standby rotating equipment.
4. Provide faceplates to display detailed component information and user input fields.
5. Vessels and Tanks: Show size relative to process importance of component and indicate physical size.

6. Process Lines: Limited number of line types and line thickness.
7. Process Controllers:
   a. Depicted as a physical entity on the graphics, with key values like set point, output, and control mode displayed.
   b. Provide faceplate type displays for process controllers with detailed information and user input fields, where required, for the process controller.

Q. Text and Values:
1. Do not display leading zeros when depicting values unless the value is less than 1.
2. Differentiate live values from static text, for example by depicting live values with a color. Units of measure should not be depicted as a live value.
3. Date and time display:
   a. Display date in form of "YYYY-MM-DD" on every format.
   b. Display time of day in form "hours:minutes:seconds" on every format. Update time display automatically once every second.

R. Page title: Each page shall have appropriate page title.

S. Provide visual display of lockout/tagout application.

T. Provide faceplates for sequences, including automatic startup and shutdown.

U. Annunciate all active trip conditions on the graphic.

V. Alarms:
1. Alarms and indications of abnormal situations shall be clear, prominent, and consistently distinguishable.
2. Provide the following minimum alarm displays:
   a. Alarm status.
   b. Alarm log.
3. Displays shall provide the Operator the ability to:
   a. Acknowledge alarms.
4. Place alarms out of service (access-controlled operation).
5. Modify alarm attributes (access-controlled operation).
6. Alarm indication in the Control System shall have audible alarms associated with them:
   a. Sound level of the alarm shall be enough for easy detection.

W. No animation except for specific alarm related graphics.

X. Alarm and Events:

1. Maintain a consistent approach to alarming across the entire system.
2. Allow for alarm monitoring for all discrete and analog inputs/outputs and communication links.
3. Document the following for each alarm:
   a. Alarm type.
   b. Alarm setpoint.
4. Indicate acknowledged alarms, unacknowledged alarms, and unacknowledged alarms which have returned to normal.
5. Time stamped logs for alarm history, event history, diagnostic, and audit history for the alarm system.

2.05 NETWORK

A. Hardware, software, and design to provide fully functional bi-directional data links to other systems, components, PLCs, PACs, and networks as required.

B. Control System shall provide support for the following minimum communication protocols:

1. DNP 3.0 per IEEE 1815.
2. Modbus Serial (RTU and ASCII).
3. Modbus Network (TCP).
4. HART Communications Protocol.

2.06 INDUSTIAL ETHERNET NETWORK SWITCH

A. All ethernet network switches shall be managed industrial switches which provide the following minimum features:

1. Layer 2 Ethernet switching.
2. Layer 3 IP routing.
   a. SNMP and Web based management. Security Features:
      1) Integrated stateful firewall.
      2) SNMPv3 encrypted authentication and access security.
      3) Multi-level passwords.
3. Supports linear, star, and ring topology.
4. Loop Prevention.

5. Resiliency.
6. Segmentation.
7. Prioritization.
8. Time synchronization.
9. Security and Diagnostics
10. Provide ports and connections, as required. Spare to include, at minimum the following:
    a. 20 percent spare ports of each type used at the switch.

B. Physical Features:
1. Copper ports:
    a. Eight 10/100BaseTX, RJ-45, minimum.
2. Fiber ports: Two 1000Base-EX, Gigabit Ethernet, single-mode 1310 nm, LC connectors, minimum.
3. Status indicators on each port.
4. Power: Redundant inputs.
5. Enclosure: Metal case.

C. Network Features:
1. IEEE 802.3 compliance.
2. Full/Half Duplex operation on ports.
3. 100-Mbps throughput, minimum.

2.07 OPERATOR INTERFACE TERMINAL (OIT)

A. Provide OIT to perform as primary operator interface to SJLWTP Regulating Tank site Control System. Harmony GTUX Series eXtreme HMIDT75X, or equal.
1. 15.6” Touch Screen Display.
2. Color TFT LCD.
3. Vijeo Designer Software Development Tool.
4. Ruggedized for outside use.

2.08 CONTROL SYSTEM ENCLOSURE

A. Locations:
1. As required for mounting system equipment and components.

2. At minimum, a Control System Enclosure shall be located on the SJLWTP Regulating Tank Site and utilized for mounting the system OIT and related components.
3. Provide adequate room for 180 degrees opening of cabinet door.
4. No less than 3- by 3-feet accessibility in front of enclosure.

B. Design enclosures to allow free and easy access to internal components.

C. Install OIT and any switches or other components that the Operators need to access during normal operation on an internal swing panel within the enclosure. Swing panel shall be latched in place when access to internal components is not necessary.
   a. Swing panel shall completely cover the entire interior area of the enclosure so prevent accidental contact with live parts when the swing panel is closed.

D. Control System Enclosure Type:
1. Type 3R ventilated in accordance with NEMA 250 with hinged door.
2. Lockable hinged door with gasket.
3. Mounting: Electrical equipment support per Standard Drawing 40-D-60001.
4. Size: As required to house components. Include a minimum of 25 percent spare space.
5. Include thermostatically controlled anti-condensation heaters and forced air ventilation system. Heater and ventilation system voltage: 120 VAC.
   a. Ventilation to include removable and washable filter.
6. Grounding connections available on door and body of enclosure.
7. Finish: Manufacturer's standard anti-corrosion coating.
8. Material: Constructed of sheet metal no lighter than 12-gauge.
9. Back panel.
10. UL listed.

E. Optical Fiber Patch Panel
1. Type fiber: Single mode.
2. Length: As required.
3. Connectors: As required to connect to fiber optic equipment.
4. Mounted within Control System Enclosure or mounted externally near Control System Enclosure in lockable enclosure.

F. Accessories:
1. Access door security magnetic contact or tamper switch that is an input to the Control System.

G. Environmental Controls:

1. Over-temperature switches shall be utilized to provide special cooling if required to maintain operating temperatures within manufacturer's specified range.

2.09 POWER

A. Provide power distribution system to all supplied components, including protection, to support full operation of the system. This distribution system shall include analog loop power supplies and contact interrogation voltages for dry contact inputs where required.

B. Failure of any power supply, or power feed, shall be alarmed in the system.

C. Provide all fuses, circuit breakers, power supplies, transformers etc., required to supply and transform power feeds at the desired voltage. Provide DIN Rail disconnect for each 120-volt circuit entering enclosure.

D. At locations with UPS power systems, the Control System components should be powered from that system.

E. DC Power Supply:

1. Type:
   a. Switch-mode power supply.
   b. DIN-Rail mountable.
2. Input Voltage: 100-240 VAC.
3. Output Voltage: 24-VDC plus-and-minus 1 percent.
4. Output Current: 5-Amps, minimum.
5. Connection Type: Screw clamp.
6. Operating Temperature Range: -20 to 60 degrees C.
7. Contractor to determine final size and rating of DC power supply.

F. Fuse Block and Fuses:

1. Type: Finger-safe terminal block.
2. DIN-Rail mountable.
3. Fuse:
   a. Rated for size required in accordance with NEMA FU1-07
   b. 250-volts, current limiting.

G. Ground Bus:

1. Material: Copper.
2. Size: Sufficient to attach equipment ground conductors.

3. Length: Sufficient to attach equipment ground conductors plus 20 percent spare.
4. Insulated mounting bracket.

2.10 UNINTERRUPTABLE POWER SUPPLY (UPS)

A. Type: Tower.

B. Minimum status display and outputs to programmable controller:
1. Online.
2. On battery.
3. Overload.
4. Replace battery.
5. UPS trouble.

C. Input voltage: 120 volts, 60 Hz.

D. Output voltage: 120 volts, 60 Hz.

E. Batteries:
1. Leak-proof.
2. Hot-swappable, user replaceable.
3. Maintenance-free sealed Lead-Acid battery with suspended electrolyte.

F. Determine size and rating of UPS to provide full load current for the following equipment for at least 30-minutes:
1. Everything inside Control System Enclosure & Network Interface Panel.
2. Networking and Control System equipment outside of panels.
3. Fiber optic equipment.

2.11 NAMEPLATES

A. Nameplates:
1. As indicated on Standard Drawing 40-D-6234.
2. Provide nameplates for following:
   a. Overall control enclosure assembly:
      1) Provide nameplate with owner's equipment designation and descriptive name.
   b. Component nameplates:

1) For each device visible from the exterior of the enclosure mount nameplates on outside of door used. These devices include, at a minimum:

   a) Control switches

   b) Protective relays

   c) OITs

2) Provide nameplates for each device and terminal block mounted within each compartment. Mount nameplates inside compartment above each device or terminal block. Use Government format designations for the copy on the nameplates.

3) Nameplates for switches shall identify the positions of the switches.

2.12 ENCLOSURE WIRE

A. Insulated conductors used to connect components external to enclosure are in accordance with Section 26 05 10 – Conductors and Cables.

2.13 FABRICATION

A. Internal Wiring:

1. Provide wiring duct system with removable covers for performing wiring within enclosure.
2. Install with wiring duct covers accessible for removal and replacement.
3. Do not attach wiring to duct system covers.
4. Wiring within ducts shall be accessible for operation, maintenance, removal, and replacement.
5. Design wiring duct system with capacity to wire devices, present and future that can practicably be mounted in enclosure.

B. Wire Connections:

1. Make connections at device terminals or terminal blocks. Maximum two wires per termination point.
2. Install incoming 120-volt branch circuits on adjacent terminal block terminals.
3. Install ring tongue connectors for terminations at terminal blocks and electrical devices. Use pin-type terminal connectors where use of ring tongues is not practical such as terminations at selector switches, pushbuttons, indicating lamps, and auxiliary relays.
4. Do not terminate wire without terminal connector.
5. Do not splice wires.

C. Terminal Blocks:

1. Arrange terminal blocks to segregate signal types and account for spare space.
2. Terminals:
   a. Binding-head or washer-head screws with serrated or grooved contact surfaces.
   b. Spring-clamp type terminal blocks are not acceptable.
3. Voltage rating: 300 volts.
4. Current rating: 20 amps.
5. Analog Inputs shall be of disconnecting switch type terminal blocks.

D. Cable and Wire Identification:

1. Color: White or gray.
2. Install wire markers on conductor end.
3. Print conductor designation first followed by conductor destination and terminal number.
4. Lettering: Machine typed. Do not print wire markers by hand.

2.14 SURGE SUPPRESSION

A. 4 mA - 20 mA transient protection modules:

1. Triple stage hybrid protection.
2. Surge Current (8/20 microsecond wave form): 10 kA, minimum.
3. Clamping Voltage: 30 VDC.
4. Response Time: Less than 5 nanoseconds.
5. Throughput Resistance: 12 Ohms, maximum.
6. Automatically resets after each transient.

B. Line voltage surge protection device:

1. Rated Voltage: 120-volt, 60 hertz.
2. Rated Current: 15 amps.
3. Single-phase service.
4. Surge Current (8/20 microsecond wave form): 10 kA, minimum.
5. Clamping Voltage: 270 volts.
6. Maximum Continuous Operating VAC (MCOV): 115 percent rated line voltage.
7. Response Time: Less than 5 nanoseconds.
8. Modes of Protection: L-N, L-G, N-G.

9. Automatically resets after each transient.

C. For automation equipment in outdoor enclosures, surge suppression is required for power supply inputs and wiring leaving enclosure, including digital I/O, analog I/O, and communication wiring. According to IEEE C62.41.1 and IEEE C62.42.

2.15 BALANCED MAGNETIC CONTACT

A. Designation: Balanced magnetic contact.

B. Separate magnet housing and contact.

C. All metal housing.

2.16 SOURCE QUALITY CONTROL

A. Government may inspect equipment at supplier's manufacturing plant prior to final testing.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with manufacturers' recommendations, with suitable and secure fasteners.

B. Install programmable controller and network equipment inside Control System Enclosure.

C. Make Control System communication connection to offsite NAPI Turnout flowmeter.

D. Make connections to place control and monitoring system into operation and in accordance with NFPA 70.

E. For connections to programmable controllers which run outside Control System equipment cabinet, surge suppression is required, including digital and analog I/O.

F. Provide 20 percent spare terminal blocks inside each cabinet with terminal blocks.

G. Supply line power for control and monitoring equipment from Contractor provided UPS system(s) and in accordance with NEMA FU1-07.

H. Provide networking cabling, designated, and easily identified to-and-from location marker at each end of cable.

I. Make cable and conduit connections. Use watertight conduit hubs for conduit connections.

J. Make grounding and bonding connections in accordance with Section 26 05 20 – Grounding and Bonding and NFPA 70.

K. Provide cables in accordance with Section 26 05 10 – Conductors and Cables.

L. Size and install communication precast handhole vault in location shown in the Electrical Equipment Plan drawing 1695-D-62485.

1. Install fiber from communication pull vault to fiber patch panel in accordance with Section 26 05 10 – Conductors and Cables and 26 05 33 – Raceways and Boxes.

M. Install Government furnished Network Interface Panel and complete all final power and communication wiring connections required to connect Control System Enclosure & fiber optic patch panel to Network Interface Panel to make a complete and functional control system.

1. After installation of GFE and completion of power and communication connections to GFE, coordinate with COR to perform Lateral Integration Testing in accordance with Specification Section 25 08 10 – Automation System Testing and Acceptance.

N. I/O and Remote Interface Data Lists:

1. Lists are solely for information of Contractor. I/O and remote data lists may change throughout construction period.

Table 25 00 01A – SJLWTP Regulating Tank I/O List

Equipment	Description	Type	Signal
S01B01-LT-101	TK-001 Level Transmitter	AI	4-20 mA
S01B01-LT-102	TK-001 Radar Level Transmitter	AI	4-20 mA
S01B01-ZSC-101	TK-001 Tank Hatch Position	DI	24 VDC
S01B01-LT-201	TK-002 Level Transmitter	AI	4-20 mA
S01B01-LT-202	TK-002 Radar Level Transmitter	AI	4-20 mA
S01B01-ZSC-201	TK-002 Tank Hatch Position	DI	24 VDC
S01B01-CP-000 Control Panel	UPS Online	MB	RTU
S01B01-CP-000 Control Panel	UPS On Battery	MB	RTU
S01B01-CP-000 Control Panel	UPS Overload	MB	RTU
S01B01-CP-000 Control Panel	UPS Replace Battery	MB	RTU
S01B01-CP-000 Control Panel	UPS Trouble/Fault	MB	RTU
S01B01-ZSC-001	Control Panel Door Open	DI	24 VDC
S01B01-UC-101	TK-001 Mixer Motor Running	MB	RTU
S01B01-UC-101	TK-001 Mixer Trouble	MB	RTU
S01B01-UC-201	TK-002 Mixer Motor Running	MB	RTU
S01B01-UC-201	TK-002 Mixer Trouble	MB	RTU
S01B01-ZSC-002	Power Panel Door Position	DI	24 VDC
S01B01-ZSC-003	NIP Door Position	DI	24 VDC

Table 25 00 01A – SJLWTP Regulating Tank I/O List

Equipment	Description	Type	Signal
S01B01-ZSC-004	Site Entrance Gate Position	DI	24 VDC
S01B01-PB-001 Splice Vault	Fiber Vault Hatch Position	DI	24 VDC
Patch Panel Enclosure	Panel Door Position	DI	24 VDC
S01B01-ZSC-005	NAPI Turnout Vault Hatch Position	DI	24 VDC
S01B01-FIT-101	NAPI Turnout Flowrate	MB	RTU
S01B01-FIT-101	NAPI Turnout Flow Totalizer	MB	RTU
S01B01-FIT-101	NAPI Turnout Flow Direction	MB	RTU

Table 25 00 01B –Pumping Plant #1 Control System Remote Interface Data List

Equipment	Description	Type	Signal
S01B01-TK-001	TK-001 Level	Output	MB TCP
S01B01-TK-002	TK-002 Level	Output	MB TCP

Table 25 00 01C –SJLWTP SCADA System Remote Interface Data List

Equipment	Description	Type	Signal
S01B01-LT-101	TK-001 Level Transmitter	Output	MB TCP
S01B01-LT-102	TK-001 Radar Level Transmitter	Output	MB TCP
S01B01-ZSC-101	TK-001 Tank Hatch Position	Output	MB TCP
S01B01-LT-201	TK-002 Level Transmitter	Output	MB TCP
S01B01-LT-202	TK-002 Radar Level Transmitter	Output	MB TCP
S01B01-ZSC-201	TK-002 Tank Hatch Position	Output	MB TCP
S01B01-CP-000 Control Panel	UPS Trouble/Fault	Output	MB TCP
S01B01-ZSC-001	Control Panel Door Open	Output	MB TCP
S01B01-UC-101	TK-001 Mixer Motor Running	Output	MB TCP
S01B01-UC-101	TK-001 Mixer Trouble	Output	MB TCP
S01B01-UC-201	TK-002 Mixer Motor Running	Output	MB TCP
S01B01-UC-201	TK-002 Mixer Trouble	Output	MB TCP
S01B01-ZSC-002	Power Panel Door Position	Output	MB TCP
S01B01-ZSC-003	NIP Door Position	Output	MB TCP
S01B01-ZSC-004	Site Entrance Gate Position	Output	MB TCP
S01B01-PB-001 Splice Vault	Fiber Vault Hatch Position	Output	MB TCP
Patch Panel Enclosure	Panel Door Position	Output	MB TCP
	Control System Trouble Alarm	Output	MB TCP
S01B01-ZSC-005	NAPI Turnout Vault Hatch Position	Output	MB TCP
S01B01-FIT-101	NAPI Turnout Flowrate	Output	MB TCP
S01B01-FIT-101	NAPI Turnout Flow Totalizer	Output	MB TCP
S01B01-FIT-101	NAPI Turnout Flow Direction	Output	MB TCP

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Perform field wiring checkout and test in accordance with Section 26 05 90 – Wiring Checkout and Tests.

B. Perform system SPAT testing in accordance with Section 25 08 10 – Automation System Testing and Acceptance.

C. Electrical testing personnel in accordance with NETA ETT-10 and IEEE C2-12.

END OF SECTION

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SECTION 25 08 10
AUTOMATION SYSTEM TESTING AND ACCEPTANCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum prices offered in Price Schedule 2 for System Control and Monitoring.

1.02 DEFINITIONS

A. I/O: Input/Output.

B. OIT: Operator Interface Terminal.

C. PLC: Programmable Logic Controller.

D. SCADA: Supervisory Control and Data Acquisition.

E. SJLWTP: San Juan Lateral Water Treatment Plant.

F. SPAT: System Performance Availability Test.

1.03 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-23 — National Electric Safety Code (NESC)

B. International Electrical Testing Association (NETA)

1. NETA ETT-10 — Certification of Electrical Testing Personnel

C. International Society of Automation (ISA)

1. ISA 62381-2012 — Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)
2. ISA 62382-2012 — Automation Systems in the Process Industry – Electrical and Instrumentation Loop Check

D. National Fire Protection Association, Inc. (NFPA)

1. NFPA 70-23 — National Electrical Code (NEC)

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 25 08 10-1, SPAT Procedure and Start Date.

1. Detailed procedures for planned testing, including individual test and inspection activities that will be performed and a step-by-step procedure for performing the tests.

C. RSN 25 08 10-2, SPAT Test Report:

1. Certification of performance and results of the SPAT.

D. RSN 25 08 10-3, Lateral Integration Test Report

1. Documentation of all hardware and software modifications made to the SJLWTP Regulating Tank Site Control System during the conduct of Lateral Integration Testing.

1.05 DESIGN REQUIREMENTS

A. Automation Testing and Acceptance Process Documentation:

1. General:

a. SPAT documentation prepared by Contractor shall represent testing program in accordance with guidelines in ISA 62381, ISA 62382, and the requirements found in this Specification.

2. Inspection, testing, and certification documentation shall include the following:

a. Name and signature of person performing test.

b. Date at which test was performed.

c. Identification of component, equipment, or system tested.

d. Identification of tests performed.

e. Any data or readings taken during test to verify component, equipment, or system acceptance.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 SYSTEM PERFORMANCE AVAILABILITY TEST (SPAT)

A. Purpose of SPAT is to demonstrate functionality, performance, and stability of the Control System.

B. Government will witness test. Notify COR in writing at least 20-days prior to beginning of SPAT.

C. Perform site acceptance testing and site integration testing in accordance with ISA 62381.

D. Perform loop checks per ISA 62382, perform verification for each loop and each input or output.

E. Demonstrate correct operation of components and systems including, but not limited to the following:

1. Control system.
2. Information technology and cyber security.
3. Communication links.
4. Instrumentation.

F. Control System:

1. Demonstrate accurate operation of graphic displays and operator interfaces to graphic displays and OITs.
   a. Operate field components and instruments for operating configurations and signals represented on OITs and graphic displays to verify accuracy of feedback signals.
2. Verify system alarms:
   a. Ensure alarms operate as intended.
   b. Where simulation of feedback signal is required to verify an alarm, perform simulation to verify system interlock unless device is inaccessible.
   c. Provide feedback, by operating or forcing feedback from device, if it does not damage device or present safety hazard.
3. Check alarms and annunciation points.
4. Adjust settings and graphic displays.

G. Information Technology and Cyber Security:

1. Capture NetFlow data between components for network and protocol analysis at time of system commissioning.

2. Perform vulnerability scan and correct deficiencies.
3. Verify account-based access control.
4. Validate network architecture including port address lists and device address lists.
5. Validate and document communication restrictions, filtering, and monitoring rules through firewalls and other network components.
6. Perform additional Contractor- and manufacturer-recommended testing.
7. Government may perform additional cyber security related testing and verification of system with cooperation from Contractor.

H. Communication Links:

1. Verify cable is free of defects and meets design and manufacturer's guidelines.
2. Verify communication links between devices.
3. Demonstrate feedback signals are transmitting correctly and are operating correctly between facilities.

I. Instrumentation:

1. Inspect each gauge, sensor, transmitter, thermometer, and other instruments. Replace defaced or broken items.
2. Inspect instrument tubing.
3. Field verify calibration and performance of each instrument. Document results for each instrument on separate field calibration sheet. Include, at minimum:
   a. Input, output, and error at 0, 25, 75, and 100 percent of span for analog instruments.
   b. Switch setting, contact action, and deadband, if applicable, for discrete elements.

J. Required I/O and feedback data not visible on OIT shall be demonstrated by temporarily connecting a computer to the PLC to verify the data is available to be transmitted to the SJLWTP SCADA System and Pumping Plant #1 Control System.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Perform field wiring checkout and test in accordance with Section 26 05 90 – Wiring Checkout and Tests.

B. Wiring checkout and tests shall occur prior to SPAT activities.

3.03 LATERAL INTEGRATION TESTING

A. SJLWTP Contractor shall be integrating the off-site remote communication systems for the entire San Juan Lateral. Coordinate with COR and SJLWTP Contractor to integrate

SJLWTP Regulating Tank Site Control System with San Juan Lateral SCADA System controlled at the SJLWTP.

1. Test communication links between the SJLWTP Regulating Tank Site and the following sites:
   a. San Juan Lateral Water Treatment Plant SCADA System
   b. Pumping Plant #1 Control System.
2. Minimum duration of lateral integration testing: 3 days.
3. Provide the following minimum technical personnel to support integration with the lateral communication system, technical personnel shall be onsite throughout the entire duration of the lateral integration testing:
   a. Two electricians
   b. SCADA/Control System representative capable of performing onsite modifications to the Control System.

END OF SECTION

SECTION 26 05 02
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Complete Electrical System:

1. Payment: Lump sum price offered in Price Schedule 2.

   a. Includes the following:

      1) Performing required design.
      2) Furnishing recently certified calibrated testing equipment.
      3) Performing testing.
      4) Provide relay settings.
      5) Provide adjustable trip breaker settings.
      6) Transporting and storing equipment and materials.
      7) Modifying and relocating equipment.
      8) Placing, leveling, and grouting channel bases.
      9) Assembling, adjusting, and installing equipment.
      10) Painting equipment and materials.
      11) Brackets, fasteners, bolts, nuts, lock washers, and other accessories required for mounting or installing electrical equipment and materials.
      12) Drilling holes in steel structures (other than tubular structures) as required for mounting or installing electrical equipment and materials.
      13) Furnishing, handling, and storing spare parts for electrical equipment.
      14) Furnishing special tools and appliances for maintenance and adjustment of equipment.
      15) Making electrical connections; furnishing all miscellaneous materials, which are required for making the connections to electrical equipment. Contractor estimates the number of connections to be made to the equipment based on prior knowledge or experience with similar equipment. No additional compensation will be allowed Contractor if actual connections exceed number estimated by Contractor at time of bidding.

16) Performing wiring checkout and tests.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM A123/A123M-17 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2. ASTM A153/A153M-16a Zinc Coatings (Hot-Dip) on Iron and Steel Hardware

B. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2017 National Electric Safety Code (NESC)

C. National Electrical Installation Standards (NEIS)

1. NECA 1-2015 Good Workmanship in Electrical Contracting

D. National Fire Protection Association (NFPA)

1. NFPA 70-2020 National Electrical Code (NEC)

1.03 EXTRA MATERIALS

A. Provide to Government special tools and equipment necessary to properly install, adjust, test, and check operation of electrical equipment. Furnish all additional tools and equipment as necessary to properly install, adjust, and check operation of electrical equipment.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Conform to NFPA 70 and IEEE C2.

B. Furnish all electrical materials and equipment.

C. Galvanize mounting brackets, bolts, nuts, and washers for major items of electrical equipment such as outdoor motor control centers in accordance with ASTM A123 and ASTM A153.

D. Provide galvanized steel or non-corrosive metal for mounting bolts, nuts, and washers for minor items of electrical equipment and lighter weight items. Do not use cadmium-plated mounting hardware.

E. Change designs as required where Contractor-furnished electrical equipment and materials differ in size, type, ratings, or other physical properties from designs in these specifications. CO will approve changes at Contractor's expense, unless Contractor can demonstrate changes are necessary regardless of manufacturer.

F. Provide special tools and appliances furnished by manufacturer for maintenance and adjustment of manufacturer's electrical equipment.

G. Use test equipment that has been calibrated within 365-days of its use with calibration sticker clearly visible.

H. Deliver all spare parts required by these specifications to Bureau of Reclamation only after completion of contract.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, assemble, and adjust equipment in accordance with this subparagraph. These specifications requirements are based on the premise that no conflict exists between specified design, standards, and codes. However, in the event a conflict is discovered by Contractor, it will be Contractor's responsibility to inform CO of the conflict:

1. In the event of conflicting requirements, establish precedence in the following order:

   a. These specifications or as directed by CO.

   b. Drawings included in these specifications.

   c. Latest edition of "National Electric Code" of the National Fire Protection Association for electrical wiring apparatus and the adopted electrical code of the State in which construction is located. Cooperate with any agency designated by that State to inspect electrical installation for conformance with applicable State code.

B. Do not install electrical equipment until approval drawings and data for associated equipment have been approved by Government.

C. Electrical Installations, Assembly Operations, and Adjustments: Comply with NFPA 70, IEEE C2, and NECA 1.

D. Make electrical installations complete and ready for service.

E. Install electrical equipment in accordance with directions furnished by manufacturer's instruction books.

F. Make all electrical wire, cable, conduit, and grounding connections and furnish all miscellaneous materials which are required for making these connections to equipment.

G. Install items of electrical equipment required to be in a lineup, so appearance is uniform, including height, depth, color, and general construction.

H. Tighten nuts used in electrical equipment assembly with torque wrenches to torque values recommended by equipment manufacturers.

I. Drill holes in bolted steel structures and provide fastenings required for mounting or installing electrical equipment and materials.

J. Do not drill holes in tubular steel structures. Fasten to tubular steel structures by means of properly drilled and tapped pads or brackets welded to tubular members.

K. Installation of Electrical Equipment includes:

1. Leveling and grouting channel bases.

2. Drilling holes, furnishing hardware, and assembling components to each other.

3. Furnishing materials for and making all connections correctly in accordance with final wiring diagrams.

4. Tagging wires and cables at each end.

5. Correcting any errors made by Contractor in installation at no expense to Government.

6. Wiring and checkout of all equipment in accordance with Section 26 05 90 – Wiring Checkout and Tests.

L. Set electrical equipment installed on concrete foundations on channel bases and grout in place to provide full and even bearing.

3.02 REPAIR

A. Repair or replace damaged devices and repair damaged painted surfaces of equipment to match original finish.

B. Correct by repair or replacement, at Contractor's expense, all damage to or failure of any part of the items of material and equipment which in opinion of COR was caused by faulty installation, faulty mechanical assembly, or mishandling.

3.03 FIELD QUALITY ASSURANCE

A. Government will inspect outdoor motor control equipment during construction. Acceptance of equipment will be made after equipment is operational.

END OF SECTION

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SECTION 26 05 10
CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for Complete Electrical System.

1.02 DEFINITIONS

A. Cable: Cable, cables, wire, or wires of one or more insulated conductors.

B. Power Cable: For power loads including receptacle outlets; motors; alternating- and direct-current distribution circuits; heating, ventilating, and air-conditioning and lighting circuits; and cable that is used for controlling heating, ventilating, air-conditioning, and lighting equipment.

C. Building Premises Wire: For connection of separately-housed components such as wiring devices and luminaire circuits to branch circuit breakers and to one another.

D. Multiconductor Control Cable: For control, metering, indication, annunciation, and relaying circuits; and circuits not identified as power circuits.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM B8-11(2017)	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. Fiber Optic Association (FOA)

1.	FOA-4	OTDR Testing of Fiber Optic Cable Plant

C. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C2-12	National Electrical Safety Code (NESC)

D. Insulated Cable Engineer Association (ICEA)

1.	ICEA S-87-640-2016	Fiber Optic Outside Plant Communications Cable
2.	ICEA S-116-732-2019	Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With or Without and Overall

		Shield) for Use in LAN Communication Wiring Systems

E. National Electrical Manufacturers Association (NEMA)

1.	NEMA WC 57-14	Control, Thermocouple Extension, and Instrumentation Cables
2.	NEMA WC 70-09	Power Cables Rated 2000V or Less for the Distribution of Electrical Energy

F. National Fire Protection Association (NFPA)

1.	NFPA 70-20	National Electrical Code (NEC)

G. Telecommunications Industry Association (TIA)

1.	TIA-526-92	Standard Test Procedures for Fiber Optic Systems
2.	TIA-568-C.1-2009	Commercial Building Telecommunications Cabling Standard
3.	TIA 568-C.2-2011	Balanced Twisted-Pair Telecommunications Cabling and Components Standards
4.	TIA 568-C.3-2008	Optical Fiber Cabling Components Standard
5.	TIA -598-2014	Optical Fiber Cable Color Coding
6.	TIA-1152-2009	Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 20-1, Approval Data:

1. Manufacturer's data.

C. RSN 26 05 20-2, Field Test Reports.

1.05 DESIGN REQUIREMENTS

A. Determine conductor sizes, except where shown or specified, in accordance with NFPA 70. In event of conflict between design requirements and NFPA 70, more stringent requirement applies.

B. Where supplied equipment differs from that specified, determine conductor sizes in accordance with NFPA 70.

PART 2 PRODUCTS

2.01 CABLE, GENERAL

A. Manufactured no more than 24-months prior to Notice to Proceed.

B. Round, except for 2-conductor cable with parallel conductors.

C. Conductors:

1. Copper in accordance with ASTM 8, class B or C.
2. Stranded conductors.

D. AWG or kcmil designation.

E. Coverings or insulation: Suitable for installation in vertical position without injury to covering or deformation of insulation when supported in accordance with NFPA 70.

2.02 PHASE IDENTIFICATION

A. Power Cable Phase Conductors:

1. 120/240, single-phase: Black.
2. 277/480 volt, 3-phase: Black with brown, orange, yellow phase tape.

B. Neutral (Grounded) Conductors: In accordance with NFPA 70.

C. Equipment Grounding Conductors:

1. 6 AWG and smaller: Green insulation.
2. Larger than 6 AWG: Green tape at both ends and visible points including junction boxes.

2.03 COLOR CODING

A. Control Cable:

1. Colored insulation or jacket compound. Do not apply color coatings to insulation or jacket surface.
2. In accordance with NEMA WC 57, Table E-2.

2.04 POWER CABLE AND MULTICONDUCTOR CONTROL CABLE

A. 600-volt rated insulation unless specified otherwise.

B. Type: Single-conductor or multi-conductor, non-shielded type.

C. Suitable For:

1. Installation in raceways.

2. Direct burial installation when required by specifications.

D. Insulation Type:

1. Single-conductor cable: XHHW.
2. Multi-conductor cable: XHHW for 14, 12, 10, 8, 6 AWG. TFFN or TFN for 18 and 16 AWG.

E. Multiconductor Overall Jacket:

1. Type: PVC (Polyvinyl chloride) or better, flame-retardant.
2. Jacket thickness:
   a. 16 AWG conductors: 45 mils for 12 conductor or less. 60 mils for greater than 12 conductors.
   b. 14 AWG conductors: 45 mils for 9 conductor or less. 60 mils for greater than 9 conductors.
   c. 12 AWG conductors: 45 mils for 9 conductor or less. 60 mils for greater than 9 conductors.
   d. 10 AWG conductors: 45 mils for 9 conductor or less. 60 mils for greater than 9 conductors.
   e. 8 AWG conductors: 45 mils for 9 conductor or less. 60 mils for greater than 9 conductors.
   f. 6 AWG conductors: 45 mils for 9 conductor or less. 60 mils for greater than 9 conductors.

F. Single-conductor power cable in accordance with NEMA WC 70. Multiconductor cable in accordance with NEMA WC 57. Cable UL listed and labeled.

G. Provide multi-conductor power cable with integral ground conductor. Size ground conductor in accordance with NEMA WC 70.

2.05 BUILDING PREMISES WIRE

A. Type: Single, solid conductor THHN/THWN rated for 600 volts.

B. Size: 14 AWG for 15 ampere branch circuits, 12 AWG for 20 ampere branch circuits, or as shown.

C. Suitable for installation in raceways.

D. Conform to NEMA WC 70. UL listed and labeled.

2.06 INSTRUMENTATION CABLE

A. Type: Twisted, single-pair or twisted triad shielded or multiple individual twisted shielded pairs or twisted triads with overall shield.

B. Suitable for installation in raceways and cable tray.

C. Size: 16 AWG or as shown.

D. Insulation: 600-volt, 105 degrees C, minimum.

E. Single-Pair or Triad Shield: Aluminum-Mylar tape providing 100 percent coverage with tinned, stranded copper drain wire.

F. Multiple Pair or Triad Shield:

1. Pair or triad shield: Aluminum-Mylar tape providing 100 percent coverage with tinned, stranded copper drain wire.
2. Cable shield: Aluminum-Mylar tape providing 100 percent coverage with tinned, stranded copper drain wire.
3. Each pair or triad sequentially numbered for identification.

G. Jacket: Black PVC with rip-cord.

2.07 TELECOMMUNICATIONS CABLE

A. Optical Fiber Cable:

1. Provide cable in accordance with ICEA S-87-640, as appropriate.
2. Cable performance shall not be impacted by immersion in water.
3. UL listed, where available.
4. Color Coding: Per TIA-598.
5. Single Mode Optical Fiber Cable:
   a. Major cable components:
      1) Protect each fiber in a buffer tube of gel free, standard loose-tube type construction.
      2) 2.5 mm buffer tubes, color coded.
      3) Central dielectric strength member: Glass reinforced plastic (GRP) rod filler.
      4) Cable core: Symmetrically stranded buffer tubes around dielectric central member.
      5) Water swellable yarn or water blocking protection.
   b. Optical fibers:
      1) 100 percent synthetic silica.
      2) Cladding diameter: 125-microns.
      3) Core/clad concentricity error: < 0.5 microns, < 0.2 microns typical.

4) Cladding non-circularity: < 1.0.

5) Primary buffer coating: 250 microns.

6) Attenuation of 1310/1383/1550 nanometer wavelength light: < 0.5/0.5/0.4 dB per kilometer.

7) Attenuation: Directly proportional to cable length for an arbitrary cable length section after steady-state conditions are reached.

8) Bend Insensitive Single-Mode Fiber.

9) Color coded.

10) Optical fibers: 12 minimum.

c. Cable Jacket:

1) Type: PVC (Polyvinyl chloride) or CPE (Chlorinated Polyethylene) or better, UV resistant, flame-retardant.

2) Ripcord under sheath.

d. Strength members: With expansion and contraction characteristics similar to glass fibers.

e. Cable Bend Radius:

1) Loaded: 7.7-inch.

2) Unloaded: 5.1-inch.

f. Cable tensile strength:

1) Long term (installed): 135 pounds per foot.

2) Short term (during installation): 600 pounds per foot.

g. Operating temperature range: -40 to 150 degrees F.

h. Suitable for installation in innerduct.

B. Optical Fiber Patch Cable:

1. Type fiber: Single-mode.

2. Length: As required.

3. Connectors: Connectorize fiber cables and connect to patch panels using ST or LC type connectors. .

4. Loss per connector: < 0.5 decibels.

C. CAT 6 Cable:

1. Provided per ICEA S-116-732 and TIA-568-C.2.

2. Four twisted pair, minimum size 24 AWG conductors.

3. Provide communications rated cabling for installation purpose installed (plenum, riser, general purpose, etc.) in accordance with NFPA 70.

4. UL listed and labeled for wet locations.
5. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating and length marking at regular intervals.

2.08 ENCLOSURE WIRING

A. Wiring inside switchboards, switchgear, control panels, etc., not intended for use extending outside of enclosure. Enclosure wiring for instrumentation or telecommunications shall maintain characteristics of those cable types.

B. Minimum 600-volt rated insulation.

C. Type:
1. NEC type SIS.
2. VW-1 Rated.
3. UL Listed.

D. Minimum Conductor Size:
1. 14 AWG.
2. Conductor sized according to application requirements, and in accordance with requirements and recommendation in NEC.

E. Insulation Type:
1. XLPE, or equal.

F. Insulation Color:
1. White or Grey, unless special purpose application.

G. Flame Test Rating:
1. UL 1581 VW-1.

2.09 ACCESSORIES

A. Cable Tags:
1. Type: Heat-shrink type, machine printable sleeve.
2. Color: White with black text.
3. Text size: As large as practical but at least 7 point (0.06-inch).
4. Be 1 inch in length, minimum, and have diameter suitable for installation on the intended conductor.

B. Multiconductor Cable Tags:

1. Type: Cross-laminated polyethylene film or Nomex. Be resistant to water, oil, solvent, abrasion, and tearing.
2. Rectangular shape and have minimum dimensions of 2- by 0.5-inches.
3. Color: White with black text.
4. Text size: As large as practical but at least 16 point (0.16-inch).
5. Attach to cable with standard nylon self-locking tie wraps or cable ties.

C. Polyethylene warning tape:

1. Width: 6-inches.
2. Color: Red.
3. Copy: Continuously imprinted with "CAUTION BURIED ELECTRIC LINE BELOW".
4. Suitable for direct burial.

D. Terminal Connectors for Control and Instrumentation Cable:

1. Heavy-duty, insulated, pressure-crimp-type with ring tongues. 600-volt, pressure-crimp pin type may be used where use of ring tongue connectors is not practical.
2. Tin-plated copper.
3. Serrated inner barrel.
4. UL listed.
5. Compatible with conductor size and type of cable for which used.

E. Telecommunications Cable Faceplates and Connectors:

1. Connectorize fiber cables and connect to patch panels using ST or LC type connectors. Make connections to components as required be component terminal.
2. Provide patch cords to connect dielectric fiber cable to fiber optic equipment.
3. Terminate unshielded twisted pair (UTP) cables in accordance with TIA-568-C.1 and TIA-568-C.2 with T-568A color configuration.
4. Use registered jack (RJ) 45 modular connector.
5. Provide each location with 2 port RJ-45 faceplates unless otherwise noted on drawings.
6. Faceplate color: White.

F. Fiber Optic Cable Patch Panels:

1. Type: Wall mount.
2. Metal housing with splice tray holder, splice tray, adaptor plates, and radius limiters.

3. Splice Trays:
   a. Same manufacturer as housing.
   b. Fusion splice organizer to retain each splice and its shrink tubing.
   c. Manufactured for loose tube type fiber optic cable.
4. Adaptor Plates:
   a. Same manufacturer as enclosure.
   b. Mount at minimum 6 fibers.
   c. Use ST or LC Connectors.

G. Optical Fiber Splice Closure:
1. Re-enterable splice enclosure:
   a. Factory installed sealing materials.
   b. Re-enterable and reusable.
   c. Telcordia GR-771 compliant.
   d. Flame retardant UV stabilized material.
   e. International Electrotechnical Commission (IEC) Ingress Protection Rating (IP), IP-68 Rating compliant.
2. 12 fiber splice, minimum.
3. Grommet sealing system to support flat or round cable profiles.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70, IEEE C2, TIA 568-C.2 and manufacturer's requirements and recommendations.

B. When using cable ties, do not over tighten, to ensure tie does not cut conductor insulation or cable outer jacket. Do not use cable ties to support cables.

C. Use building premises wire for lighting circuits and 120-volt receptacles unless shown otherwise.

D. Maintain manufacturer recommended minimum bending radius for cables.

E. Cable Splicing:
1. Fiber Optic Cable:
   a. Do not splice fiber optic cables outside of patch panels.
   b. Fiber optic splicing:

1) Method: Arc-fusion.

2) Splices per set of fusion tips: 50.

a) Splice loss: 0.1 decibels, average bi-directional.

2. All other cable types: Do not splice cables.

F. Cable Installed in Conduit:

1. Do not pull cable into conduit until they have been cleaned and are free from obstructions and sharp corners.

2. Draw a clean, dry, tight-fitting rag through conduit immediately before installing cable.

3. Install cable using gradual and uniform pulling stresses. Do not exceed allowable pulling tensions and sidewall pressures as recommended by cable manufacturer.

4. Install cable in such a manner as to prevent cuts or abrasions in insulation or protective covering and kinks in cable.

5. When a lubricant is needed as an aid to pulling, use only soapstone or other suitable lubricant that is not injurious to cable insulation.

6. When mechanical cable pulling equipment is used, use a tension meter release mechanism to ensure pulling tension remains below tensile strength of the cable.

7. Remove and replace cables damaged during installation.

8. All conductors, in a single conduit, shall be pulled in at the same time.

G. Cable in Boxes and Enclosures:

1. Provide slack in cable in all boxes, and enclosures. Do not pull cable tight against any edge or component in enclosures and boxes.

2. If cable is terminated in box or enclosure include enough spare length in terminated conductor to reach any other terminal in enclosure. In multi-panel control cabinets conductor should be able to reach any other terminal within that panel of enclosure.

H. Fiber optic cables:

1. Termination:

a. Terminate fiber optic cable installed between enclosures at patch panels.

b. Coil 10-feet of fiber cable inside each patch panel.

c. Leave spare fibers in each patch panel.

d. Retain fibers at each cable end equal in length to longest single fiber.

2. Provide fiber optic coils inside pull boxes, junction boxes, and other electrical and control enclosures, and where recommended by manufacturer.

3. Clamp cable entry with fiber type cable clamp.

I. CAT 6 Cable:

1. Install in accordance with TIA-568-C.2 and NFPA 70 as applicable.
2. Install per manufacturer's instructions and do not exceed manufacturers' cable pull tensions for copper cables.
3. Install back boxes for RJ-45 connectors.
4. Do not install power and communication cable in same conduit.
5. No cable shall contain unterminated elements.
6. Do not untwist Category 6 cables more than 1/2-inch from point of termination to maintain cable geometry.
7. Terminate networking cables in T568A configuration per TIA-568-C.2.

J. Direct Buried Cables:

1. Depth: 24-inches, minimum.
2. Install by trenching method. Do not plow cables in.
3. Surround cables by 2-inches of sand, minimum.
4. Install polyethylene warning tape 18-inches above cable.

K. Excavation and backfill for buried cable: In accordance with Section 31 23 11 – Earthwork for Structures.

L. Grounding.

1. Provide one nonactive conductor grounded at both ends in each multiconductor control cable.
2. Ground spare conductors by wire jumpers from equipment terminal block points to equipment ground bus.

M. Wiring methods:

1. Terminate control cable with terminal connectors.
2. At termination point of multiconductor cable, form conductors into neat packs and tie conductors with self-locking cable ties.
3. Clamp cable entering equipment with commercial type cable clamps.
4. Leave sufficient length cable ends to make connections conveniently to equipment, fixtures, and devices.
5. Retain spare single conductors at each end of a multiconductor cable in a length equal to longest single conductor of multiconductor cable.
6. Terminate spare conductors of multi-conductor cable at terminal blocks. Ground spare conductors by using wire jumpers between terminations and equipment ground bus.

3.02 CABLE AND CONDUCTOR IDENTIFICATION

A. Power Cable:

1. Identify power conductors that are service conductors and panelboard feeders with colored insulation or colored phase tape in accordance with this section. An additional conductor marker is not required.
2. Provide a single-line marker on the load end of feeder and branch-circuit conductors that originate at panelboards. The marker to include designation of source equipment and circuit number.

B. Conductor Markers:

1. Text to be machine or computer generated. Handwritten text is not acceptable.
2. Provide individual conductors of multiconductor control cable with conductor marker. Print conductor designation, as shown on approved schematic diagram, on first line. Print conductor destination and device terminal number on second line.
3. A single line conductor marker will be acceptable provided the conductor designation is enclosed in parenthesis followed by the conductor destination.
4. Do not heat shrink marker onto conductor. Allow marker to rotate about the conductor.

C. Multi-Conductor Cable Tags:

1. Tag multiconductor cables at each end.
2. Text to be machine or computer generated. Handwritten text is not acceptable.
3. Mark tags with cable designations as shown on approved wiring and interconnection diagrams. Cable designation to be a single-line of text that includes cable number, originating equipment designation, and destination equipment designation. Develop cable designations when not shown. Examples of cable designations are:
   a. 1MCA-DV1 - First cable from motor control center MCA to discharge valve No. 1).
   b. 3MCB-ACP - Third cable from motor control center MCB to auxiliary control panel ACP.
4. Attach tags to cable with self-locking tie wraps or cable ties.

3.03 CONTRACTOR FIELD QUALITY TESTING

A. Perform testing after installation, but before connection to equipment.

B. Test cables in large groups to minimize number of testing sessions.

C. Notify COR, in writing, of date, time, and cables to be tested at least 5 working days before testing. Testing dates to be mutually agreeable between Contractor and COR.

D. Perform following tests:

1. Continuity test: Test continuity of each conductor prior to performing insulation resistance test.
2. Insulation resistance tests for power, control, and instrumentation cables:
   a. Measure insulation resistance between each conductor and station ground with all other conductors in same cable or conduit grounded.
   b. Test voltage: 1,000 volts direct current, minimum.
   c. Minimum acceptable insulation resistance: R in MΩ (rated voltage in kV + 1) x 1,000/length in feet.
3. Insulation resistance test for telemetry cable:
   a. Test cable before making ground connections,
   b. Test voltage: 1,000 volts direct current, minimum.
   c. Measure insulation resistance between each conductor and remaining conductors, and between conductor and shield.
4. Record following test data on test report for each conductor tested:
   a. Date of test.
   b. Name or names of Contractor's personnel who performed test.
   c. Name of Government inspector who witnessed test.
   d. Conductor identification.
   e. Megohms between conductor and ground.
   f. Total length of conductor.

E. Fiber Optic Cable: Perform the following tests:

1. Test each fiber using an Optical Time Domain Reflectometer (OTDR):
   a. Purpose and intent of testing:
      1) Determine if installed cable is free from defects.
      2) Compare measured attenuation with cable manufacturer’s specified attenuation of 0.4 decibels per kilometer for 1,300 nanometer light.
      3) Compare measured bi-directional splice loss with specified splice loss of 0.1 decibels per splice.
      4) Compare measured connector loss with specified connector loss of 0.5 decibels.
      5) Verify cable length.
   b. OTDR requirements:
      1) Fiber type: Single-Mode.
      2) Dynamic Range: 25 decibels, minimum.

3) Resolution: Selectable 0.1- to 10-meters.

4) Pulse width: Selectable. 1 for all tests.

5) Reflectance accuracy: Plus or minus 2 decibels.

6) Loss accuracy (Linearity): 0.02 decibel per decibel.

c. Obtain an OTDR waveform for each fiber to:

1) Determine actual cable length.

2) Determine attenuation and splice loss.

3) Identify and locate splices and step discontinuities/possible fiber breaks.

d. Prepare test reports:

1) Generate PDF copy and paper copy of each trace made during testing for inclusion in report:

2) OTDR waveform for each fiber showing “A” and “B” range marks:

a) Do not move or change location of either mark.

3) Include Analysis Summary Results Table for each fiber:

a) Indicate numerical values associated with each event.

b) Do not use question marks, dashes, or blanks.

4) Include the following information for each trace:

a) Trace name.

b) Operator’s name.

c) Date and time.

d) Fiber type being tested.

e) Bundle color.

f) Fiber color.

g) Fiber number.

h) Launch reel length.

i) OTDR resolution.

j) Pulse width.

k) Wavelength.

l) Index of refraction.

m) Averaging number.

n) Receiver bandwidth.

o) Sampling point count.

p) End to end loss, decibels.

q) Reflectance, decibels.

r) Fiber Break, decibels.

s) Backscatter.

5) Traces to be viewable and reproducible on PC using Windows 7 or later.

F. CAT 6 Cable: Perform the following tests:

1. Test equipment shall conform to TIA-1152.
2. Inspect network cabling terminations for T568A color configuration.
3. Perform testing for each outlet.
4. Performance test:
   a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2.
   b. Include the following in Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

G. If conductor fails continuity or insulation resistance testing, remove, and replace cable and conductor.

END OF SECTION

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SECTION 26 05 20
GROUNDING AND BONDING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of grounding and bonding in prices offered in Price Schedules for Complete Electrical System.
   a. Includes, but not limited to the following:
      1) Ground Cable.
      2) Ground Rods.
      3) Tank Lightning Protection system
      4) Electrical Ground Resistance Test.
      5) Includes costs of associated accessories.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM B3-13(2018)	Soft or Annealed Copper Wire
2.	ASTM B8-11(2017)	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3.	ASTM B228-11a(2016)	Concentric-Lay-Stranded Copper-Clad Steel Conductors

B. Institute of Electrical and Electronic Engineers (IEEE)

1.	IEEE 80-2013	Safety in AC Substation Grounding
2.	IEEE 81-2017	Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
3.	IEEE 142-2010	Grounding of Industrial and Commercial Power Systems
4.	IEEE 837-2014	Qualifying Permanent Connections Used in Substation Grounding
5.	IEEE C2-2017	National Electrical Safety Code (NESC)

C. National Fire Protection Association (NFPA)

1. NFPA 70-2023 National Electrical Code (NEC)
2. NFPA 780-2023 Installation of Lightning Protection Systems

D. Underwriters Laboratories (UL)

1. UL 467-2013 Grounding and Bonding Equipment

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 20-1, Approval Data:

1. Manufacturer's catalog data.

C. RSN 26 05 20-2, Approval Drawings

1. Grounding system:
   a. Wiring diagrams showing interconnection between grounding equipment.
   b. Provide layout drawings showing location of Contractor installed grounding components throughout the site. Include details of grounding system installation and locations of connections to equipment.
2. Lightning protection system:
   a. Provide plan and elevation layout drawings showing lightning protection system installation and location of lightning protection system components throughout the site. Includes details of lightning protection system installation.
   b. Provide as-built drawings
   c. Include mounting details and wiring diagrams showing interconnection between equipment.
3. Separate Bill of Materials (BOM) for both Grounding and Lightning Protection systems.
4. Government Format.

D. RSN 26 05 20-3, As-built Drawings:

1. Specification drawings indicating as-built changes made to grounding systems.

E. RSN 26 05 20-3, Test Reports.

1. Include UL Lightning Protection Certificate.

1.04 SYSTEM DESCRIPTION

A. Design grounding system for all new structures at the Regulating Tank Site:

1. Refer to Drawing 1695-D-62486 for design details.
2. Contractor shall develop final routing, terminations, and installation details to meet performance, code, and coordination requirements.

B. Design grounding system for new equipment including new metallic equipment not intended to conduct electricity as well as equipment and systems listed herein.

C. Construct and test grounding systems for new structures and new equipment including new metallic equipment not intended to conduct electricity.

D. Grounding system conductor sizes shall be in accordance with NFPA 70 unless indicated otherwise.

E. Replace and reconnect existing grounding infrastructure damaged by construction.

F. Design a lightning protection system for the Regulating Tanks meeting the requirements of NFPA 780. Lightning protection equipment shall include air terminals, main conductors, down conductors, conduit, equipment jumper conductors, ground rods, and auxiliary equipment to support connections.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ground Cable:

1. Annealed bare-copper cable:
   a. ASTM B8, Class B.
   b. Solid wires used in forming copper cable: ASTM B3.
2. Copper-clad steel cable: ASTM B228.
3. Concentric stranded.
4. Sizes:
   a. As indicated on drawings.
   b. Where not shown, minimum sizes:
      1) Ground risers and electrode conductors: 4/0 AWG.
      2) Equipment grounding conductors:
         a) Major equipment: Equal in size to electrode conductors.
         b) Minor equipment: 4 AWG.
      3) Electrode interconnecting conductors: Equal in size to electrode conductors.
5. Lightning Protection Ground System conductor sizes:

a. Minimum sizes in accordance with NFPA 780.

b. Electrode interconnecting conductors shall be equal in size to electrode conductors.

B. Ground Rods:

1. Type: Solid, copper-clad steel:

a. Bond 0.010-inch thick layer of copper inseparably to steel core.

2. Length: 10-feet.

3. Diameter: 3/4-inch, nominal.

4. In accordance with UL 467.

2.02 ACCESSORIES

A. Cable Connectors:

1. Welded or bolted solderless type.

2. Current-carrying capacity: Equal to cable with which they are used.

3. Connectors for ground cables, including fittings, lugs, bolts, nuts, and washers: Copper alloy containing not more than 4 percent zinc.

4. Bolted solderless type connectors: IEEE 837.

5. Ground connectors that will be direct buried or embedded in concrete: Listed for direct burial use in accordance with requirements of UL 467.

B. Ground Plates:

1. High-strength, high-conductivity, cast-copper alloy.

2. Four-hole type, except where indicated on drawings.

3. Suitable for concrete construction.

C. Flexible Copper Braid:

1. Flat, extra flexible, tinned, pure copper braid.

2. Un-plated, seamless, pure copper ferrules formed into a rectangular shape on each end.

3. Outdoor ampacity: Contractor to calculate minimum ampacity prior to installation.

4. Overall length: Suitable for application.

2.03 WELDING PROCESS

A. Use Cadweld, Thermoweld, or equivalent exothermic process.

B. Molds and Weld Metal:

1. Use fresh stock from same manufacturer.
2. Weld metal and starting material: No significant quantities of hazardous ingredients.

2.04 LIGHTNING PROTECTION

A. General:

1. Do not use materials that accelerate corrosion in the presence of moisture.
2. When metallic conduit is provided, electrically bond conductor to conduit or tubing at upper and lower ends by clamp type connectors or welds (including exothermic).
3. All equipment shall be copper unless otherwise noted.
4. Design and provide in accordance with NFPA 780.

B. Conductors:

1. NFPA 780.
2. Main and down conductors:
   a. Stranded Copper Conductors: 57,400 circular mils at 187 pounds per 1,000-foot minimum.
3. Secondary conductors:
   a. Secondary or Bonding Conductors: 26,240 circular mils for stranded copper minimum.

C. Air Terminals:

1. Solid air terminals with blunt tip.
2. Tubular Air Terminals: Not permitted.
3. Support air terminals more than 24 inches in length by suitable brace, supported at not less than one-half height of terminal.

D. Connections and Terminations:

1. Provide connectors for splicing conductors.
2. Conductor connections can be made by clamps or welds (including exothermic).
3. Provide style and size connectors required for installation.

E. Connectors and Fittings: Provide connector fittings for “end-to-end”, “Tee”, or “Y” splices that conform to NFPA 780.

PART 3 EXECUTION

3.01 INSTALLATION

A. Lightning protection system shall be installed by a UL-Listed Lightning Protection Installer qualified to obtain and provide a UL Master Label certification for the completed system.

B. Install in accordance with NFPA 70, IEEE C2, and this Section.

C. Make grounding connections in accordance with standard drawings 40-D-4334, 40-D-4335, and 40-D-4753; and as shown.

D. Use at least 4 AWG stranded bare copper as equipment grounding conductors.

E. Do not connect equipment grounding conductors directly to steel reinforcing bars.

F. Ground or Bond as applicable:

1. Electric motors.
2. Metal enclosures for electrical equipment.
3. Elevated steel tanks.
4. Regulating tanks.
5. Shielding and armor on insulated conductors.
6. Steel structural columns.
7. Site service yard fence.
8. Metal structures located within 200-feet of power or distribution line centerlines.

G. Service Yard Fence:

1. Ground service yard fence, gate posts, and gate frames.
2. Ground fence fabric on each side of corner post or location where fabric is not continuous.

H. Ground Rods:

1. Drive ground rods vertically until tops of rods are within 2-inches above installation location of ground cables to which rods will be connected.
2. If solid rock is encountered within 3-feet of subgrade, grout ground rod into 1 1/4-inch vertical hole such that top of rod is within 2-inches above installation location of ground cables to which rod will be connected.
3. If solid rock is encountered deeper than 3-feet below subgrade, drive ground rod to refusal at approximately 45-degree angle, then bend ground rod horizontally such that top of rod is within 2-inches above installation location of ground cables to which rod will be connected.

I. Connections:

1. Make all ground connections between equipment, miscellaneous metalwork, and ground plates whether or not such grounding connections are shown.
2. Number of grounding connections for equipment may be one, two, or more in some cases.
3. Remove paint, enamel, scale, oil, grease, or other foreign nonconductive material from point of contact on metal surfaces before making ground connections.
4. Repair damaged or removed paint or galvanizing material on metal finishes.
5. Make ground connections that are direct buried or embedded in concrete using an exothermic process and in accordance with manufacturer's instructions:
   a. In accordance with manufacturer's instructions.
   b. Inspect in accordance with pocket handbook A7D *Installers and Inspectors Guide for CADWELD® Electrical Connections* written by ERICO® Products, Inc., Cleveland, Ohio.
   c. Remove and replace rejected connections.

J. Excavate, place, and compact backfill in accordance with Sections 31 23 11 – Earthwork for Structures and 31 23 02 – Compacting Earth Materials, respectively.

K. Lightning Connections: Provide a single, continuous, low impedance path from the air terminals to buried ground rods.

1. Install and bond the lightning protection system in accordance with NFPA 780.
2. Air terminals to be bonded together with main conductor.
3. Air terminal conductor to be bonded to the main down conductors.
4. Expose conductors on structures except where conductors are required to be in protective sleeves.
5. Bond secondary conductors with grounded metallic parts within Regulating Tanks.
6. Make interconnections within side-flash distances at or below level of grounded metallic parts.
7. Coordinate with tank manufacturer and provide certification or written confirmation the tank manufacturer's warranty is maintained after air terminal and conductor installation. Refer to Section 33 16 00 – Water Storage Tanks.
8. Use adjustable base for installation of air terminals and main conductors that does not produce any roof penetrations.
9. Conceal main conductors as much as practicable.
10. Protect exposed down conductors from physical damage as required by NFPA 780.

11. Use Schedule 80 PVC to protect down conductors. Paint Schedule 80 PVC to match surrounding surface in accordance with Section 09 96 20 - Coatings.

12. Conceal down conductors within Rigid Metallic Conduit mounted to exterior tank wall. Bond the conduit to the lightning protection conductor at both the top and bottom of its run to ensure a low-resistance path for current and prevention of sideflashes.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test Resistance of Grounding System:

1. Notify COR in writing at least 3 working days in advance of time of test in order that test may be witnessed by COR.

2. Perform test no sooner than 30-days after completion of structural concrete work.

3. Measured resistance: Less than 10 ohm.

4. Use fall of potential method in accordance with section 8.2.1.5 of IEEE 81.

5. Testing device:

   a. Earth resistance tester:

      1) Heavy-duty, low-resistance type with direct-reading and direct-current ohmmeter as described in bulletin No. 25 and any one of bulletins Nos. 25J, 25J-2, and 25T, all by James G. Biddle Company; 3 point electronic Vibroground® by Associated Research, Incorporated; or equal.

      2) Capable of measuring ground resistance to an accuracy of 0.5 ohms or better.

6. Test performance:

   a. Initial distance between remote current electrode (C) and grounding system under test (X): At least six times longest diagonal dimension of grounding system.

   b. Distance between electrode C and electrode X if grounding electrode system consists of one or two ground rods: At least 100-feet or as directed by COR.

   c. Beginning at electrode X, drive potential-reference electrode (P) into ground at a number of test points on a straight line between electrode X and electrode C.

   d. Distance between test points: Approximately 5 percent of actual distance between electrodes X and C.

   e. Continuously log apparent resistance readings for each test point and plot curve of resistance versus distance to ensure that electrode C location is giving acceptable results as indicated in IEEE 81.

f. Measure and record test points until reaching electrode C or as directed by COR. If plot of resistance -vs- distance curve indicates remote current electrode is in area of influence of grounding system, increase distance between electrode C and grounding system, and measure and record new set of test data.

g. Allow 40 calendar days after receipt of grounding system resistance test reports for Government to determine location and size of any additional grounding is required.

h. Retest grounding system resistance in accordance with these paragraphs if additional grounding is added.

B. Lightning protection system testing:

1. Inspect the lightning protection system following completion of the installation and perform any testing or inspections that are recommended or required in NFPA 780.

END OF SECTION

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SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of grounding and bonding in prices offered in Price Schedules for Complete Electrical System.
   a. Includes, but not limited to the following:
      1) Electrical conduit.
      2) Fabricated sheet steel boxes.
      3) Wiring troughs.
      4) Precast handholes.
      5) Drilling and punching holes.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

1.	ANSI C80.1-2020	Electric Rigid Steel Conduit (ERSC)
2.	ANSI/SCTE 77-2017	Specification for Underground Enclosure Integrity

B. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C2-2017	National Electrical Safety Code (NESC)

C. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2014	Enclosures for Electrical Equipment (1,000 Volts Maximum)
2.	NEMA FB 1-2014	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
3.	NEMA RN-1-2018	Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
4.	NEMA TC 2-2020	Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

5. NEMA TC 3-2016 — Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

D. National Fire Protection Association, Inc. (NFPA)

1. NFPA 70-2020 — National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL)

1. UL 360-13 — Liquid-tight Flexible Steel Conduit
2. UL 6-2007 — Electrical Rigid Metal Conduit – Steel
3. UL 651-11 — Schedule 40 and 80 Rigid PVC Conduit

1.03 DESIGN REQUIREMENTS

A. Determine/verify size of junction and pull boxes, fabricated sheet steel boxes, and precast handholes in accordance with NPFA 70.

B. Determine/verify size of wiring trough in accordance with NFPA 70.

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 33-1, Approval Drawings and Data:

1. Manufacturer's drawings and catalog data.

C. RSN 26 05 33-2, As-built Drawings:

1. Marked prints of specifications drawings indicating "As-built" changes made to electrical raceways during construction.

PART 2 PRODUCTS

2.01 RACEWAYS

A. Plastic Coated Rigid Steel (PCRS):

1. Conduit conforms to ANSI C80.1, UL6 and NEMA RN-1.

B. Rigid Metal Conduit (RMC):

1. ANSI C80.1.

C. Rigid Polyvinyl Chloride Conduit (PVC):

1. Product Description: Schedule 80 PVC conduit. Conduit and elbows furnished with integral bell end.

2. Length: Manufacturer's standard 10- or 20-foot lengths.
3. Temperature Rating: Equal to or greater than temperature rating of enclosed conductors.
4. Conduit: Conform to NEMA TC 2, NFPA 70, and UL 651. Fittings and conduit bodies conform to NEMA TC 3, NFPA 70, and be UL listed.

D. Liquidtight Flexible Metal Conduit (LFMC):
1. Interlocked steel construction with PVC jacket.
2. Ultra-violet resistant.
3. Color: Black.
4. Conform to NFPA 70 and UL 360.
5. Fittings conform to NEMA FB 1.

E. Wiring Trough:
1. Material: 16-gauge or 14-gauge galvanized steel.
2. Enclosure:
   a. NEMA Type 3R in accordance with NEMA 250.
   b. Drip shield top and no knockouts.
3. Slip-on removable cover fastened with captive screws along bottom edge and provided with provisions for padlocking.
4. Embossed mounting holes on back of enclosure.
5. Finish: Manufacturer's standard grey coating inside and outside of enclosure.

2.02 OUTLET BODIES, DEVICE BOXES, JUNCTION AND PULL BOXES

A. Outlet Bodies and Fittings:
1. Material: Cast iron or malleable iron.
2. Covers: Cast or sheet metal.

B. Cast Devices Boxes: Type FD and GRF manufactured by Cooper Crouse-Hinds; or equal, having the following essential characteristics:
1. Rectangular or round, deep-wiring device outlet boxes with threaded hub connections for rigid steel conduit.
2. Material: Iron alloy.
3. Number of gangs: As required.
4. Provide plugs for unused openings.
5. Extension rings: Iron alloy with corrosion-resistant finish.

C. Boxes for Dry Wall Construction:

1. Standard galvanized sheet steel switch and outlet boxes.
2. Switch boxes:
   a. Depth: 2 1/8-inches, minimum.
   b. Number of gangs: As required.
   c. Furnish with raised device covers (plaster rings).

D. Fabricated Sheet Steel Boxes:

1. Used as junction and pull boxes.
2. Sheet steel thickness: No. 14 United States Standard gauge, minimum.
3. Boxes installed in pumping plant building to be NEMA Type 12. Boxes installed outdoors to be NEMA type 4.
4. Hinged cover with oil-resistant gasket.
5. Finish: Manufacturer's standard grey coating.
6. Conform to NEMA 250.

E. Large, Fabricated Sheet Steel, Free Standing, Type 4 Enclosures:

1. Large free-standing pull box, NEMA 250, Type 4.
2. Sheet steel: 12-gauge, minimum.
3. Seams: Continuously welded and ground smooth.
4. Coating: Polyester powder coating over phosphatized surface, inside and out, ANSI 61 gray.
5. Internal mounting channels welded horizontally to sides at top, bottom, and center.
6. Stainless-steel door clamps and heavy gauge continuous hinge with stainless-steel pin.
7. Includes lifting eyes, document pocket, and oil resistant door gasket.
8. Size in accordance with NFPA 70 or as indicated on drawings.

2.03 PRECAST PULLBOX

A. Type: Precast polymer concrete with open bottom and Tier 15 rating.

B. Cover:

1. Bolt down type with gasket and stainless-steel bolts.
2. Tier level rating embossed on the surface.
3. Electrical pull box: Embossed logo "ELECTRIC" on the surface.

4. Communication pull box: Embossed logo "OPTICAL FIBER" on surface.

C. Provide embedded pulling eyes with ratings suitable for installation. Locate pulling eyes on wall opposite each conduit entrance.

D. Conform to test provisions of ANSI/SCTE 77.

2.04 CONDUIT FITTINGS

A. Expansion-deflection Couplings:

1. Furnish for movement in any direction.
2. Watertight, raintight, concrete tight.
3. Deflection and expansion: 3/4-inch, minimum.
4. Angular misalignment: 30-degrees, minimum.

B. Watertight Conduit Hubs:

1. Myers hub manufactured by Cooper Industries, Crouse-Hinds Division, Syracuse, NY, catalog series ST-, STA- and SSTG-; catalog series HUB- and HUBG- manufactured by Appleton, Rosemont, IL; catalog series CHM- manufactured by O-Z Gedney, Rosemont, IL; or equal with the following essential characteristics:
   a. Suitable for terminating rigid steel electrical conduit through the walls of enclosures.
   b. Recessed O-ring for raintight connection.
   c. In accordance with NEMA FB-1.
   d. Galvanized malleable iron.
   e. Insulated throat.

2.05 ACCESSORIES

A. Fittings required to complete electrical conduit systems. Includes, caps, connectors, couplings, unions, nipples, reducers, elbows, pipe plugs, bondnuts, and any other fittings.

B. Devices required to fasten, clamp, attach, and support conduit in place. Includes supports and clamps complete with bolts, washers, and nuts.

C. Locknuts and Bushings:

1. Locknuts: Steel. Die cast locknuts are not acceptable.
2. Bushings: Insulated and pressure cast or malleable iron. Grounding bushing to be lay-in saddle type.

D. Conduit Riser Grips:

1. Suitable to support vertical cable runs in rigid steel conduit.

2. Single weave closed or split mesh type.

3. Mesh material: Tin-coated bronze strands.

E. Conduit Tags: Round brass or stainless-steel.

F. Polyethylene Warning Tape:

1. Type: Heavy-duty polyethylene, detectable underground warning tape.

2. Width: 6-inches.

3. Color: Red.

4. Copy: Continuously imprinted with "CAUTION BURIED ELECTRIC LINE BELOW" or equivalent wording.

5. Suitable for direct burial.

G. Thread Lubricant: Lithium, graphite, or zinc-based material designed to inhibit corrosion and to lubricate metal-to-metal joints.

H. Electrical duct seal for sealing ends of raceways.

I. Protective Sealant: Water repellant, and resistant to peeling and cracking.

J. PVC Solvent Cement: In accordance with NEMA TC 2 and conduit manufacturer's recommendations.

K. Corrosion Protection Tape:

1. ScotchrapTM 51 All-Weather Corrosion Protection Tape manufactured by 3M, St. Paul, MN, and Plymouth Plywrap 11 Vinyl Pipe Wrap manufactured by Plymouth Ruber Company, Canton, MA; or equal, having the following essential characteristics:

a. Thickness: 20 mils minimum.

b. Material: Polyvinyl chloride (PVC).

PART 3 EXECUTION

3.01 INSTALLATION

A. Conduit Type: As listed below unless shown otherwise:

1. PVC Conduit: For direct-buried conduit inside and outside the fenced pumping plant yard.

2. PVC Conduit: For conduit installed beneath concrete slab floors.

3. Rigid Metal Conduit: Exposed conduit, unless shown otherwise. Vertical risers through concrete slab floor.

B. Install as shown and in accordance with NFPA 70 and IEEE C2.

C. Determine routing of exposed, buried, and embedded conduit when not shown.

D. Determine exact location of embedded conduit stub-ups based on equipment being furnished.

E. Equipment base templates or mockups.

1. Provide for electrical equipment where conduits embedded in concrete penetrate cutouts in base or floors of enclosures.

   a. Fabricated using approved project specific equipment manufacturer's drawings as a guide.

   b. Examples of equipment: metal-clad switchgear, motor control equipment, switchboards, motor control centers, and floor mounted enclosures.

2. Use to demonstrate proper alignment of conduit prior to concrete placement.

3. Do not modify equipment enclosures to permit entry of misaligned conduit.

F. Bends:

1. Make smooth, gradual bends to permit pulling insulated conductors without undue stress or damage to conductors or conduit.

2. Ensure bends are free from kinks, indentations, or flattened surfaces.

3. Make metal conduit bends onsite with radii in accordance with NFPA 70.

4. Bend conduit cold to prevent damage to protective coating.

G. Remove burrs and sharp corners at ends of metal conduit.

H. Coat male threads of rigid metal conduit joints with suitable graphite or zinc sealing material before making joints.

I. Tighten conduit joints securely to ensure electrical continuity and to prevent entrance of moisture or foreign material.

J. Install with necessary fittings and supports.

K. Make transitions from PVC conduit to RMC with suitable fittings designed for application.

L. Tighten conduit to electrical equipment mounted on tubular metal structures securely and support rigidly in place by conduit clamps, hex head nuts, and threaded 3/8-inch stud fasteners driven by powder-actuated tools.

M. Install expansion couplings where exposed or embedded conduits cross expansion or contraction joints. Install expansion couplings and expansion-deflection couplings in accordance with manufacturer's instructions.

N. Exposed Conduit Runs:

1. Straight and parallel with each other and with centerlines of room or structure.
2. Support conduit rigidly in place and in accordance with NFPA 70. Do not weld conduit to conduit supports or structural steel.

O. Conduit Beneath Concrete Slab Floors:

1. Transition horizontal runs of PVC conduit to rigid metal conduit before making 90-degree bends using appropriate conduit fitting.
2. Make 90-degree bend with rigid metal conduit and extend vertically through concrete slab floor. Ensure conduit risers are vertically plumb.
3. Wrap rigid metal conduit with anti-corrosion tape from transition coupling to at least 6-inches above concrete slab floor.
4. Apply manufacturer's recommended pipe primer to rigid metal conduit before wrapping with corrosion tape.
5. Apply anti-corrosion tape in accordance with manufacturer's instructions and recommendations.
6. Make adequate provisions to protect anti-corrosion tape wrap from physical damage during backfill operations.

P. Conduit Embedded in Concrete:

1. Conduit to be rigid steel (RMC) type.
2. Conduit not to displace more than 3 percent of gross area of cross-section of slab (Calculate cross sectional area as 12-inches times slab thickness).
3. Conduit outside diameter to be no larger than 1/3 of overall thickness of slab in which they are embedded.
4. Conduit to be spaced at least 3 diameters or widths on center.
5. Conduit to occupy middle third of cross-sectional depth of slab in which they are embedded, where possible.
6. Protect ends of conduit with coupling and plug to prevent entrance of concrete, sand, or other foreign material.
7. Tie conduit from reinforcing bars or otherwise support to prevent sagging while concrete is being placed.
8. Conduit stub-ups:
    a. Minimum length above finished floor: 4-inches, not including coupling.
    b. Terminate conduit with coupling and plug until ready to connect remaining conduit sections. Replace plug with bushing or Chase-type nipple before installing insulated conductors.
    c. Approximately 1-foot of horizontal embedded conduit and entire vertical stub-up to be plastic-coated rigid steel conduit.

9. Seal conduit boxes with rubber gasketed blank cover. Clean concrete from inside of conduit boxes immediately after forms are removed.

10. Swab conduit within 24-hours after removal of forms with clean dry rags until conduit is thoroughly cleaned and dried.

11. Terminate ends of conduit that do not terminate at boxes with couplings and pipe plugs or insulating bushings and caps.

Q. Direct-Buried Conduit:

1. Depth: 24-inches, minimum unless shown otherwise.

2. Install 2-inches of sand around conduit.

3. Install detectable warning tape 18-inches above buried conduit.

4. Backfill and compact trench in accordance with Section 31 23 22 – Pipe Trench Earthwork.

R. Liquid tight Flexible Metal Conduit:

1. Use flexible conduit for connections to equipment that is subject to vibration, where flexibility is required, or where shown.

2. Maximum length of a flexible conduit section is not to exceed 24-inches.

S. Hand Holes:

1. Install in locations shown and in accordance with manufacturer's instructions and recommendations.

2. Place a minimum of 6-inches of pea gravel or crushed rock in bottom of excavation before installing hand hole.

3. Install such that top of hand hole is at finished grade level.

4. Backfill and compact around hand hole in accordance with Section 31 23 11 – Earthwork for Structures and as directed by COR.

T. Conduit Terminations:

1. Make conduit terminations to indoor boxes, cabinets, and panel boards in accordance with standard drawings.

2. Make conduit terminations to outdoor boxes with watertight conduit hubs. Use of locknuts, bushings, or bushed nipples at outdoor conduit terminations is not acceptable.

3. Install bushings or Chase-type nipples on ends of conduit to protect insulation of insulated conductors from abrasion.

4. Install locknuts and bond nuts to provide tight ground connections between conduit and boxes, panel boards, and cabinets.

5. Make terminations of conduit beneath substation switchgear, motor control equipment, motor control centers, and floor mounted cabinets with grounding

bushings. Connect grounding bushing to equipment ground bus with a 4 AWG bare-copper conductor.

6. Seal ends of conduit terminations with electrical duct seal to prevent air circulation and entrance of vermin through conduits into boxes, panel boards, or cabinets. Install duct seal to a minimum depth of 1-inch.

U. Conduit Tags:

1. Provide metal conduit tags for conduit terminations.
2. Stamp or engrave tag with conduit number as shown on "As-Built" cable and conduit schedule.
3. Permanently attach tag to conduit with wire and metal crimp-type connector.

END OF SECTION

SECTION 26 05 90
WIRING CHECKOUT AND TESTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for Complete Electrical System.

1.02 DEFINITIONS

A. Qualified Person: In accordance with Article 100 of NFPA 70.

1.03 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA)

1. NFPA 70-14 National Electrical Code (NEC)

1.04 QUALIFICATIONS

A. Testing Personnel:

1. Competent and qualified persons to perform wiring checkout, operational and functional testing and make revisions to drawings.
2. Have thorough knowledge of the electrical equipment, installation, and drawings.
3. Qualified to operate equipment being tested.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Tests:

1. Demonstrate proper interaction between equipment through cabling interconnections and verify these interconnections are accurately documented.
2. In addition to tests required by Section 26 05 10 – Conductors and Cables.

B. Furnish materials, including test instruments, required for checkout and testing.

C. Make wiring changes and drawing revisions to ensure there are no discrepancies between check prints, and internal equipment wiring and external cabling.

D. Replace defective equipment and make device setting adjustments as required for operation of electrical systems in accordance with this section and manufacturer's instructions.

E. If required during testing, remove and replace wire connections.

F. Make wiring changes, wire tag revisions, and other repairs or revisions during the testing session the discrepancy is discovered.

G. Perform wiring checkout, and operational and functional tests in presence of COR.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Notify COR in writing, 10 working days in advance of each testing session.

B. Provide the following at time wiring checkouts and tests are performed:

1. Two complete sets of full-size (D-size) electrical schematic and wiring diagram check prints for equipment being tested:

   a. One set to be used and maintained by COR.

   b. One set to be maintained by Contractor and used to produce final drawings.

C. Perform wiring checkout and tests in accordance with the following.

1. Wiring checkout:

   a. Use electrical schematic and wiring diagram check prints to perform internal wiring inspection of factory wired equipment. A detailed wire-by-wire verification of pre-wired assemblies is not required to be performed in the field unless errors are noted during the equipment inspection.

   b. Use electrical schematic and wiring diagram check prints to perform wiring check of external cabling.

   c. Perform a complete wire-by-wire, terminal-by-terminal (point-to-point) check of interconnected circuits.

   d. Verify agreement with approved wiring diagrams. Revise to reflect circuit logic corrections made during checkout.

   e. Verify agreement with approved schematic diagrams. Revise to reflect circuit logic corrections made during checkout.

   f. Verify continuity of wiring.

   g. Verify proper wire tagging at ends of interconnecting conductors and cables.

h. Check conductors for insulation damage. Perform additional insulation resistance test of damaged conductors.

i. Field verify custom cabinet wiring.

2. Operational and functional testing:

a. Perform after completion of wiring checkout of equipment being tested.

b. If required, adjust and calibrate protective devices in accordance with specifications, and manufacturer's instructions and recommendations.

c. Check electrical systems and controls for proper sequence of operation, correct adjustments and settings, and agreement with schematic diagram.

END OF SECTION

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SECTION 26 24 41
DISTRIBUTION PANELBOARDS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for Complete Electrical System.

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2023	Enclosures for Electrical Equipment (1,000 Volts Maximum)
2.	NEMA PB 1-2011	Panelboards

B. National Fire Protection Association (NFPA)

1.	NFPA 70-2023	National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL)

1.	UL 67-18(2024)	Panelboards
2.	UL 489-16(2019)	Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals and Section 01 33 26 - Electrical Drawings and Data.

B. RSN 26 24 41-1, Approval Data:

1. Manufacturer's Technical Data.

C. RSN 26 24 41-2, Approval Layouts:

1. Equipment Layout Drawing.

D. RSN 26 24 41-3, Test Data.

1.04 REGULATORY REQUIREMENTS

A. UL listed and labeled.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle and store equipment in accordance with manufacturer's instructions. Include copy of these instructions with equipment at time of shipment.

PART 2 PRODUCTS

2.01 240/120 VOLT DISTRIBUTION PANELBOARD

A. Voltage and System: 240/120 volts, Single-phase, 3-wire, 60-hertz.

B. Input Type: Main Circuit Breaker: 100 amperes.

C. Main Bus Rating: 100-amperes, minimum.

D. Enclosure Type: In accordance with NEMA 250 Type 4X with hinged door.

E. Solid neutral bus.

F. Bus Material: Copper.

G. Mounting: Unistrut.

H. Accessories:

1. Ground bus:
   a. Copper.
   b. Sufficient length for attaching equipment ground conductors.
2. Circuit directory:
   a. Show breaker number and connected load as shown on drawings.
   b. Provide panelboard schedule on drawings unless as-built conditions require directory to be revised.
   c. Use computer generated lettering in capital letter for directory entries.
   d. Directory to provide the following information:
      1) Panel name.
      2) AIC Rating.
      3) Feeding circuit number and panel name.
      4) Volts, Amps, Phase, Wire, and Date printed.

I. Nameplate:

1. As indicated on standard drawing 40-D-6234.
2. Provide nameplate for each Panelboard.

3. Engraving:

   a. "S01B01-PNL-001".

4. Provide nameplates for each circuit breaker within panelboard sections. Information to identify load served as indicated on associated as-built panelboard schedules.

J. Conform to NEMA PB-1, UL 67, and NFPA 70.

K. Finish: Manufacturer's standard Grey finish for intended installation location.

2.02 MOLDED CASE CIRCUIT BREAKER

A. Thermal-magnetic type with inverse-time trip characteristics on overload and instantaneous trip on short circuit.

B. Voltage: 240/120 volts, as required.

C. Single or multi-pole as indicated on panelboard schedules.

D. Frequency: 60-hertz.

E. Interrupting Rating: 14,000 symmetrical RMS amperes, minimum.

F. Arc quenchers.

G. Quick-make and quick-break toggle mechanisms.

H. Trip-free operating handle.

I. Circuit breakers shall be lockable where required by other systems. A lockable breaker is accomplished by using circuit breaker lock that is listed for use with circuit breaker and that allows breaker to trip but does not allow tampering with breaker.

J. Single operating handle. Use of handle ties on multiple-pole circuit breakers is not acceptable.

K. Equip with padlock attachments for locking breakers in "OFF" position.

L. Conform to UL 489.

2.03 SURGE PROTECTION DEVICE (SPD)

A. Utilize metal oxide varistors (MOV).

B. Maximum Continuous Operating Voltage (MCOV): Not less than 115 percent of nominal system voltage.

C. Protection Modes: Line to neutral (L-N), line to ground (L-G), and neutral to ground (N-G).

D. Suppressed Voltage Rating (SVR): Not to exceed 800 volts for L-N, L-G, and N-G modes.

E. LED indicators to show loss of protection and status of TVSS.

F. Conform to NFPA 70, UL 1449, and be UL listed.

2.04 FABRICATION

A. Mount ground bus at bottom of panelboard enclosure. Bond bus to enclosure.

B. Mount circuit directory on inside of door.

C. Provide spare circuit breakers as shown.

D. Cover blank spaces with removable covers.

E. Circuit Directory:

1. Use computer generated lettering for directory entries. Handwritten directory entries are not acceptable.
2. Show breaker number and connected load as indicated in their relative physical location.
3. Provide panelboard schedule on drawings unless as-built conditions require directory to be revised.
4. Mount directory in transparent plastic front on inside surface of access doors for each board.
5. Fabricate circuit directory frame such that directory need not be folded when placed in frame, and such that all information on directory is clearly visible and legible.
6. Directory to provide the following information:
   a. Panel name.
   b. AIC Rating.
   c. Supply circuit number and panel name.
   d. Volts, Amps, Phase, Wire, and Date printed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide anchoring, supporting, and mounting materials for a complete installation.

B. Install in accordance with manufacturer's instructions and recommendations.

C. Panelboard shall be mounted so that no operating handle is less than 24-inches or more than 72-inches above finished floor.

D. Set panelboard plumb and level.

E. Make conduit and wiring connections.

F. Provide required safety labels.

G. Provide engraved nameplate on panelboard.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Enclosure keys for lockable panelboards shall be shown to operate in presence of government representative.

B. Provide test equipment, labor, and personnel as required to perform the following tests. Panelboards shall be given continuity and insulation tests after installation has been completed and before panelboard is energized:

1. Continuity tests using dc device with buzzer.
2. Insulation test using 500-volt minimum insulation-resistance test set:
   a. Record readings after 1-minute and until readings are constant for 15-seconds. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.
3. Record test data and include identification of panelboard and megohms readings.

END OF SECTION

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SECTION 26 27 10
METER SOCKET

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered in Price Schedules for Complete Electrical System.

1.02 REFERENCE STANDARDS

A. American National Standard Institute (ANSI)

1. ANSI C12.7-2014 — Requirements for Watthour Meter Sockets

B. National Electrical Manufacturers' Association (NEMA)

1. NEMA 250-2020 — Enclosures for Electrical Equipment (1,000 V Maximum)

C. National Fire Protection Association (NFPA)

1. NFPA 70-2023 — National Electrical Code (NEC)

D. Underwriters Laboratories, Inc (UL)

1. UL 489-2016 — Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

1.03 SUBMITTALS

A. In accordance with Sections 01 33 00 - Submittals and 01 33 26 - Electrical Drawings and Data.

B. RSN 26 27 10-1, Approval Drawings and Data:

1. Layout drawings.
2. Manufacturer's technical data.

1.04 DESIGN REQUIREMENTS

A. Meter-Main: Meet the requirements of local utility.

B. Main Circuit Breaker:

1. Mounted in meter-main enclosure.
2. Molded case.

3. Size: In accordance with NFPA 70.

PART 2 PRODUCTS

2.01 METER SOCKET

A. System: 1-phase, 3-wire.

B. Location: Contractor to coordinate with utility.

C. Voltage Rating: 300 V.

D. Nominal Voltage: 120/240 V.

E. Current Rating: 100A, minimum.

F. Enclosure: NEMA 250, Type 4X.

G. Provided with instrument transformers, jaws, and sealing ring as required by local utility.

H. One self-contained socket and main circuit breaker.

I. Conform to the requirements of local utility, ANSI C12.7, and be UL (Underwriters Laboratories) listed.

2.02 MOLDED CASE CIRCUIT BREAKER

A. Type: Thermal-magnetic.

B. Voltage: 120/240 volts.

C. Amps/Poles: 100A, two-pole.

D. Automatic: Inverse-time trip characteristics on overload and instantaneous trip on short circuit with an interrupting rating of 10kA symmetrical RMS amperes, minimum.

E. Arc quenchers.

F. Quick-make and quick-break toggle mechanisms.

G. Operating Handle:

1. Trip-free.
2. Single operating handle. Handle ties on multiple-pole circuit breakers are not acceptable.
3. Meet OSHA Lock-out/Tag Out requirements. Padlockable in “OFF” position.

H. Conform to UL 489 and be UL listed.

2.03 SERVICE ENTRANCE

A. Underground.

B. Voltage Rating: 120/240 V.

C. Ratings: 100 Amperes.

D. Disconnect switch:

1. Conform to applicable standards and code.
2. Coordinate appropriate ratings and type for provided utility service.
3. Strut-mounted adjacent to pole mounted meter.
4. Fused.
5. Enclosure: NEMA 250, Type 4X.

2.04 ELECTRICAL EQUIPMENT

A. Furnish all cables, conduits, terminations, and accessories required for interconnecting the equipment included in this section.

2.05 FINISHES

A. Manufacturer's standard finish appropriate for installed location.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.

B. Items anticipated to be furnished and installed by local utility prior to the Notice to Proceed:

1. Distribution power transformer.
2. Revenue meter.
3. Cables between power transformer and meter-main.

C. Make cable and conduit connections on load side of meter socket.

D. Coordinate with local utility to ensure utility requirements and standards are met.

E. Ground and bond in accordance with Section 26 05 20 – Grounding and Bonding and NFPA 70.

END OF SECTION

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SECTION 26 42 00
CATHODIC PROTECTION SYSTEMS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cathodic Protection and Corrosion Monitoring Systems for Reach 2:

1. Payment: Lump sum price offered in Price Schedule 1.

B. Cathodic Protection and Corrosion Monitoring Systems for Reach 3:

1. Payment: Lump sum prices offered in Price Schedule 2.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM B3-13(2024)	Soft or Annealed Copper Wire
2.	ASTM B843-18(2025)	Magnesium Alloy Anodes for Cathodic Protection
3.	ASTM C33/C33M-24A	Concrete Aggregate

B. Bureau of Reclamation (USBR)

1.	USBR M-47	Guide to Concrete Repair, Second Edition available at: https://www.usbr.gov/tsc/techreferences/mands/mands-pdfs/Guide2ConcreteRepair2015_Final.pdf

C. Association for Materials Protection and Performance (AMPP)

1.	NACE/ASTM G193-2022	Standard Terminology and Acronyms Relating to Corrosion
2.	NACE SP0169-2024	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
3.	NACE SP0196-2020	Galvanic Anode Cathodic Protection of Internal Submerged Surfaces of Steel Water Storage Tanks
4.	NACE TM0497-2022	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems

5.	NACE CP3-2008	Cathodic Protection Technologist Course Manual
6.	NACE/Lewis, T.H.-00	Deep Anode Systems: Design, Installation, and Operation

D. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2020	Enclosures for Electrical Equipment (1,000Volts Maximum)

1.03 DEFINITIONS

A. Bonded Dielectric Coating:

1. Protective barrier coating system with high electrical resistivity bonded directly to underlying structure, acting to physically and electrically isolate metallic structure from electrolyte.

B. Cathodic Protection:

1. Galvanic Anode Cathodic Protection:
   a. Reduction of corrosion of metal in electrolyte by galvanically coupling to more anodic metal:
      1) Also referred to as Sacrificial Protection.
2. Impressed Current Cathodic Protection:
   a. Reduction of corrosion of electrolytes by supplying DC current through external power source and employing impressed current anode.

C. Electrolyte: Electrically conductive solution, such as soil or water:

1. Terms for specific conductive solutions may be substituted for "electrolyte" in these definitions:
   a. Conductive solutions include:
      1) Water.
      2) Soil.

D. Reference Electrode: Electrode whose open circuit potential is constant under similar conditions of measurement; used for measuring relative potential of other electrodes (e.g., protected structures):

1. Sometimes referred to as reference half-cell.
2. Copper/Copper Sulfate Reference Electrode (CSE) is often used.

E. Structure-to-Electrolyte Potential, (structure-to-soil and structure-to-water potentials):

1. Potential of structure in electrolyte as compared to potential of reference electrode contacting same electrolyte.

2. Static Structure-to-Electrolyte Potential: Structure-to-electrolyte potential determined without any external current:
   a. (e.g., prior to energizing cathodic protection system, and with no galvanic couple, pH cell, interference currents, or like present) or,
   b. After such a current source has been disconnected for an extended time.
   c. Also referred to as native structure-to-electrolyte potential.
3. Uncorrected Structure-to-Electrolyte Potential: Structure-to-electrolyte potential determined with cathodic protection system energized and cathodic protection current flowing:
   a. Also referred to as Protective Potential (ON Potential) and may contain significant IR drop error.
4. Polarized Structure-to-Electrolyte Potential: Structure-to-electrolyte potential determined after cathodic protection system has been energized, but immediately after cathodic protection current is interrupted:
   a. Also referred to as "instant off" structure-to-electrolyte potential.
5. Polarization: Change from static or native potential as result of current flow across electrode/electrolyte interface:
   a. Also considered difference between polarized and native potentials.

1.04 QUALIFICATIONS

A. Cathodic Protection Specialist: Certified by Association for Materials Protection and Performance (AMPP), formerly known as NACE International.

1.05 SYSTEM DESCRIPTION

A. Provide Corrosion Monitoring Systems for the following features:
   1. Metallic pipe, fittings, and associated metalwork.
   2. Non-metallic pipe fittings and associated metalwork.
   3. Casings.
   4. Yard pipe and associated metalwork.

B. In accordance with Section 26 42 11 – Buried Galvanic Anode Cathodic Protection

C. In accordance with Section 26 42 12 – Buried Impressed Current Cathodic Protection

D. In accordance with Section 26 42 15 –Galvanic Anode Cathodic Protection for Welded Steel Tanks

1.06 QUALITY

A. Installation and testing conducted by or under the direction of Cathodic Protection Specialist. Other qualified individuals may assist installation and testing personnel.

B. Manufacturer's Standards: Comply with manufacturer's recommendations and standards unless otherwise specified.

C. Materials, Installation, and Testing:

1. Consistent with sound corrosion engineering principles and practices in accordance with NACE TM0497, NACE SP0169, NACE SP0196, NACE SP0100, NACE CP3, and NACE/Lewis.

1.07 SYSTEM PERFORMANCE

A. Provide corrosion-engineering services to furnish, install, and test corrosion monitoring and/or cathodic protection systems:

1. Include electrical continuity bonds, test stations, isolation joint flange kits, and accessory equipment and features as directed in this specification or otherwise indicated.

B. Corrosion Monitoring Systems shall have the capacity to:

1. Provide minimum service-life of 20-years for all components.

C. Cathodic Protection Systems:

1. Provide minimum service-life of 20-years for all components and system as determined by final data.
2. Maintain on all locations of protected metallic structures, with reference to copper/copper sulfate electrode placed in contact with electrolyte close to structure:
   a. Polarized structure-to-electrolyte potential of -0.850 volts or more negative.
   b. Alternately, at discretion of Government, -0.100 volts of polarization if the -0.850 volt criterion cannot be obtained due to extenuating circumstances (e.g., on bare or poorly coated structures).
   c. Polarized potential at any point on dielectrically coated structure not more negative than -1.100 volts.

1.08 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 26 42 00-1, Certification and Data:

1. Copy of Cathodic Protection Specialists' AMPP certification for personnel performing or directing installation and testing of corrosion monitoring system(s).
2. Manufacturer's Data:
   a. Test station.
   b. Anode Junction Box.
   c. Metallurgical bonding system.
   d. Dielectric coating system for bonds.
   e. Cables.
   f. Cable identification labeling system.
   g. Isolation Joint Flange Kit (IJFK).

PART 2 PRODUCTS

2.01 CABLES

A. Conform to ASTM B3.

B. Manufactured not more than 24-months prior to notice to proceed.

C. Single-Conductor: Stranded, plain, annealed copper cable.

D. Cable Insulation:
   1. Rated for 600-volts and direct immersion or burial.
   2. High Molecular Weight Polyethylene (HMWPE) outer jacket with minimum thickness of 0.100-inch:
      a. Black, unless otherwise noted.

E. Suitable lengths to permit installation from terminus to terminus (e.g., structure-to-test station or structure-to-structure) free of splices and without stress, unless otherwise specified.

Table 26 42 00A – Cable Gauge

Gauge (AWG), or larger:	Use for	Additional Notes
No. 14	Permanent Ref Electrodes	Yellow Insulation (if available)
No. 12	Structure cable	Black Insulation
No. 12	Galvanic Anodes	Black Insulation
No. 12	Casing structure cables	Orange insulation (if available)
No. 12	Foreign pipe test cables	Blue or white insulation (if available)
No. 6	Foreign pipe structure cables	Blue or white insulation (if available)
No. 6	Structure cable in foreign test station (for bond purposes)	Black Insulation

No. 6	Electrical Continuity Joint Bonds (Jumper) on non-metallic pipe	Black Insulation
No. 2	Electrical Continuity Joint Bonds (Jumper) on metallic pipe	Black Insulation

2.02 BONDS

A. Electrical Continuity Joint Bonds:

1. Insulate copper cable in accordance with cable requirements in Article 2.01, Cables.
2. Size of bond specified in Table 26 42 00A – Cable Gauge.

B. Metallurgical Bonds:

1. Exothermic Metallurgical Bonds:
   a. Exothermic metallurgical bond system manufactured by ThermOweld, 6100 S. Yale Ave., STE 1110, Tulsa, OK 74136; or equal, having the following essential characteristics:
      1) Designed for:
         a) Cathodic protection or monitoring systems.
         b) Metallic substrate material.
         c) Bond orientation.
      2) Exothermic reaction produces molten copper, which produces permanent, high conductivity connection.
      3) Uses special alloy to provide minimum heat effect on substrate material.
      4) Current carrying capacity equal or better than that of conductor.

2.03 DIELECTRIC COATING FOR BONDS

A. Dielectric Material: Ci thermOcap® PC, manufactured ThermOweld, 6100 S. Yale Ave., STE 1110, Tulsa, OK 74136; or equal, having the following essential characteristics:

1. Specifically designed for cathodic protection systems.
2. Applied with primer coat, as needed.
3. Approved dielectric coating material.
4. Suitable for intended environment.
5. Cover exposed weld nugget, exposed cable, or structure metal.

B. Refer to Section 09 96 20 – Coatings.

2.04 TEST STATION ENCLOSURE

A. Refer to Drawing(s) 1695-D-62493 and 1695-D-62494 for details.

B. Test Stations: TESTOX Series 100 or Series 700, manufactured by Gerome Electric Supply Co., 336 E. Main St., Uniontown, PA 15401; or equal, having the following essential characteristics:

1. Pipe-mounted, above-ground type.
2. Cast aluminum enclosure.
3. Specifically constructed for cathodic protection system installations and intended environment.
4. Protected as required for permanency.
5. Secured to pipe with setscrew or threaded.
6. Enough terminals, including associated hardware for number and size of cables and required accessories: Minimum 5 terminals.
7. Equip with 0.01-ohm calibrated shunt for each anode such that current output of each anode can be determined.
8. Equip with variable resistors for each anode (if necessary) such that the current output of each anode can be adjusted.

C. Test station cables in accordance with cable requirements of this Section.

2.05 ANODE JUNCTION BOX

A. Refer to Drawing(s) 1695-D-62494 for details.

B. Enclosed within a NEMA 250, Type 3-R, lockable cabinet constructed of No. 16-gauge or thicker galvanized steel or fiberglass, weatherproof, lockable, and vented for heat dissipation.

1. Specifically constructed for cathodic protection system installations.
2. Equip with 0.01-ohm calibrated shunt for each anode such that current output of each anode can be determined.
3. Equip with variable resistors of adequate electrical rating for each anode such that current flow of each anode can be adjusted as required within 125 percent of one another, without overheating variable resistor.
4. Protected as required for permanency.
5. Enough terminals (5 terminals minimum) with associated hardware for number and size of cables.
6. Engraved 1/4-inch minimum NEMA Grade C phenolic panel.
7. Solderless, pressure-type terminals.

8. Identified terminals.

9. Equip with combination bracket for pole or wall mounting.

C. Anode junction box cables in accordance with cable requirements of this Section.

2.06 TEST STATION PIPE AND BOLLARDS

A. Steel Pipe:

1. In accordance with Section 05 50 00 – Metal Fabrications:

   a. Pipe size indicated on drawing(s).

B. Painting:

1. Test station support post coated or galvanized in accordance with Section 09 96 20 – Coatings.

2. Protective post coated in accordance with Section 09 96 20 – Coatings.

C. Concrete:

1. In accordance with applicable requirements of Section 03 30 00 – Cast-in-Place Concrete.

2.07 PERMANENT REFERENCE ELECTRODE

A. Copper/Copper Sulfate permanent reference electrode: IonX40, manufactured by M.C. Miller Co., 11640 US Highway 1, Sebastian, FL, 32958; or equal, having the following essential characteristics:

1. Zero leakage of half-cell filling solution into the soil.

2. Zero contamination of electrode by electrolyte.

3. Electrode cable in accordance with cable requirements of this Section.

4. Minimum 20-year design life:

   a. No. 14 AWG stranded copper cable with yellow (if available) HMWPE insulation of suitable length to extend from reference electrode location to junction box without splicing.

2.08 SAND BACKFILL

A. ASTM C33, fine aggregate.

2.09 WARNING TAPE

A. Polyethylene warning tape for anode cables:

1. Minimum 3-inches wide.

2. Red or yellow with black lettering.

3. Suitable for direct burial.
4. Print full length of tape with the following:

"Caution –Cathodic Protection Cable Buried Below"

2.10 ISOLATION JOINT FLANGE KIT (IJFK)

A. Isolation kit manufactured by GPT Industries, 4990 Iris Street, Wheat Ridge, CO 80033; or equal, with the following essential characteristics:
   1. Consist of an isolating gasket, bolt sleeve, and one or more isolating washer.
   2. Sized for turnout pipe diameter in accordance with Drawings 1695-D-62496.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Installation and testing shall be performed or directed by Cathodic Protection Specialist certified by AMPP.

B. Installation details indicated on drawing(s).

C. Electrical isolation:
   1. All structures to be cathodically protected shall be electrically isolated from other extraneous metal (e.g., casings, foreign structures, and rebar in concrete).

D. Dielectric materials, other than non-metallic carrier pipe, that might cause shielding of cathodic protection current (e.g., plastic debris) shall not be left in excavation with structure.

E. Cable:
   1. Inspect for insulation defects prior to backfilling.
      a. Replace the cable if insulation is damaged.
   2. Install without kinks, stresses, and/or splices.
   3. Buried applications:
      a. Horizontal segments:
         1) For all horizontal segments of cable (long segments of jumper bonds or cables) the following requirements must be met in accordance with drawing(s) and Section 31 23 02 – Compacting Earth Materials:
            a) Minimum burial depth: 30-inches.
               i. Minimum burial depth in agricultural fields: 42-inches.

b) Surround cable with minimum 6-inches of sand backfill.

c) Place warning tape approximately 12-inches above cable for entire length of cable segments.

b. Run cable through rigid galvanized conduit, test station pipe, or similar protection once cable emerges from ground.

4. Connect to test station, anode junction box, and rectifier with crimped, ring-tongue connectors.

5. Identify the origin of cables terminating in an enclosure:

a. Cable identification as to the distinct originating structure or anode in accordance with drawing(s).

b. Printed letters on shrinkable labels attached to cables clearly visible within enclosure.

c. Encase printed labels in clear heat shrink tubing.

F. Structure Cables:

1. Cable information for each test station type and anode junction box shown on drawing(s).

a. Two cables per structure at each test station and anode junction box.

2. Connect cables and jumper bonds to structures by exothermic metallurgical bond as shown on drawing(s):

a. Make exothermic metallurgical bonds in accordance with bonding supply manufacturer's instructions.

b. Bonds shall not damage linings inside pipes or fittings.

c. Test metallurgical bond integrity by striking side of weld nugget with 16-ounce hammer, in presence of OGR.

d. Coat bare copper, weld nugget, and ferrous materials at metallurgical bonds with approved dielectric metallurgical bond coating.

e. Allow dielectric material to cure before repair of damaged structure coating or lining:

1) Repair dielectric coatings/linings in accordance with Section 09 96 20 – Coatings

2) Repair mortar/concrete coating and lining in accordance with USBR M-47.

G. Electrical Continuity Joint (Jumper) Bonds:

1. Provide metallurgical bonds at mechanical type joints (e.g., non-welded joints) between ferrous parts to be included in cathodic protection system as indicated in this section or as necessary to ensure electrical continuity.

2. Minimum number and size of bond cables per bond joint for long metallic pipe sections is shown in material table on drawing(s).
3. Minimum of two cables per bond joint for fittings on non-metallic pipe.
4. Bond cable installed with sufficient slack to prevent stress or tugging.
    a. Allow for minimum 1/2-inch of joint movement.
5. Jumper Bond Locations:
    a. Between non-welded ferrous pipe sections and ferrous pipe and fittings.
    b. Between stargrips and fittings for non-metallic pipe.
    c. Between pipe installed under this contract and pipe installed by others: specifically:
        1) Between Reach 2 and Frank Chee Willetto Reservoir – Outlet Works at the tie-in vault.
        2) Between Reach 2 and existing Reach 1 pipelines at three locations if Reach 2 line pipe is metallic at the crossing.

H. Test Stations:
1. Locations:
    a. Each end of pipeline.
    b. Foreign pipeline crossings.
    c. Upstream side of metallic casings.
    d. Locations requiring galvanic anodes such as metallic fittings and structures on non-metallic pipe.
    e. Locate the test stations and junction boxes to make them readily accessible.
    f. Do not locate test stations inside agricultural fields.
    g. Where test stations will not likely be damaged or interfere with personnel and/or equipment (e.g., adjacent to above ground structures). Exact location is subject to approval of OGR.
    h. As close to each current carrying structure connection as possible.
2. Details for each type of test station are shown in drawing(s).
3. Permanently, uniquely, and clearly identify each test station with station number. Hand lettering inside of test station cap with a permanent marker is acceptable.
4. Terminate cables for given location within the same test station enclosure.
5. Contain two cables, at minimum:
    a. Specific cable information for each test station type is shown on drawing(s).

6. Protect test stations using steel Bollards in accordance with drawing(s):
    a. Secure test station support pipe to steel Bollard with metal straps or pipe clamps.

I. Pipeline Casings:
1. Metallic pipe shall be electrically isolated from casing using non-metallic spacers and non-metallic sleeves when necessary.
2. Test station or anode junction box on upstream side shall include two cables from casing (if metallic), two cables from pipe (if metallic), and one cable from each anode required for casing and pipe:
    a. Anode junction box details are shown on drawing(s).
    b. Anode cables connected through individual 0.01-ohm calibrated shunts in test station or anode junction box (one per anode).
    c. Variable resistor for each anode (as necessary).
3. Anodes are not required on casing if casing is non-metallic.
4. Anodes are not required on carrier pipe if carrier pipe is non-metallic.
5. Anodes are not required on carrier pipe if protected by an impressed current cathodic protection system at said location.

J. Foreign Pipeline Crossings:
1. Test station and installation shall be in accordance with this section and drawing(s):
    a. Obtain permission from the foreign pipe owner 30-days prior to attaching cables on foreign line.
    b. Cables shall be attached to foreign pipeline by pipeline owner or by Contractor at discretion of foreign line owner.
2. Permanent reference electrode installed in accordance with manufacturer's instructions.
3. Test stations are only required if both Reclamation line and foreign line are metallic, and an impressed current system is installed on one or both pipes.

K. Isolation Joint Flange Kits (IJFK):
1. Locations:
    a. Specifically located:
        1) At the N.A.P.I turnout between the pipeline and blind flange.
            a) To isolate the future turnout pipe from the transmission line.
2. Install isolation joint flange kit in accordance with Drawing 1695-D-62496:

a. Test each bolt and flange to ensure isolation is satisfactory.

3.02 INSTALLATION OF GALVANIC ANODE CATHODIC PROTECTION SYSTEMS

A. In accordance with Sections 26 42 11 – Buried Galvanic Anode Cathodic Protection, 26 42 15 – Galvanic Anode Cathodic Protection for Welded Steel Tanks.

3.03 INSTALLATION OF IMPRESSED CURRENT CATHODIC PROTECTION SYSTEMS

A. In accordance with Section 26 42 12 – Buried Impressed Current Cathodic Protection.

3.04 FIELD TESTING

A. Include energizing, adjusting, and testing corrosion monitoring and cathodic protection systems.

B. Perform testing in presence of OGR.

C. Inform OGR of date, time, and tests to be performed at a minimum of 5 working days prior to testing.

D. Testing equipment:

1. Portable Voltmeter:

a. Minimum input impedance of 10-megohms and capable of measuring DC voltages between plus or minus 0.1-millivolt to ±100-volts.

b. Portable $Cu/CuSO_4$ reference electrode.

E. Verify each test station, anode junction box, and rectifier are properly labeled.

F. Testing shall include the following:

1. Record and report all readings with final test data submittal.

2. Verify electrical continuity.

3. Verify isolation at locations where IJFK's were installed.

a. Check isolation flanges before backfilling to ensure adequate electrical isolation using appropriate equipment.

b. Check isolation flanges after backfilling to ensure adequate electrical isolation using appropriate equipment.

4. Native structure-to-electrolyte potentials at all test stations and anode junction boxes.

G. Buried galvanic anode cathodic protection system:

1. Conduct testing in 2 testing cycles, minimum:

a. First Testing Cycle:

1) Prior to energizing system:

a) Test structure electrical continuity.

b) Test station and anode junction box integrity:

i. Determine voltage difference between cables within each test station and anode junction box enclosure.

c) Measure static structure-to-soil potentials of the buried metalwork:

i. At each individual test station and anode junction box location.

ii. Place portable reference electrode as close to buried metalwork as possible for structure-to-soil potential measurements.

iii. Ground shall be saturated with water to reduce reference cell contact resistance.

d) Measure static anode-to-soil potentials of galvanic anodes:

i. At each individual test station and anode junction box location.

ii. Ground shall be saturated with water to reduce reference cell contact resistance.

2) After energizing the system:

a) Determine protective (uncorrected) and polarized structure-to-soil potentials in accordance with capacity requirements of this Section:

i. At each individual test station and anode junction box location.

ii. Place portable reference electrode as close to buried metalwork as possible for structure-to-soil potential measurements.

iii. Saturate ground with water to reduce reference cell contact resistance.

b) Determine current output of each individual anode in test stations and anode junction boxes.

c) Adjust variable resistor settings for each anode to obtain the required balance of current output.

d) Determination of rectifier outputs in volts and amperes and associated tap settings.

b. Second and Subsequent Testing Cycles:

1) Time between testing cycles shall be 30- to 60-days.

2) Cathodic protection system shall not be adjusted between testing cycles.

3) Repeat testing required after energizing system during first testing cycle.

4) If testing cycle data indicates that cathodic protection system requires adjustment to meet specifications requirements, adjust cathodic protection system and conduct subsequent testing cycles within 30- to 60-days window.

2. Buried impressed current cathodic protection system: Conduct testing in 2 testing cycles, minimum:

a. First Testing Cycle:

1) Prior to energizing system:

a) Test structure electrical continuity.

b) Test station integrity:

i. Determine voltage difference between cables within each test station enclosure.

c) Measure static structure-to-soil potentials of the buried metalwork:

i. At each individual test station location.

ii. Place portable reference electrode as close to buried metalwork as possible for structure-to-soil potential measurements.

iii. Ground shall be saturated with water to reduce reference cell contact resistance.

d) Test for cathodic interference:

i. The area is known to have potential AC and DC cathodic interference issues.

ii. Notify foreign pipeline owner and OGR 30-days prior to interference testing to interrupt energized cathodic protection systems.

iii. Approved mitigation methods shall be followed prior to subsequent testing cycles.

2) After energizing the system(s):

a) Determine protective (uncorrected) and polarized structure-to-soil potentials in accordance with capacity requirements of this Section:

i. At each individual test station location.

ii. Place portable reference electrode as close to buried metalwork as possible for structure-to-soil potential measurements.

iii. Saturate ground with water to reduce reference cell contact resistance.

b) Determine current output of each individual anode in anode junction boxes.

c) Adjust variable resistor settings for each anode to obtain the required balance of current output.

d) Determination of rectifier outputs in volts and amperes and associated tap settings.

e) Test for cathodic interference:

i. The area is known to have potential AC and DC cathodic interference issues.

ii. Notify foreign pipeline owner and OGR 30-days prior to interference testing in order to interrupt energized cathodic protection systems.

iii. Approved mitigation methods shall be followed prior to subsequent testing cycles.

b. Second and Subsequent Testing Cycles:

1) Time between testing cycles shall be 30- to 60-days.

2) Cathodic protection system shall not be adjusted between testing cycles.

3) Repeat testing required after energizing system during first testing cycle.

4) If testing cycle data indicates that cathodic protection system requires adjustment to meet specifications requirements, adjust cathodic protection system and conduct subsequent testing cycles within 30- to 60-days window.

c. In absence of permanent power, generators shall be utilized:

1) Energizing impressed current system shall only be required for the period necessary to show proper operation to verify system will polarize structure:

a) Rectifier output.

b) Current output of anodes.

c) Change in potential of structure at corrosion monitoring test station nearest to anode bed.

2) Each anode bed can be tested separately or multiples at a time, as may be required near areas of interference.

3) Test stations at locations where interference was determined, or probable shall be tested after energizing the system.

4) Testing shall be completed in its entirety for galvanic anode systems installed.

H. Submerged galvanic anode cathodic protection system:

1. Conduct testing in 2 testing cycles, minimum:

a. First Testing Cycle:

1) Prior to energizing the system:

a) Automatic anode current controller integrity:

i. Determine voltage difference between structure cables.

b) Measure potential difference between permanent copper/copper sulfate reference electrodes and portable copper/copper sulfate reference electrodes:

i. Potential: 0.00 plus or minus 5 mV.

c) Measure potential difference between permanent copper/copper sulfate reference electrodes in each tank:

i. Potential: 0.00 plus or minus 5 mV.

d) Measure static structure-to-water potentials with each permanent reference electrode.

2) After energizing the system:

3) Determination of protective (uncorrected) and polarized structure-to-water potentials in accordance with capacity requirements of this Section:

a) Measure potentials with each permanent reference electrode.

4) Adjust auto-potential controller if necessary.

b. Second and Subsequent Testing Cycles:

1) Time between testing cycles shall be 30- to 60-days.

2) Cathodic protection system shall not be adjusted between testing cycles.

3) Repeat testing required after energizing the system during the first testing cycle.

4) If testing cycle data indicates cathodic protection system requires adjustment to meet requirements, adjust cathodic protection system and conduct subsequent testing cycles within 30- to 60-days.

I. Troubleshoot and correct any problems determined by OGR.

J. Submit final data after the last testing cycle when performance criteria have been met and no further adjustments are needed.

K. After reviewing submittal, Government may require additional testing and re-submittal to determine if corrosion monitoring system conforms to specification requirements.

END OF SECTION

SECTION 26 42 11
BURIED GALVANIC ANODE CATHODIC PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Buried Galvanic Anode Cathodic Protection for Reach 2:

1. Payment: Lump sum price offered in Price Schedule 1.

B. Buried Galvanic Anode Cathodic Protection for Reach 3:

1. Payment: Lump sum prices offered in Price Schedule 2.

1.02 REFERENCE STANDARDS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.03 DEFINITIONS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.04 QUALIFICATIONS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.05 SYSTEM DESCRIPTION

A. Provide Galvanic Anode Cathodic Protection Systems for the following features:

1. Sections of isolated metallic pipe, fittings, and associated metalwork.
2. Non-metallic pipe fittings and associated metalwork.
3. Casings.

1.06 QUALITY

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.07 SYSTEM PERFORMANCE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.08 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 26 42 11-1, Certification and Data:

1. Copy of Cathodic Protection Specialists' AMPP certification for personnel performing or directing installation and testing of cathodic protection systems.
2. Manufacturer's data if applicable, including catalog data sheets when available, including but not limited to:
    a. Galvanic anodes.
    b. Cables (submitted under RSN 26 42 00-1)
    c. Cable identification labeling system (submitted under RSN 26 42 00-1).
    d. Shunts.
    e. Variable Resistors.
    f. Pipeline casing end seals.
    g. Cable trench backfill material.
    h. Warning tape.
3. Preliminary drawings, including:
    a. Proposed location of test stations and anode junction boxes.
    b. Proposed location of galvanic anode beds.

C. RSN 26 42 11-2, Final Data:

1. Information and data including:
    a. Include data for all continuity, isolation, and cathodic protection required for the project.
    b. Test equipment and methods utilized.
    c. Placement of reference electrode during each test, if required.
    d. Tests results.
    e. Photos.
2. As-built and Final Drawings:
    a. Provide as-built and final installation drawings in accordance with Section 01 78 30 – Project Record Documents:
        1) Final anode and/or anode beds locations and connection details.
        2) Electrical continuity bonds and Isolation details.
        3) Locations of test stations, junction boxes, and cable runs:
            a) Locations shall be given using unique identifier and GPS coordinates.
            b) Location shall include type of test station and junction box per drawing(s).

4) List of anode cable identifications in test stations and anode junction boxes, as applicable.

PART 2 PRODUCTS

2.01 CABLES

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.02 GALVANIC ANODES

A. 20D2 or larger UltraMag High Potential Magnesium Anode manufactured by Farwest Corrosion Control Co., 480 Artesia Blvd., Gardena CA, 90248; or equal, with the following essential characteristics:

1. Twenty (20) pounds magnesium anode material per anode, minimum.
2. High potential magnesium anode material specifically designed for cathodic protection systems and intended environment.
3. Anode material meeting or exceeding requirements of ASTM B843 and having minimum potential of -1.700 volts referenced to copper/copper sulfate reference electrode (CSE).
4. Contains mild steel core extending essentially entire length of anode. Center mild steel core within anode material and exposed on one end of anode for factory made anode-to-cable connection.

B. Factory anode-to-cable connection, exposed mild steel core, and exposed copper cable potted in epoxy.

C. Silver-solder connection between anode cable and mild steel core.

D. Anode Cable: In accordance with cable requirements above.

2.03 SAND BACKFILL

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.04 TEST STATION ENCLOSURE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.05 ANODE JUNCTION BOX

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.06 TEST STATION PIPE AND BOLLARDS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.07 WARNING TAPE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

PART 3 EXECUTION

3.01 GENERAL

A. In accordance with Section 26 42 00 – Cathodic Protection System.

B. Installation and testing shall be performed or directed by a Cathodic Protection Specialist certified by AMPP.

C. Dielectric materials that might cause shielding of cathodic protection current (e.g., plastic debris) shall not be left in excavation with structure.

D. Electrically isolate all structures to be cathodically protected or electrically continuous for future cathodic protection, from other extraneous metal (e.g., casings, foreign structures, and rebar in concrete).

3.02 INSTALLATION OF GALVANIC ANODE CATHODIC PROTECTION SYSTEMS

A. Installation details indicated on Drawing(s) 1695-D-62494 and 1695-D-62496.

B. Cable:

1. In accordance with Section 26 42 00 – Cathodic Protection Systems, Article 3.01 E.

C. Structure Cables:

1. In accordance with Section 26 42 00 – Cathodic Protection Systems, Article 3.01 F.

D. Electrical Continuity Joint (Jumper) Bonds:

1. In accordance with Section 26 42 00 – Cathodic Protection Systems, Article 3.01 G.
2. Bond all metalwork within 100-feet.

E. Test Stations:

1. In accordance with Section 26 42 00 – Cathodic Protection Systems, Article 3.01 H.

F. Anode Junction Box:

1. In accordance with Section 26 42 00 – Cathodic Protection Systems, Article 3.01 I.

G. Galvanic Anodes:

1. Install horizontally or vertically as follows and as directed by OGR:

   a. Location:

      1) Metallic casings and metallic fittings or structures on non-metallic pipeline.

      2) Minimum 25-feet from nearest part of structures to be protected.

      3) Minimum 10-feet between anodes (center-to-center).

      4) Minimum 1 anode length from non-metallic piping.

      5) Bond all metalwork within 100-feet.

      6) Install a minimum of one anode on metallic fittings and structures.

      7) Install a minimum of three anodes on long isolated lengths of metallic pipe.

      8) Install a minimum of six anodes on metallic casings.

   b. Depth:

      1) At or below invert of pipe fitting,

      2) Minimum of 8-feet below final grade.

2. Remove outer water-resistant covering on pre-packaged anodes before installation, taking care not to damage wettable covering containing backfill and magnesium.

3. At no time shall anodes be supported by their cables.

4. Do not wet pre-packaged anodes until in the ground, surrounded with compacted earth, and covered by at least 1-foot of compacted backfill.

5. Do not connect anodes to structures at test stations or anode junction boxes, energizing systems only at time of testing.

6. Connect individual galvanic anodes to structures through individual calibrated 0.01-ohm shunts within test station or junction box for current measurement.

7. Where multiple anodes are involved, a calibrated shunt shall be included for each individual anode.

8. Connect individual anodes to structure through variable resistors within test station or junction box to allow for equalizing current from individual anodes (if necessary).

H. Pipeline Casings:

1. In accordance with Section 26 42 00 – Cathodic Protection Systems, Article 3.01 I.

3.03 FIELD TESTING

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

END OF SECTION

SECTION 26 42 12
BURIED IMPRESSED CURRENT CATHODIC PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Buried Impressed Current Cathodic Protection for Reach 2:

1. Payment: Lump sum price offered in Price Schedule 1.

B. Buried Impressed Current Cathodic Protection for Reach 3:

1. Payment: Lump sum prices offered in Price Schedule 2.

1.02 REFERENCE STANDARDS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.03 DEFINITIONS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.04 QUALIFICATIONS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.05 SYSTEM DESCRIPTION

A. Provide Impressed Current Cathodic Protection Systems for the following features:

1. Reach 2 metallic pipe, fittings, and other associated metalwork, which is electrically continuous.
2. Reach 3 metallic pipe, fittings, and other associated metalwork, which is electrically continuous.

1.06 QUALITY

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.07 SYSTEM PERFORMANCE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.08 SUBMITTALS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

B. RSN 26 42 12-1, Certification and Data:

1. Copy of the Cathodic Protection Specialists' AMPP certification for personnel performing or directing installation and testing of cathodic protection systems.
2. Manufacturer's data including catalog data sheets when available, including but not limited to:
    a. Impressed current anodes.
    b. Rectifier.
    c. Anode junction box.
    d. Cables (submitted under 26 42 00-1).
    e. Cable identification labeling system (submitted under 26 42 00-1).Metallurgical bonding system (submitted under 26 42 00-1).
    f. Dielectric coating system for bonds (submitted under 26 42 00-1).
    g. Shunts.
    h. Variable resistors.
    i. Electrical conduit.
    j. Anode bed backfill materials:
        1) Carbonaceous backfill material (coke breeze).
        2) Sealing backfill material.
        3) Sand.
        4) Pea gravel.
        5) Other backfill materials.
    k. Vent pipe
    l. Air valve (if necessary)
    m. Casing for anode bed (if necessary)
    n. Anode centering device.
3. Provide certifications that ground bed components, materials, and drilling fluids/additives to be used are non-polluting and safe for potable water applications.
4. Preconstruction drawings:
    a. Proposed location of test station(s).
    b. Proposed location of rectifier(s) and anode beds.

C. RSN 26 42 12-2, Groundwater Mitigation Method:

1. Plan to mitigate any risk of groundwater contamination during installation and operation of the system.

D. RSN 26 42 12-3, Interference Mitigation Method:

1. Proposed mitigation method for cathodic interference submitted for approval by foreign pipeline or powerline owner and Reclamation.

E. RSN 26 42 12-4, Preliminary Data:

1. Pilot hole drill log and associated soil resistivity data.
2. Proposed detailed configuration of anode ground beds:
   a. Anode vertical spacing.
   b. Ground bed resistance.
   c. Individual anode and column discharge current densities.
   d. Potential gradients for step and touch.

F. RSN 26 42 12-5, Final Data:

1. Information and data including:
   a. Include data for all continuity, isolation, and cathodic protection required for the project.
   b. Test equipment and methods utilized.
   c. Placement of reference electrode during each test, if required.
   d. Tests results.
   e. Photos.
2. As-built and Final Drawings:
   a. Provide as-built and final installation drawings in accordance with Section 01 78 30 – Project Record Documents:
      1) Electrical continuity bonds and isolation details.
      2) Locations of test stations, anode junction boxes, rectifiers, anode beds, conduits, and cable runs:
         a) Locations shall be given using unique identifier and GPS coordinates.
         b) Location shall include type of test station, anode junction box, rectifier, and conduit per drawing(s).
      3) List of anode cable identifications in test stations, junction boxes, controllers, and rectifiers, as applicable.

PART 2 PRODUCTS

2.01 CABLES

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.02 BONDS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.03 DIELECTRIC COATING FOR BONDS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.04 ELECTRICAL CONDUIT

A. Schedule 80 PVC conduit and fittings sized for the number and size of for deep well anode cables.

B. Schedule 80 PVC conduit and fittings sized for four #2 AWG or larger bond cables for bonding Reach 2 (upstream side of San Juan Lateral Water Treatment Plant Regulating Tank Site) to Reach 3 (downstream side of San Juan Lateral Water Treatment Plant Regulating Tank Site).

2.05 IMPRESSED CURRENT ANODES

A. Anodes: LIDA MMO Tubular Anodes as supplied by MESA Products, 4445 S 74th E Ave, Tulsa, OK 74145, or equal , with the following essential characteristics:

1. Number of anode beds, anodes per bed, and anode dimensions specified on Drawing(s) 1695-D-62495.
2. Mixed metal oxide conductive coating material specifically designed for cathodic protection systems and intended environment.
3. Low resistance cable connection with waterproof seal for anode-to-cable connection.

B. Anode Cables:

1. In accordance with cable requirements above and as shown on Drawing(s) 1695-D-62495.
2. Anode cable insulation: Dual insulation construction, inner layer of Halar or Kynar and outer layer of high molecular weight polyethylene.

2.06 TEST STATION ENCLOSURE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.07 ANODE JUNCTION BOX

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

B. Refer to drawing(s).

2.08 RECTIFIER(S)

A. Voltage and amperage requirements are specified in materials table on Drawing(s) 1695-D-62495.

B. Constant voltage type.

C. Air cooled.

D. Capable of continuous operation at 120 percent of rated output in ambient temperature of 50 degrees C.

E. Fitted with heavy-duty transformer.

F. Silicon diode type.

G. Fitted with individual meters for determining output voltage and current, and which are:

1. Accurate within 2 percent of full scale.
2. Marked with red lines designating rated capacities.

H. Output voltage is adjustable in 20 or more equal increments or continuously from 0 to 100 percent rated output.

I. Energized by 115/230-volts, single phase set for $115V_{AC}$.

J. Equipped with AC and DC lightning arrestors and protective fuses or relays.

K. Equipped with solderless, pressure-type terminals for anode and cathode cables.

L. NEMA 250 type 3-R, weatherproof, lockable, vented for heat dissipation cabinet constructed of No. 16-gauge or thicker galvanized steel.

M. Equipped with a single slide out rack for easy access to internal components during maintenance. Rack shall slide out front of cabinet.

N. Equipped with accessible shunt on front panel for determining current output. Stamp shunt with amperage per millivolt rating.

O. Equipped with 115-volts AC convenience outlet.

P. Fitted with combination bracket for wall or pole mounting.

Q. Screened against entry of bees, hornets, or wasps.

R. External circuit breaker preceding and mounted on same pole as rectifier with shut-off switch and lockout/tagout capability.

2.09 DEEP WELL VENT PIPE

A. Deep Anode Venting System Pipe: AllVent, manufactured by Loresco® International, 421 J.M. Tatum Industrial Park drive, Hattiesburg, MS, 39401; or equal, having the following essential characteristics:

1. Nominal 1-inch inside diameter.
2. Vent pipe shall be slotted within coke backfill column and non-slotted outside limits of coke backfill column. Slots shall conform to either of the following requirements while maintaining maximum pipe strength:
   a. Vertical slits 1.5-inches in length with width of 0.006-inches parallel to longitudinal centerline of pipe. Center-to-center spacing of 6-inches placed 1-inch in circumferential distance from preceding slot, allowing for 360-degree venting ability.
   b. 1/8-inch holes drilled on 6-inch centers in area of anodes for plastic vent pipe. Do not drill holes in vent pipe above anodes.

2.10 DEEP WELL ANODE BED BACKFILL MATERIALS

A. Impressed Current Anode Backfill

1. Coke Backfill:
   a. Use SC3 calcined fluid petroleum coke as manufactured by Loresco® Inc., 421 J.M. Tatum Industrial Park drive, Hattiesburg, MS, 39401; or equal, having the following essential characteristics:
   b. Typical Chemical Analysis:

Component	Percent Composition
Carbon (fixed)	99.35 minimum
Ash	0.6 maximum
Volatiles	0 (950 degrees C)
Moisture	0.05

   c. Particle Analysis: Dust free with maximum particle size of 1-mm.
   d. Maximum resistivity of 50 ohm-cm.

B. Sand Backfill:

1. ASTM C33, fine aggregate.

C. Pea Gravel:

1. 1/8- to 3/8-inch smooth (no rough edges) pea gravel.

D. Sealing Material:

1. PermaPlug Environmental Deep Anodes Seal as manufactured by Loresco® Inc., 421 J.M. Tatum Industrial Park drive, Hattiesburg, MS, 39401; or equal, having the following essential characteristics:
    a. Manufactured for cathodic protection.
    b. Provides a permanent non-porous molding clay seal.
    c. Manufactured from naturally occurring Bentonite with no additional chemicals.
    d. Environmentally accepted for use near potable water.

2.11 PERMANENT REFERENCE ELECTRODE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.12 AIR VALVE

A. Air Bleed Valve: VAB1 manufactured by DripWorks, 190 Sanhedrin Circle, Willits, CA 95490; or equal, having the following essential characteristics:
    1. 1-inch diameter pipe size.
    2. Pressure controlled air bleeder valve.
        a. Opens when pressure drops below 5 psi.
    3. Maximum operating pressure no less than 80 psi.

2.13 WARNING TAPE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

PART 3 EXECUTION

3.01 GENERAL

A. In accordance with Section 26 42 00 – Cathodic Protection System.

B. Installation and testing shall be performed or directed by a Cathodic Protection Specialist certified by AMPP.

C. Dielectric materials that might cause shielding of cathodic protection current (e.g., plastic debris) shall not be left in excavation with structure.

D. Electrically isolate all structures to be cathodically protected or electrically continuous for future cathodic protection, from other extraneous metal (e.g., casings, foreign structures, and rebar in concrete).

3.02 INSTALLATION OF IMPRESSED CURRENT CATHODIC PROTECTION SYSTEMS

A. Installation details indicated on Drawing(s) 1695-D-62493 to 1695-D-62496:

1. Anode bed location subject to approval of OGR.

B. Rectifier:

1. Mount rectifier, field circuit breaker, anode junction box, and electrical usage meter (as required) on power pole or pole imbedded in concrete footing and located as indicated on drawing(s).
2. Rectifier and field circuit breaker shall meet governing electrical codes to include sufficient grounding.
3. Ground rectifier on AC side in accordance with local electrical codes.

C. Anode Junction Box:

1. Mount directly under rectifier.
2. Terminate cables through anode junction box:
   a. Connect individual anodes through individual calibrated shunts within junction box for current measurements.
   b. Connect individual anodes to structure through variable resistors within junction box to allow for equalizing current output from individual anodes.
3. Single cable from anodes and single cable from structures shall be installed for connection from junction box to rectifier terminals.
4. Identify originating anodes and structures connected to terminals on both cables and panel.

D. Test Station:

1. Installed in accordance with drawing(s) and Section 26 42 00 – Cathodic Protection Systems.
2. Locations:
   a. Approximately every 1,200-feet along an electrically continuous segment of pipeline.
3. Permanently, uniquely, and clearly identify each test station.
4. Terminate all cables for a given location within the same test station enclosure. Identify all cables as to the distinct originating structure.

E. Deep Well Anode Bed:

1. Meet all Federal, State, and local regulations including permitting, licensing, and installation requirements.

2. Seal against entry of foreign materials and fluids, and prevent groundwater contamination and inter-aquifer exchange of groundwater:
    a. Seal top of anode ground bed with permanent non-porous molding-clay seal backfill material to prevent groundwater contamination due to flooding and runoff.
    b. Minimum depth: As required, no less than 20-feet.
3. Use of potable water or chlorinated fresh water is recommended for drilling purposes:
    a. Drilling muds or additives: Certified as free of any potential pollutants.
    b. Drilling fluids, additives, sealants, and materials used: Designated for potable water use and be NSF/ANSI 60 certified where applicable.
4. Casing:
    a. Use where required by applicable regulations or to prevent groundwater contamination, inter-aquifer exchange, or collapsing of hole:
        1) Do not extend into the bottom 50-feet of the deep well (discharge zone).
        2) Grouted such as to fill the annulus between casing and soil.
5. Discharge zone: Placement of the active discharge column in an aquifer is not permitted.
6. Cap or securely cover wells during work stoppages.
7. Minimize or mitigate hazardous step and touch potentials created by the anode ground beds and rectifiers to a safe level for humans and animals.

F. Drill a smaller pilot hole to confirm suitability of deep well anode bed site. Hole may then be widened as needed:
1. Log soil resistivity every 25-feet to ensure suitability for deep well anode bed site.
2. Utilize casing in locations where drill hole is collapsing and where required by applicable regulations:
    a. Casing must not extend into bottom 50-feet of deep well.
    b. Casing must be grouted to fill annulus between casing and soil.
    c. If an aquifer is encountered while drilling, modify depth or location of ground bed as necessary to avoid placing aquifer within current discharge zone:
        1) Appropriate nonconductive casing and annular sealing is required to properly seal aquifer and avoid the potential for groundwater contamination.
    d. Perforation of multiple aquifers is not permitted.

G. Number of anodes per bed, anode spacing, approximate locations of anode beds, length and depth of beds is shown drawing(s).

H. Each anode cable: Continuous (without splices) from anode-to-anode junction box and be permanently identified as to the location of originating anode.

I. Install anodes vertically in 8-inch diameter bed as indicated on drawing(s):

1. Anodes:

a. Fitted with centralizers to maintain orientation of anode in center of drill hole:

1) Lowered into drill hole using rope.

a) At no time shall anodes be supported by their cables.

2) Equally spaced length of anode bed.

J. Anode cables: Installed in PVC conduit from sand backfill to rectifier as shown on drawing(s).

K. Install nonmetallic vent pipe from bottom of deep anode bed to rectifier installation as shown on drawing(s):

1. Vent pipe is buried, except at rectifier installation where it:

a. Terminated above ground, protected, goose necked, and fitted with perforated cap.

b. Terminate vent pipe close to, but not directly beneath rectifier.

2. Install goose necked portion of pipe such that it can be removed for manually introducing water into deep anode ground bed with a 3/4-inch garden hose.

3. Slot vent pipe within coke backfill column:

a. Non-slotted vent pipe outside limits of coke backfill column.

4. Install vent pipe in hole with first anode:

a. Cap top of vent pipe throughout anode and coke backfill installation procedure to prevent intrusion of foreign material.

b. Cap bottom of vent pipe.

5. Do not allow drilling mud to enter vent pipe.

L. Introduce coke backfill material into the bottom of the drill hole and by pumping action fill drill hole in manner to prevent bridging and completely encasing anodes:

1. Either presoaked metallurgical coke breeze or calcined petroleum coke.

2. Coke backfill column, as a minimum, shall extend 5 feet below lower most anode and 10-feet above uppermost anode see drawing(s).

3. Pump coke from bottom of hole up using pipe the length of anode hole:

a. Do not use vent pipe to pump coke.

b. Raise pipe as anode column is filled with coke.

4. Allow coke backfill to settle as recommended by coke backfill manufacturer.

5. After settlement period, determine the level of coke backfill column and if required, add additional coke backfill to drill hole.

M. Place 5-foot (minimum) sand backfill on top of coke backfill, then backfill with 50-feet (minimum) of smooth (no rough edges) pea gravel:

1. Introduce into well bore in manner to prevent bridging and damage to anode cables.

N. Surface sealing:

1. Properly seal top of anode ground bed with permanent non-porous molding-clay seal backfill material to prevent groundwater contamination due to flooding and runoff:

a. Minimum depth: As required and no less than 20-feet.

O. Do not attach main anode cable or structure cable to rectifier or energize rectifier:

1. Energize system only at time of testing.

3.03 FIELD TESTING

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

END OF SECTION

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SECTION 26 42 15

GALVANIC ANODE CATHODIC PROTECTION FOR WELDED STEEL TANKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Galvanic Anode Cathodic Protection for Welded Steel Tanks for Reach 3:

1. Payment: Lump sum prices offered in Price Schedule 2, for San Juan Lateral Water Treatment Plant Regulating Tanks.

1.02 REFERENCE STANDARDS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.03 DEFINITIONS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.04 QUALIFICATIONS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.05 SYSTEM DESCRIPTION

A. Provide Galvanic Anode Cathodic Protection Systems for the following features:

1. Welded tank interior:

a. San Juan Lateral Water Treatment Plant Regulating Tanks

1.06 QUALITY

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.07 SYSTEM PERFORMANCE

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

1.08 SUBMITTALS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

B. Submit in accordance with Section 01 33 00 – Submittals.

C. RSN 26 42 15-1, Certification and Data:

1. Copy of Cathodic Protection Specialists' AMPP certification for personnel performing or directing installation and testing of cathodic protection systems.
2. Manufacturer's data including catalog data sheets when available, including but not limited to:
    a. Galvanic anodes.
    b. Metallurgical bonding system (submitted under RSN 26 42 00-1).
    c. Mechanical bonding system (splice kits).
    d. Dielectric coating system for bonds (submitted under RSN 26 42 00-1).
    e. Cables (submitted under 26 42 00-1).
    f. Cable identification labeling system (submitted under RSN 26 42 00-1).
    g. Automatic anode current controller.
        1) Permanent reference electrodes (Copper/Copper-Sulfate).
    h. Conduit.
3. Preliminary drawings, including:
    a. Proposed location of anodes, permanent reference electrodes, automatic anode current controller, and conduit.
    b. Proposed anode and automatic anode current controller installation details.
    c. Proposed method for attachment of permanent reference electrodes to interior tank wall and floor.

D. RSN 26 42 15-2, Final Data:

1. Information and data including:
    a. Include data for all continuity and cathodic protection required for the project.
    b. Test equipment and methods utilized.
    c. Placement of reference electrode during each test, if required.
    d. Tests results.
    e. Photos on cathodic protection system installation.
2. As-built and Final Drawings:
    a. Provide as-built and final installation drawings in accordance with Section 01 78 30 – Project Record Documents:
        1) Final anode locations and connection details.
        2) Locations of controller and cable runs:
            a) Locations shall be given using unique identifier and GPS coordinates.

b) Location shall include type of controller and conduit per Drawing(s) 1695-D-62497.

3) List of anode cable identifications in controller, as applicable.

PART 2 PRODUCTS

2.01 CABLES

A. In accordance with Section RSN 26 42 00 – Cathodic Protection Systems.

2.02 BONDS

A. In accordance with Section RSN 26 42 00 – Cathodic Protection Systems.

2.03 SPLICE KITS

A. Wye Resin Splice Kit: Scotchcast™ Wye Resin Splicing Kits – 82-B1, manufactured by 3M, 2501 Hudson Rd, Maplewood, MN 55144; or equal, having the following essential characteristics:

1. Insulates and moisture seals wye splices, non-shielded cables through 5 kV.
2. Kit contains a snap-together mold body which fits around the splice:
   a. Mold large enough to encapsulate split bolt connector.
3. Epoxy electrical insulating resin in a Unipak™ container.
4. Suitable for immersion.

2.04 DIELECTRIC COATING FOR BONDS

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

2.05 ELECTRICAL CONDUIT

A. Galvanized conduit for anodes, permanent reference electrode cables, and solar power cable.

1. Sized for number and diameter of cables.

2.06 GALVANIC ANODES

A. Extruded rod UltraMag high potential magnesium anode, manufactured by Farwest Corrosion Control Company, 12029 Regentview Avenue, Downey, CA 90241; or equal, with the following essential characteristics:

1. High potential magnesium anode material specifically designed for cathodic protection systems and intended environment.

2. Magnesium rod anode material length and diameter specified for above-ground welded storage tanks on Drawing(s) 1695-D-62497.
3. Anode material meeting or exceeding requirements of ASTM B843 and having minimum potential of -1.7 volts referenced to copper/copper sulfate reference electrode (CSE).
4. Contains mild steel core extending essentially entire length of anode. Center mild steel core within anode material and exposed on one end of anode for factory made anode-to-cable connection.
5. Factory anode-to-cable connection, exposed mild steel core, and exposed copper cable potted in epoxy.
6. Silver-solder connection between anode cable and mild steel core.
7. Anode Cable: In accordance with cable requirements above.

2.07 AUTOMATIC ANODE CURRENT CONTROLLER

A. Magnesium anode current controller (MACC3), manufactured by Cathtect USA, 1627 US Hwy 1, Suite 213, Sebastian, FL 32958; or equal, with the following essential characteristics:

1. Automatic potential control set range, adjustable from -0.7 to -1.5 V.
2. IR-Free cathodic protection readings.
3. No external AC power required:
   a. Uses sacrificial anodes for power,
   b. Solar generated power, or
   c. Battery pack with minimum 10-year life.
4. Non-metallic enclosure, NEMA 3R, NEMA 4X, or equal.
5. Minimum of 3 permanent reference electrodes.
6. Mounting pole in accordance with Section 26 42 00 – Cathodic Protection Systems – Test Station Pipe and Bollards.

B. Copper/Copper Sulfate permanent reference electrode for use in freshwater service: STAPERM Model CU-2-FW, manufactured by GMC Electrical, Incorporated, 280 N. Smith Ave, Corona CA 92880; or equal, having the following characteristics:

1. Rugged 1-inch plastic housing.
2. ±5 mV with 3.0 micro-amp load.
3. Minimum 20-year design life:
4. Electrode cable in accordance with cable requirements of Specification Section 26 42 00 Article 2.01 and drawing(s).
   a. Suitable length to extend from reference electrode location to junction box without splicing.

PART 3 EXECUTION

3.01 INSTALLATION OF GALVANIC ANODE CATHODIC PROTECTION SYSTEMS FOR TANKS

A. Installation details indicated on Drawing(s) 1695-D-62496 and 1695-D-62497.

B. Installation and testing shall be performed or directed by a Cathodic Protection Specialist certified by AMPP.

C. Above-Ground Storage Tank(s):

1. Install anodes vertically in above-ground storage tanks as described in drawing(s).
2. Anode Cables:
   a. Inspect for insulation defects prior to after installation:
      1) Cables: Replaced if insulation is damaged.
      2) OGR shall approve and inspect necessary splices prior to installation.
      3) Install without kinks or stresses.
   b. Do not support array anodes by their cables. Use coated stainless steel wire ropes as described in drawings.
   c. Run anode cables to roof of tanks and out single port to auto-potential controller.
   d. Run cables through a galvanized conduit outside of tank to auto-potential controller.
   e. Protect cables from damage inside tanks.
   f. Connect anode cable(s) to controller terminals in accordance with manufacturer's instructions.
   g. Do not connect anodes to structures at automatic anode current controller, energizing systems only at time of testing.
   h. Identify origin of cables terminating in an enclosure:
      1) Cable identification as to the distinct anode in accordance with drawing(s).
      2) Printed letters on shrinkable label attached to cables clearly visible within enclosure.
      3) Encase printed labels in clear heat shrink tubing.
3. Structure Cables:
   a. Two cables from tank near the auto-potential controller.
   b. Connect cables to structures by exothermic metallurgical bond as shown in drawing(s).

1) Exothermic metallurgical bond in accordance with bonding supply manufacturer's instructions.

2) Bonds shall not damage tank linings.

a) Repair dielectric coatings/linings in accordance with Section 09 96 20 – Coatings.

4. Permanent Copper/Copper Sulfate Reference Electrodes:

a. Install three permanent reference electrodes in each tank:

1) Install two reference electrodes on tank walls placed on opposite sides of tank at different elevations.

2) Install one reference electrodes on tank floor near the center of the tank.

b. Protect reference electrode cables from damage inside tanks.

c. Run reference electrode cables to roof of tanks and out single port with anode cables to auto-potential controller.

5. Auto-Potential Controllers:

a. Location:

1) Mounted on steel post 1-foot from tank ring wall.

2) Minimum 4-feet from ground level.

3.02 WELDING

A. Weld anode anchors to tank wall as shown in Drawing(s) 1695-D-62497 and in accordance with Section 26 42 00 – Cathodic Protection Systems and AWS welding code.

3.03 FIELD TESTING

A. In accordance with Section 26 42 00 – Cathodic Protection Systems.

END OF SECTION

SECTION 31 02 10
WATER FOR DUST ABATEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Water for Dust Abatement Reach 2:

1. Measurement: Volume of water applied for dust abatement as directed by OGR:
   a. Only water used for dust abatement as directed by OGR will be included.
   b. Quantity will be measured by calibrated water meter approved by OGR.
2. Payment: M (1,000) gallons prices offered in Price Schedule 1.

B. Water for Dust Abatement Reach 3:

1. Measurement: Volume of water applied for dust abatement as directed by OGR:
   a. Only water used for dust abatement as directed by OGR will be included.
   b. Quantity will be measured by calibrated water meter approved by OGR.
2. Payment: M (1,000) gallons prices offered in Price Schedule 2.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 02 10-1, Meter Calibration.

PART 2 PRODUCTS

2.01 WATER

A. Required for application.

PART 3 EXECUTION

3.01 APPLYING WATER FOR DUST ABATEMENT

A. Furnish calibrated water meter for use in measuring water usage.

B. Provide water in accordance with Section 01 51 00 – Temporary Utilities.

C. Provide means of conveying water to point of use and applying water.

D. Install water meter at source.

E. Use pressure spray or distributor bar to apply water evenly.

F. Do not use water for dust abatement on temporary equipment roads, completed backfill areas, and other construction activities unless directed by OGR.

G. Apply water for dust abatement as directed by OGR.

END OF SECTION

SECTION 31 02 30
DUST PALLIATIVE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Dust Palliative Reach 2:

1. Measurement: Area covered as approved by OGR:

   a. Only palliative applied in areas approved by OGR will be included.

2. Payment: Acre price offered in Price Schedule 1.

B. Dust Palliative Reach 3:

1. Measurement: Area covered as approved by OGR:

   a. Only palliative applied in areas approved by OGR will be included.

2. Payment: Acre price offered in Price Schedule 2.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 02 30-1, Proposed Application Area for Dust Palliative:

1. Include dust palliative composition, equipment, and application.
2. Certification that dust palliative does not inhibit revegetation.

PART 2 PRODUCTS

2.01 DUST PALLITIVE

A. Biodegradable.

B. Water based.

C. Shall not inhibit revegetation.

2.02 WATER

A. Required for mixing and application.

B. Water requirements per Section 01 51 00 – Temporary Utilities.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation:

1. Shape and grade surface.
2. Loosen surface with rock rake or blade grader to depth of 1- to 2-inches.
3. Water loose surface so it is visibly moist.
4. In areas without surfacing materials: Do not disturb subgrade, moisten only.

3.02 APPLICATION

A. Apply in areas approved by OGR immediately after clearing, grubbing and topsoil stockpiling have been completed.

B. Apply palliative to cleared and grubbed areas not disturbed by excavation, stockpiled topsoil materials, roads, and access ramps.

C. Do not apply to areas to be excavated unless directed by OGR.

D. After backfill and topsoil has been replaced.

E. Other areas as directed by OGR where application of water for dust abatement is ineffective as determined by OGR.

F. Perform maintenance applications to control dust for duration of contract as recommended by manufacturer and as directed by OGR.

G. Apply within 24 hours after completion of surface preparation.

H. Equipment: Designed for uniform application on variable widths at predetermined rates.

I. Location: Access road, stockpiles and right-of-way (ROW) as directed by OGR.

J. Area: Surface width as necessary with designated ROW.

K. Reseeded area: Suitable for reseeding, as recommended by manufacturer.

L. Limitations:

1. Not during rain.
2. Not if rain is anticipated within 4 hours following treatment.
3. Not on frozen ground.

M. Application Rate:

1. As recommended by manufacturer.

2. If material runs off during application, make repeated passes at lesser rates.

N. Compaction:

1. By equipment travel.
2. Keep traffic off treated surface until dust palliative has penetrated and cured enough to prevent excessive pickup under traffic.

END OF SECTION

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SECTION 31 03 33
REMOVAL AND CONTROL OF WATER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Removal of Water from Excavation Reach 2:

1. Payment: Lump sum price offered in Price Schedule 1.

B. Cost:

1. Include cost of removal of water from excavation for Reach 3, in prices offered in Price Schedule 2, for applicable items of work.

1.02 DEFINITIONS

A. Dewatering: Removal and control of groundwater from pores or other open spaces in soil or rock formations to allow construction activities to proceed as intended, and includes relief of groundwater pressure, and control and discharge of effluent water.

B. Unwatering: Control and removal of ponded, seeping, or flowing surface water or emerging subsurface water from excavated surfaces and from precipitation within and adjacent to excavations and construction zones using channels, ditches, gravel drains, gravel blankets, pipe, sumps, and discharge lines. Includes control and discharge of effluent waters.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 31 03 33-1, Removal and Control of Water Plan:

1. Showing proposed method for removal and control of water (unwatering or dewatering) from foundations:
   a. Include proposed equipment for removal of water, including pump types, capacities, quantities, etc.
   b. Specific plans for controlling runoff and ponded water.
   c. Include plan view site map of proposed methods.
2. Include a specific plan for area shown on drawings, immediately downstream from Frank Chee Willetto (FCW) Reservoir.
3. Discharge location(s).
4. Abandonment and removal.
5. For payment purposes, prepare the plan with not more than 3 major divisions.

1.04 CONTRACTOR RESPONSIBILTIES

A. Design, furnish, install, operate, maintain, monitor, remove, and abandon water removal and control facilities.

B. Design and layout facilities to collect discharge water from water removal systems and convey water to designated approved discharge points.

C. Locate water removal facilities to maximize water removal and minimize construction interference.

D. Select pump types and design discharge systems and settling ponds.

E. Provide required equipment and monitor as required by permit.

F. Remove and control water using unwatering and/or dewatering to facilitate excavation and construction.

1. Other methods, such as cutoffs, may be used as approved by COR.

G. Equipment calibrated in the field shall be calibrated following the manufacturer's recommended calibration schedule and procedures. The calibration schedule, and procedures shall be readily available on site for review and reference.

H. All sumps and/or ditches for removal of water beyond the limits of excavation shown on the construction and/or excavation drawings shall be backfilled with materials conforming to the gradation and compaction requirements specified for adjacent materials.

I. All material used in the Removal and Control of Water Plan shall remain property of the contractor and shall be removed from the site at the end of the project.

J. Removal and Control of Water Plan may be placed in operation upon approval, but nothing in this section shall relieve Contractor from full responsibility for adequacy of water removal installation and operation.

1.05 PROJECT CONDITIONS

A. Conditions which may influence dewatering and unwatering include:

1. Frequency and rate of precipitation at the site.
2. Subsurface conditions including natural layering, thickness, permeability, and storativity of materials, and groundwater levels.
3. Efficiency of pumps, collectors, and discharge systems.
4. Elevation of FCW Reservoir.

5. Discharge from the FCW Dam foundation/toe drain system, from the Trapezoidal Flume West and the Trapezoidal Flume East.

6. San Juan River stage height. Found at link below:

   a. https://waterdata.usgs.gov/monitoring-location/09367540/#parameterCode=00065&period=P7D&showMedian=false

   b. Instrumentation Number: 09367540

   c. Location: Fruitland, NM

B. Water content and water levels in subsurface materials vary with location, depth, and material.

C. Refer to Section 53 20 00 – Records of Geologic and Subsurface Investigations.

1.06 REGULATORY REQUIREMENTS

A. Obtain required Federal, State, Tribal and local permits for water discharge and other activities associated with removal and control of water.

B. Refer to Section 01 57 30 – Water Pollution Control.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Clearing and Grubbing:

1. Payment: Lump sum prices offered in the Price Schedules:

a. Includes costs of disposing of cleared and grubbed material.

1.02 DEFINITIONS

A. Vegetation: Trees, shrubs, brush, stumps, exposed roots, down timber, branches, grass, and weeds.

B. Clearing: Removal of all debris and vegetation with a trunk diameter smaller than 3 inches.

C. Grubbing: Cutting and removal of all large vegetation with a trunk diameter greater than or equal to 3 inches.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Obtain clearances and permits before clearing and grubbing.

B. Obtain COR approval before clearing and grubbing.

3.02 CLEARING AND GRUBBING

A. Clear and grub only areas to be stripped of topsoil.

B. Clear and grub rights-of-way (ROW) to be occupied by permanent construction and temporary construction ROW to facilitate work as approved by COR.

C. Clear and grub area adjacent to excavation/cut or fill sections to a minimum distance of 3 feet outside of slope lines.

D. Obtain COR approval before removing trees.

E. Remove vegetation, rubbish, and objectionable material as determined by OGR.

F. Where vegetation cutting is required:

1. Usable trees:

a. Size: 3-inch diameter or larger.

b. Remove branches and leave them on roadside for local residents to collect and use as firewood.

c. Remove and dispose of tree root balls.

d. Remove and dispose of stumps.

2. Smaller woody vegetation:

a. Size: Less than 3-inch diameter.

b. Chip and spread on ROW during revegetation process.

G. Clear and grub areas in accordance with Sections 01 57 50 – Tree and Plant Protection and 01 57 60 – Protected Species.

3.03 DISPOSAL OF CLEARED MATERIAL

A. Dispose of material in accordance with Section 01 74 00 – Cleaning and Waste Management, or as directed by COR.

END OF SECTION

SECTION 31 14 10

TOPSOIL STRIPPING, STOCKPILING AND PLACEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Topsoil Stripping, Stockpiling, and Placement:

1. Payment: Lump sum price offered in Price Schedules:

   a. Stripping will not be paid under other items.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Obtain clearances and permits before stripping topsoil.

B. Obtain COR approval before stripping topsoil.

C. Strip all areas to be disturbed by construction activities to expose unknown cultural resources immediately after mobilization. Refer to Section 01 57 90 – Preservation of Historical and Archeological Data if cultural resources are discovered.

D. Vegetation removal in accordance with Section 31 11 00 – Clearing and Grubbing.

3.02 STRIPPING

A. Remove topsoil only in areas to be disturbed by construction activities to a depth of 6 inches, and to additional depths as determined by COR:

1. If a true topsoil layer does not exist, consider the top 6 inches of surface soils removed to be topsoil for the purpose of this section.
2. If surface is rock, stripping not required.

3.03 STOCKPILING

A. Transport and stockpile topsoil for future use prior to final placing.

B. Protect quality of topsoil. Stockpile topsoil separately from other excavated materials to prevent topsoil from mixing during construction and reclamation activities.

C. Do not compact, drive on, place equipment on, or otherwise disturb stockpiled topsoil.

D. Cover stockpile with a non-permeable tarp or dust palliative as approved by OGR.

E. Haul excess topsoil offsite in accordance with Section 31 23 39 – Disposal of Excavated Materials as approved by COR.

3.04 PLACEMENT

A. Prior to topsoil placement, remove trash, debris, weeds, stones larger than 6 inches, and large pieces of vegetative materials.

B. Place topsoil in areas of earthen surface disturbed by construction.

C. Place topsoil to a minimum thickness of 6 inches.

D. Equipment travel over replaced topsoil is prohibited unless associated with reseeding/reclamation activities to avoid compaction and improve chances for successful reclamation, unless otherwise authorized by COR.

END OF SECTION

SECTION 31 23 02
COMPACTING EARTH MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of compacting earth materials in prices offered in Price Schedules for items of work where earth materials are required to be compacted:

   a. Includes:

      1) Furnishing water and moistening materials.

      2) Contractor Quality Testing.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D422-63(2007)e2	Particle-Size Analysis of Soils
2.	ASTM D653-24a	Terminology Relating to Soil, Rock, and Contained Fluids
3.	ASTM D698-12(2021)	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
4.	ASTM D1140-17	Amount of Material Finer than the 75-µm (No. 200) Sieve in Soils by Washing
5.	ASTM D1556/D1556M-24	Density and Unit Weight of Soil in Place by the Sand-Cone Method
6.	ASTM D2216-19	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7.	ASTM D2487-17(2025)	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
8.	ASTM D2488-17e1	Description and Identification of Soils (Visual-Manual Procedure)
9.	ASTM D4318-17e1	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
10.	ASTM D4546-21	One-Dimensional Swell or Collapse of Cohesive Soils

11.	ASTM D4564-08e1	Standard Test Method for Density and Unit Weight of Soil in Place by the Sleeve Method
12.	ASTM D4647/D4647M-13(2020)	Identification and Classification of Dispersive Clay Soils by the Pinhole Test
13.	ASTM D4718/D4718M-15(2023)	Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
14.	ASTM D4914/D4914M-24	Density of In-place Soil and Rock in Place by the Sand Replacement Method in a Test Pit
15.	ASTM D5030/D5030M -21	Density of In-place Soil and Rock in Place by the Water Replacement Method in a Test Pit
16.	ASTM D5080-20	Rapid Determination of Percent Compaction
17.	ASTM D6572-21	Determining Dispersive Characteristics of Clayey Soils by the Crumb Test
18.	ASTM D6913/D6913M -17	Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
19.	ASTM D6938-23	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
20.	ASTM D7382-20	Determination of Maximum Dry Unit Weight of Granular Soils Using a Vibrating Hammer
21.	ASTM D7928-21e1	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

B. Bureau of Reclamation (Reclamation)

1. *Guidelines for Earthwork Construction Control Testing of Gravelly Soils*, Earth Sciences and Research Laboratory, Technical Service Center, Bureau of Reclamation, Denver, Colorado, September 2006.

1.03 DEFINITIONS

A. Use definitions from ASTM D653.

B. Control Fraction: Portion of soil sample consisting of particles smaller than designated sieve size. Control fraction is used to compare in-place unit weight with standard

laboratory unit weight. Control sieve size depends on laboratory test used to determine laboratory maximum density.

C. C-Value: Ratio expressed as a percentage of (1) in-place unit weight at fill moisture content to (2) unit weight of laboratory-compacted specimen prepared at fill moisture content as determined by rapid method of construction control in accordance with ASTM D5080. C-Value is a comparison of compactive effort of field compaction equipment to standard laboratory compactive effort.

D. D-value: Ratio expressed as a percentage of (1) in-place unit weight at fill moisture content to (2) laboratory maximum unit weight as determined from compaction curve constructed at fill moisture content as determined by rapid method of construction control in accordance with ASTM D5080. D-value is approximately the equivalent of percent compaction in accordance with ASTM D698.

E. Percent Compaction: Ratio expressed as a percentage of field in-place dry unit weight to laboratory maximum dry unit weight in accordance with ASTM D698 or ASTM D7382.

F. Special compaction: Compaction close to structures or in spaces not accessible by standard width mechanical rollers.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 23 02-1, Test Results:

1. Results of tests listed in Table 31 23 02A – Contractor Materials Testing Requirements and Frequency.
2. Include test date, time, location, and name of person performing tests.
3. Notify COR within 2 hours if testing does not meet specified requirements.

1.05 AMBIENT CONDITIONS

A. Do not place or compact soil under the following conditions:

1. Rain or seepage that creates puddles in clayey or silty materials.
2. Heat or wind that dries material below specified moisture conditions.
3. Ice, frost, or snow pockets are visible in soil being placed or on working surface (underlying materials).

B. Ambient air temperature below freezing may make placement and compaction operations difficult:

1. Cease operations when placed materials are at or below freezing temperatures.
2. Obtain COR approval before performing operations when ambient air temperatures are below freezing.

3. Minimize interruptions of operations.

4. Continuous operations may be required to eliminate freezing of materials.

PART 2 PRODUCTS

2.01 WATER

A. Required for soil mixing and moisture control.

B. Water requirements per Section 01 51 00 – Temporary Utilities.

2.02 SOIL CLASSIFICATION

A. When required, classify earth materials using the Unified Soil Classification System (USCS) according to ASTM D2487:

1. Gradation tests for classification: ASTM D422, ASTM D6913 and or ASTM D1140.

2. Atterberg limits testing for classification: ASTM D4318.

2.03 SOIL TYPES

A. Clean Fill:

1. Any soil except soils with classifications of Peat (PT), Organic Silt and Organic Clay (OL and OH), or Elastic Silt (MH), per ASTM D2487.

2. Do not use soils that exhibit expansive or dispersive characteristics in accordance with ASTM D4546, ASTM D4647, or ASTM D6572.

3. Free of roots, stumps, limbs, vegetation, organic matter, and snow/ice.

4. Does not contain construction debris, scrap materials, refuse, man-made wastes, or chemical or hydro-carbon contamination.

B. Do not use frozen soils.

C. Special Gradations and Plasticity.

1. In some cases, such as compacted backfill under foundations and bedding and embedment for buried pipe, special gradations, plasticity index (PI), and/or swell characteristics may be required. Refer to Sections 31 23 11 - Earthwork for Structures and 31 23 22 – Pipe Trench Earthwork, for details.

2.04 DESIGNATION OF SOILS FOR COMPACTION

A. Requirements for lift thickness, method of compaction, and method of determining degree of compaction depend on whether soil is silty or clayey, coarse-grained, or coarse-grained containing some silt and clay.

B. Silty or Clayey Soils:

1. Contains appreciable amounts of fines (more than 15 percent plastic fines or 30 percent non-plastic fines).

C. Coarse-Grained Soils:

1. Contains few fines (less than 5 percent fines).
2. Coarse-Grained Free-Draining Material: Water does not pond on surface.
3. Coarse-Grained Non-Free-Draining Material: Water does pond on surface.

D. Coarse-Grained Soils Containing Some Silt or Clay:

1. Contains some silt or clay (between 5 percent fines and 15 percent plastic fines or 30 percent non-plastic fines).

2.05 MAXIMUM PARTICLE SIZE

A. Soil for compacted backfill:

1. Maximum particle size limitations are described in Sections 31 23 11 - Earthwork for Structures and 31 23 22 – Pipe Trench Earthwork. Refer to the appropriate Sections for compacted backfill, pipe bedding, and pipe embedment.
2. Otherwise, no particles larger than 3 inches.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Clear, grub, and strip surface area.

B. Prepare in-situ horizontal surface so first compacted lift is placed on a firm and stable foundation base.

1. Building and structure foundations: if excavated foundation base is soil, scarify, moisten, and proof-roll horizontal surface (excavated footprint) with a 10-ton vibratory steel drum (or equivalent compaction equipment for fine grained soils, see below) until surface does not settle (yield).
2. Excavate areas that settle excessively (yield) or rut and replace with compacted backfill.
3. Use woven geotextile, geogrid, or similar product at base of the excavation if development of a stable base is causing difficulties during proof roll.
4. Minimum number of compaction equipment passes as approved by COR.

C. Scarify and moisten in-situ surface to provide satisfactory bonding surface before placing layer of material to be compacted.

D. OGR shall approve surface before the first lift is placed.

3.02 SOIL MOISTURE CONTENT

A. Moisten or aerate (dry) material, as necessary, to provide moisture content that will readily facilitate obtaining specified compaction. Add water to soil only in increments that will permit moisture content to be uniform and homogenous throughout each layer after mixing.

B. Silty or Clayey Soils and Coarse-Grained Soils Containing Some Silt or Clay:

1. Add no more than 2 percent water to fill by sprinkling just prior to compaction when fill is clayey and contains dry clods of clay:

   a. If clayey borrow soil is more than 2 percent below optimum moisture, pre-conditioning and curing may be required to obtain uniform and homogenous distribution of moisture in the clods.

   b. Use of disks, harrows, rakes, or other equipment may be required to blend moisture in borrow area.

2. Moisture content during compaction:

   a. Soils controlled by impact compaction:

      1) Within 2 percent dry to 2 percent wet of optimum moisture content determined in accordance with ASTM D698.

   b. Soils controlled by vibrating hammer:

      1) Applicable only to Coarse-Grained soils for which consistent results are not obtained using ASTM D698.

      2) Within water content range for effective compaction as determined by ASTM D7382.

   c. Compare field compaction moisture content with moisture contents determined in accordance with:

      1) ASTM D2216, or

      2) ASTM D6938. Correct moisture from nuclear gauge for gauge error for specific soils tested, moisture content of total material may require adjustment for control fraction (ASTM D4718). If nuclear gauge is utilized, rod shall test entire lift being tested.

C. Coarse-Grained Soils:

1. Add water during compaction as necessary because these soils are typically free-draining.

3.03 PLACEMENT

A. Placed soils to be compacted in horizontal layers.

B. If necessary, blend materials prior to placement so compacted backfill is homogenous and free from lenses, pockets, streaks, voids, laminations, or other imperfections.

3.04 COMPACTION

A. Compact earth materials according to the following methods and techniques appropriate to the type of soil.

B. Density, based on Percent Compaction of Maximum Dry Unit Weight using ASTM D698:

1. Compacted backfill:
   a. Minimum: 98 percent beneath structures, extending down and away from outside bottom edge of structure (foundation) at 1H:1V slope.
   b. Minimum: 95 percent outside of structures and 1H:1V slope.
2. Pipe Bedding:
   a. Minimum: 95 percent.
3. Pipe Embedment
   a. Minimum: 95 percent.

Wash Crossing and Erosion Control Backfill (above pipe):
   b. Minimum: 85 percent.

C. Silty or Clayey Soils:

1. Compact with mechanical impact tampers, tamping rollers, vibrating pad foot rollers (not smooth), other suitable compaction equipment, or equipment travel:
   a. Uniformly distribute equipment passes.
   b. Compact in horizontal layers to compacted thickness of 6-inches or less.
2. Special compaction: Compact with walk-behind roller, handheld impact tampers, or small tamping equipment:
   a. Uniformly distribute effort.
   b. Compact in horizontal layers to compacted thickness of 4-inches.
   c. Required within 3 feet horizontally of:
      1) Structures.
      2) Pipe.
      3) Buried utilities.

D. Coarse-Grained Soils:

1. Compact with crawler-type tractors, vibrating drum rollers, surface plate vibrator, or similar equipment:

a. Uniformly distribute equipment passes.

b. Compact in horizontal layers to compacted thickness of 12-inches or less.

2. Special compaction: Compact with walk-behind vibrating roller, handheld impact tampers, vibrating plate tampers, or small tamping equipment:

a. Uniformly distribute effort.

b. Compact in horizontal layers to compacted thickness of 6-inches.

c. Required within 3 feet horizontally of:

1) Structures.

2) Pipe.

3) Buried utilities.

E. Coarse-Grained Soils Containing Some Silt or Clay:

1. Compact in accordance with either procedure above.

F. Adjustment:

1. Silty or clayey soils containing 5 to 30 percent oversized particles:

a. In-place unit weight of minus No. 4 sieve size control fraction determined by screening gravel, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D4718.

2. Silty and clayey soils containing more than 30 percent oversize particles:

a. Required D-ratio or Percent Compaction may be adjusted in accordance with appropriate curve on Figure 3 in Reclamation *Guidelines for Earthwork Construction Control Testing of Gravelly Soils*.

G. Demonstration:

1. Lift thicknesses may vary depending on equipment and methods.

2. Before changing requirements in this Section, demonstrate that required density shall be obtained.

3.05 MEASURE OF COMPACTION

A. Determine unit weight of in-place soils by using one of the following methods appropriate to the type of soil:

1. Silty or Clayey Soils and Coarse-Grained Soils Containing Some Silt or Clay:

a. ASTM D1556, or

b. ASTM D4914, or

c. ASTM D5030, or

d. ASTM D6938.

2. Coarse-Grained Soils:

   a. ASTM D4564, or

   b. ASTM D6938.

B. Determine Percent Compaction by one of the following techniques appropriate to the type of soil:

1. Silty or Clayey Soils:

   a. Laboratory Compaction Test: Comparison of in-place dry unit weight of minus No. 4 sieve size control fraction to laboratory maximum dry unit weight as determined by ASTM D698, Method A.

   b. Rapid Method: ASTM D5080.

2. Coarse-Grained Soils:

   a. In-place dry unit weight of minus 2-inch control fraction compared to the maximum dry unit weight determined by ASTM D7382.

3. Coarse-Grained Soils Containing Some Silt or Clay:

   a. Use ASTM D698 except for soils for which consistent results are not obtained using ASTM D698. In this case, use ASTM D7382.

4. Adjustment:

   a. For soils containing 5 to 30 percent oversized particles:

      1) In-place unit weight of minus No. 4 sieve size control fraction determined by screening gravel, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D4718.

   b. For soils containing more than 30 percent oversized particles:

      1) Required D-ratio or Percent Compaction may be adjusted in accordance with appropriate curve on Figure 3 in Reclamation *Guidelines for Earthwork Construction Control Testing of Gravelly Soils*.

3.06 CONTRACTOR FIELD QUALITY TESTING

A. Testing:

1. Independent testing laboratory shall perform sampling, testing, and reporting as required in Table 31 23 02A - Contractor Materials Testing Requirements and Frequency:

   a. Independent testing laboratory shall meet requirements specified in Section 01 46 20 – Testing Agency Services.

2. Notify independent testing laboratory and COR 24 hours before compaction work begins and 24 hours before significant change in compaction operations (major change in equipment or procedure used).
3. Notify independent testing laboratory and OGR immediately of equipment change due to breakdown, or re-deployment.
4. Testing Frequency:
    a. At minimum, perform test at frequencies specified in Table 31 23 02A - Contractor Materials Testing Requirements and Frequency.
    b. Greater frequency of testing shall be performed at beginning of new work, new work crew, or new equipment.
    c. After successful work operation pattern is established, testing frequency may be performed at minimum guidelines.
    d. Perform additional tests at sites considered questionable by OGR.
        1) Such as suspected incomplete compaction, surfaces that have become excessively wet or dry since compaction, compacted surfaces torn up by subsequent equipment travel, or other similar circumstances.
        2) Frequency of additional testing is at discretion of OGR.
    e. Perform compaction test at every road crossing to verify compaction.

Table 31 23 02A – Contractor Materials Testing Requirements and Frequency

PROCEDURE	TEST STANDARD	STANDARD TITLE	MINIMUM FREQUENCY OF TESTING
Soil Classification	ASTM D2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)	As necessary to classify material to meet specification requirements or to index material for determining density by nuclear method.
	ASTM D2488	Description and Identification of Soils (Visual-Manual Procedure)	
Moisture Content	ASTM D2216	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	With in-place density or as required to index material for determining density by nuclear method.

Table 31 23 02A – Contractor Materials Testing Requirements and Frequency

PROCEDURE	TEST STANDARD	STANDARD TITLE	MINIMUM FREQUENCY OF TESTING
Sand Cone	ASTM D1556	Density and Unit Weight of Soil in Place by Sand-Cone Method	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation.
Rapid Construction Control	ASTM D5080	Rapid Determination of Percent Compaction	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation.
Laboratory Compaction (Maximum Dry Unit Weight)	ASTM D 698, Method A	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation.
Laboratory Compaction with Vibratory Hammer	ASTM D7382	Determination of Maximum Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibrating Hammer	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation.
Nuclear Method	ASTM D6938	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)	One test every 100 yd^3 Minimum 1 test per day per compacted backfill operation. Minimum 1 test per foundation prior to concrete placement.
Oversized Correction	ASTM D4718	Correction of Unit Weight and Water Content for Soils Containing Oversize Particles	When oversize material is between 5 and 30 percent

Table 31 23 02A – Contractor Materials Testing Requirements and Frequency

PROCEDURE	TEST STANDARD	STANDARD TITLE	MINIMUM FREQUENCY OF TESTING
Rock Factor		Reclamation Guidelines for Earthwork Construction Control Testing of Gravelly Soils	When oversize material is greater than 30 percent

B. Contractor Support:

1. Provide timely access to areas for density testing:
   a. Excavate and level an area in compacted material to provide surface for testing.
   b. Test fills compacted by sheepsfoot rollers one or two lifts below surface.
2. OGR may select location of testing.
3. When density is being measured by:
   a. Sand-cone device in accordance with ASTM D1556, cease construction activity in immediate vicinity of testing.
   b. Nuclear gauge reading shall be taken with the rod extended to full depth.
4. Dig test pits as requested to examine compacted soil against structures or pipe.
5. Replace compacted backfill within test pits to original requirements.
6. Provide warning lights, flags, or other safety devices as needed by testing personnel.
7. Provide adequate lighting for performing test if required because of darkness.

3.07 FIELD QUALITY ASSURANCE

A. COR may perform testing as required to verify contractor quality control testing.

B. Contractor shall provide access and support (at Contractor's cost) as required for COR to perform quality assurance testing.

END OF SECTION

SECTION 31 23 11
EARTHWORK FOR STRUCTURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Common Excavation for Structures:

1. Measurement: Made to excavation paylines shown on drawings or to paylines as directed by COR:

   a. Regardless of quantities removed, measurement for payment will be made to prescribed paylines.

   b. For safety or other reasons, Government reserves the right to require Contractor to excavate beyond prescribed paylines.

   c. Measurement for payment for additional excavation will be made to limits as directed by COR.

2. Payment: Cubic yard prices offered in Price Schedule 2:

   a. Includes:

      1) Cost of labor and materials for pumping, unwatering, and dewatering.

      2) Shoring, sheeting, bracing, timbering, safety sloping and other temporary construction necessary to maintain excavations in good order during construction.

      3) Removing such temporary construction where required.

      4) Stockpiling excavated material for compacted backfill.

      5) Disposal of unused or wasted excavated materials.

   b. Does not include:

      1) Stripping quantities.

      2) Rock excavation for Line Pipe.

   c. Over-excavation performed beyond specified or directed paylines and compacted backfill for such over-excavation will be at expense of Contractor.

B. Rock Excavation for Structures:

1. Measurement: Made to excavation paylines shown on drawings or to paylines as directed by COR:

   a. Regardless of quantities removed, measurement for payment will be made to prescribed paylines.

b. For safety or other reasons, Government reserves the right to require Contractor to excavate beyond prescribed paylines.

c. Measurement for payment for additional excavation will be made to limits as directed by COR.

2. Payment: Cubic yard prices offered in Price Schedules:

a. Includes:

1) Cost of labor and materials for pumping and unwatering.

2) Mechanical breaking, shoring, sheeting, bracing, timbering, safety sloping and other temporary construction necessary to maintain excavations in good order during construction.

3) Removing such temporary construction where required.

4) Stockpiling excavated material for compacted backfill.

5) Disposal of unused or wasted excavated materials.

b. Over-excavation performed beyond specified or directed paylines and compacted backfill for such over-excavation will be at expense of Contractor.

C. Compacted Backfill for Structures:

1. Measurement: Made to structure lines, excavation lines, and compacted backfill lines shown on drawings.

2. Payment: Cubic yard prices offered in the Price Schedules:

a. Includes cost of work associated with excavation or procuring, hauling and placement of necessary material.

b. Material from required excavation used for compacted backfill will be paid for both as excavation when removed from original position and as compacted backfill when placed.

c. Where additional material is obtained from approved borrow pits and used for compacted backfill, payment will be made for compacted backfill only.

d. Replacement of materials where excavation is performed outside of established paylines will be at expense of Contractor.

D. Processing of Site and Foundation Materials:

1. Measurement: Made to Foundation Excavation paylines shown on drawings.

2. Payment: Cubic yard prices offered in Price Schedules.

a. Includes cost of screening oversize materials after excavation of material, and before placement as compacted backfill.

E. Cost:

1. Include costs of excavation and compacted backfill for buried electrical items in prices offered in Price Schedules for Division 26 items of work requiring excavation and compacted backfill.
2. Include costs of excavation and compacted backfill for fencepost footings in items in price offered in the Price Schedule for Chain Link Fence**.**

1.02 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by COR to remove unsuitable foundation material.

B. Over-excavation: Excavation performed for convenience, fault, or operation of Contractor beyond specified or directed additional excavation lines.

C. Rock Excavation:

1. Material that cannot be ripped using conventional excavation equipment and requires a 400 horsepower or larger dozer tractor equipped with rock tooth ripper rated for hard rock.
2. Material that cannot be excavated with conventional excavation equipment and requires a 300 horsepower or larger hydraulic excavator, with rock bucket and teeth, specifically manufactured for rock excavation, and/or a hydraulic hammer (breaker, hoe-ram), in areas where it is not feasible for ripping with a dozer tractor.

D. Additional Backfill: Backfill of additional excavation as directed by OGR.

E. Cover: Distance between top surfaces of buried cables, conductors, or conduits and finished grade.

F. Earthwork for Structures: Excavation, placing backfill, and compacting backfill for:

1. Regulating Tanks.
2. Precast concrete structures.
3. Access Road.
4. Other structures not covered in other Sections.
5. In areas as directed by OGR.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM D4546-21 One-Dimensional Swell or Collapse of Cohesive Soils

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 23 10-1, Processing Plan for Soils under Structures:

1. Describe equipment and methods for removing, stockpiling, processing, crushing, screening, moistening, placing, and compacting material to achieve requirements in Parts 2.02 and 3.03.

2. Provide schedule and sequence.

3. Include working and stockpiling areas and haul route plans.

C. RSN 31 23 10-2, Test Results:

1. Include test date, time, location, name of person collecting soil samples, and correlating in-situ soil density and moisture information according to Section 31 23 02 - Compacting Earth Materials.

2. Provide laboratory test results for swell and collapse potential in accordance with ASTM D4546, and as indicated in Parts 3.05 and 3.09.

1.05 PROJECT CONDITIONS

A. Refer to Section 53 10 00 – Geologic Investigations for available field explorations, information regarding subsurface soil, rock, and groundwater conditions.

B. Soils requiring remediation may be encountered on site (e.g. expansive materials).

C. Excavate and process in-situ soils and bedrock, and place compacted backfill to provide a stable foundation for tanks, vaults, thrust blocks and other structures.

PART 2 PRODUCTS

2.01 EXCAVATED MATERIALS

A. Operations shall be such that excavations will yield as much suitable material for use in permanent construction required under these specifications as practicable.

B. Place excavated materials which are too wet for immediate compaction temporarily in stockpiles, and process until moisture content is reduced sufficiently to permit placement.

2.02 MATERIAL FOR COMPACTED BACKFILL

A. Type and amount of material used for compacted backfill, and manner of depositing material shall be subject to approval by COR.

B. Obtain compacted backfill material from required excavations. If sufficient suitable material is not available from this source, obtain additional material from other sources approved by COR:

1. Government makes no guarantee that specified materials for compacted backfill are contained in or can be processed from excavated materials.

2. All reasonable effort shall be expended to obtain suitable material for compacted backfill from required excavation prior to obtaining commercial sources.

C. Do not use material removed during topsoil stripping.

D. Do not use organic material or other deleterious material.

E. Material shall be thoroughly mixed and evenly moistened (processed) to achieve a uniform material and to avoid pockets or lenses of variable material.

F. Maximum particle size: 3-inch.

G. Minimum of 60 percent particles passing the No. 4 sieve size, by weight.

H. Plasticity Index (PI): Less than 15.

I. Swell potential: Less than one percent under a load of 1,000 pounds per square-foot (psf) (ASTM D4546, inundated/saturated at 1,000 psf).

J. Where special compaction is required, in accordance with 31 23 02 – Compacting Earth Materials, the gradation requirements are the same.

PART 3 EXECUTION

3.01 EXCAVATION, GENERAL

A. Excavate structure foundations to elevations and lines shown on drawings, as approved, or as directed by OGR.

B. Comply with Occupational Safety and Health Administration (OSHA) requirements for temporary excavations.

C. Government reserves the right, during progress of work, to vary slopes, grades, and dimensions of excavations from those specified.

D. Government does not represent that excavation performed under these specifications can be made to or maintained at paylines shown on the drawings or described in these specifications.

E. Perform excavation in the dry.

F. Do not excavate in frozen materials without written approval of COR.

G. Blasting: Not allowed.

H. Preserve material below and beyond established lines of excavation in soundest possible condition:

1. Damage to work due to Contractor's operations shall be repaired by and at expense of Contractor.
2. Material beyond required or prescribed excavation lines which is loosened by Contractor's operations shall be removed at expense of Contractor.

3.02 OVER-EXCAVATION

A. If foundation material is excavated beyond lines required to receive structure, fill over-excavation with suitable materials as directed by OGR and compact in accordance with Section 31 23 02 – Compacting Earth Materials.

B. If foundation material is disturbed or loosened during excavation or otherwise, compact foundation in place or remove and replace it with suitable material as directed by OGR and compact in accordance with Section 31 23 02 – Compacting Earth Materials.

3.03 PROCESSING AND STOCKPILING COMPACTED BACKFILL MATERIAL

A. Stockpile material in maximum 12-inch lifts as it is removed from excavation.

B. Do not compact stockpile material.

C. Wet material as it is stockpiled to minimum of optimum moisture content.

D. Test moisture content in accordance with Section 31 23 02 – Compacting Earth Materials.

E. Excavated materials may require crushing, screening, and/or other processing to meet requirements of Part 2.02. Provide processing equipment and perform work necessary to process excavated materials to produce materials meeting the requirements of these specifications.

F. Thoroughly mix and moisten material to achieve a uniform material and to avoid pockets or lenses of variable material.

G. Earthwork equipment should be used to uniformly blend, moisture condition, and aerate (if necessary), the stockpile material to achieve a uniform fill material before it is placed as compacted backfill material.

3.04 SURFACES OF EXCAVATION

A. Vertical offsets within rock surfaces are not to extend more than 2 inches unless surfaces are to be covered with concrete or surfacing materials.

3.05 PREPARATION OF STRUCTURE FOUNDATIONS

A. Prepare foundations at structure sites by methods which will provide firm foundations for structures:

1. Finish bottom and side slopes of excavation, upon or against which the structure is to be placed, to prescribed dimensions.
2. Moisten and compact prepared surfaces with suitable tools to form firm foundations upon or against which to place structure.

B. Where unsuitable material is encountered in the foundation for a structure, OGR will direct performance of additional excavation to remove unsuitable material. Fill additional excavation with compacted backfill in accordance with Section 31 23 02 - Compacting Earth Materials.

C. Keep surfaces of shale, claystone, and/or mudstone (if encountered) that are exposed by excavation moist until concrete or earth material are placed on them.

D. If potentially expansive materials, such as clay, shale, claystone, or mudstone are encountered below structures, in-place material shall be tested for swell potential as directed by OGR.

1. Test in accordance with ASTM D4546.
2. Include information required in RSN 31 23 11-2 Test Results.

E. Test moisture content of foundation subgrade no more than 12 hours prior to placing concrete in accordance with 31 23 02 – Compacting Earth Materials.

3.06 FOUNDATION INSPECTION

A. Inspection will be performed by Government to obtain a geologic record of the final foundation surface:

1. Provide safe access for Government personnel during inspection.
2. Notify COR at least 7 days before reaching final excavation elevation for foundation.
3. Once an adequate foundation has been obtained, and before backfilling, Government will require 3 days to inspect, map and survey foundation for structures.
4. Clean surface with straight edge of equipment bucket to expose foundation as directed by OGR.
5. Maintain prepared surfaces free of debris and standing water until inspection and geologic mapping are completed.
6. Do not operate equipment in area being inspected until inspection and survey are complete.

3.07 PLACING COMPACTED BACKFILL

A. Place compacted backfill to lines and grades shown on drawings, as approved, or as directed by OGR.

B. Place material carefully and spread in uniform layers so compacted backfill is homogeneous and free from lenses, pockets, voids, laminations, or other imperfections.

C. Do not place compacted backfill material when either material or surfaces on which it is to be placed are frozen.

D. Place backfill to the same elevation on both sides of the structure to prevent unequal loading.

E. Subsequent layers of compacted backfill may be placed as soon as compaction of previous layers is completed. Placement of additional materials may be delayed by COR at designated locations for procurement of samples for testing.

F. Additional information is provided in 31 23 02 – Compacting Earth Materials.

3.08 CONTRACTOR FIELD QUALITY TESTING

A. Notify COR within 48 hours of completion of excavation but before compaction. Do not compact until approved by COR.

3.09 COMPACTING BACKFILL MATERIAL

A. Place, moisten, and compact materials of the compacted backfill as provided in Section 31 23 02 – Compacting Earth Materials.

B. Testing of swell potential of in-place compacted backfill material shall be performed. Testing shall be in accordance with ASTM D4546, as directed by OGR, and as follows:

1. Take one test per 5,000 square feet per lift, or as directed by OGR. Take a minimum of one test per day.
2. Swell Potential shall be less than one percent under load of 1,000 psf (ASTM D4546, inundated/saturated at 1,000 psf).
3. Include details listed in RSN 31 23 11-2, Test Results.

3.10 PROTECTION

A. To provide adequate protection for compacted backfill around structure, Government reserves the right to direct Contractor to place enough uncompacted backfill material over compacted backfill within 72 hours after compaction of compacted backfill.

3.11 DISPOSAL OF EXCAVATED MATERIALS

A. Dispose of excavated materials unsuitable for or in excess of backfill or other earthwork requirements, as determined by COR, as provided in Section 31 23 39 - Disposal of Excavated Waste Materials.

END OF SECTION

SECTION 31 23 22
PIPE TRENCH EARTHWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Rock Excavation for Line Pipe:

1. Measurement: Made to paylines shown on drawings and trench lengths of rock material excavated:

   a. Regardless of actual trench widths, bottoms, and side slopes excavated, measurement will be made to paylines made to paylines (Wp) as shown on drawings. See Drawing 1695-D-60795.

   b. Measurement for payment for additional excavation will be made to Wp and trench bottom shown on drawings and to depth directed by OGR and will be continuous through pipe fittings.

2. Payment: Cubic yard prices offered in Price Schedules.

   a. Includes cost of labor and materials for:

      1) Mechanical breaking, shoring, sheeting, bracing, timbering, safety sloping, and other temporary construction.

      2) Pumping and unwatering.

      3) Removing temporary construction, where required.

      4) Stockpiling excavated material for backfill.

      5) Disposal of unused or wasted excavation material.

   b. No direct payment will be made for rock excavation of pipe trenches outside Wp, depth, and length listed above.

   c. Include cost of rock excavation for pipe trenches required outside paylines in prices offered in the Price Schedules for Rock Excavation.

B. Use of Trench Box Reach 2:

1. Measurement: Length of Trench Box.

2. Payment: Linear foot price offered in Price Schedule 1.

C. Use of Trench Box Reach 3:

1. Measurement: Length of Trench Box.

2. Payment: Linear foot price offered in Price Schedule 2.

D. Cost:

1. Include cost of common excavation for pipeline trenches in prices offered in Price Schedules for applicable Line Pipe.
2. Include cost of processing pipeline backfill materials in prices offered in Price Schedules for applicable Line Pipe.
3. Include cost of compacted backfill pipeline trenches in prices offered in Price Schedules for applicable Line Pipe.
4. Include cost of controlled low strength material (CLSM) in prices offered in Price Schedules for Steel Manifold Piping, Corrugated Metal Pipe Culvert, and applicable Line Pipe.

1.02 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by OGR to remove unsuitable foundation material.

B. Additional Backfill: Backfill of additional excavation when directed by OGR.

C. Additional Compacted Backfill: Compacted backfill of additional excavation when directed by OGR.

D. Over-excavation: Excavation performed for the convenience, fault, or operation of Contractor beyond specified or directed additional excavation lines.

E. Rock Excavation:

1. Material that cannot be ripped using conventional excavation equipment and requires a 400 horsepower or larger dozer tractor equipped with rock tooth ripper rated for hard rock.
2. Material that cannot be excavated with conventional excavation equipment and requires a 300 horsepower or larger hydraulic excavator, with rock bucket and teeth, specifically manufactured for rock excavation, and/or a hydraulic hammer (breaker, hoe-ram), in areas where it is not feasible for ripping with a dozer tractor.

F. Cover: Distance between top surfaces of buried cables, conductors, or conduits and finished grade.

1.03 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO SSHB-02 — Standard Specifications for Highway Bridges, 17th Edition

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 23 22-1, Processing Plan:

1. Describe equipment and methods for removing, stockpiling, processing, crushing, screening, moistening, placing, and compacting pipe bedding, embedment, and backfill to achieve requirements in Parts 2.03 and 3.06.

2. Provide schedule and sequence.

3. Include working and stockpiling areas and haul route plans.

C. RSN 31 23 22-2, Test Results:

1. Include test date, time, location, name of person collecting soil samples, and correlating in-situ soil density and moisture information in accordance with Section 31 23 02 – Compacting Earth Materials.

D. RSN 31 23 22-3, Trench Box Design:

1. Completed by Registered Professional Engineer in accordance with Reclamation Safety and Health Standards (RSHS).

2. Include access and excavation plans.

1.05 PROJECT CONDITIONS

A. Refer to Section 53 10 00 – Geologic Investigations for available field explorations, information regarding subsurface soil and rock conditions and groundwater.

B. Soils requiring remediation may be encountered on site (e.g. expansive or dispersive materials).

C. Excavate and process in-situ soils and bedrock.

D. Table 31 23 22A – Reach 2 and Table 31 23 22B Reach 3 summarize Government's interpretation of geological investigations to predict native (in-situ) material types for trench geometries.

1. Refer to Drawing 1695-D-60795 for explanation of Native Material/Trench Types.

2. Some field explorations are far from the station ranges provided (up to one mile); therefore, actual conditions in the field may vary.

Table 31 23 22A – Reach 2

Beginning Station	Ending Station	Expected Native Material/Trench Types
Start Reach 2 (2002+00)	2007+00	1
2007+00	2024+00	3
2024+00	2030+50	1
2030+50	2050+00	3
2050+00	2058+50	1
2058+50	2059+00	3
2059+00	2061+50	1
2061+50	2062+00	2 to 3
2062+00	2072+50	1
2072+50	2085+12	3
2085+12	2094+89	HDD
2094+89	2118+00	3
2118+00	2157+29	3
2157+29	2180+43	HDD
2180+43	2190+00	3
2190+00	2237+63	HDD and Pumping Plant 1
2237+63	End Reach 2 (2287+90.28)	1

Table 31 23 22B – Reach 3

Beginning Station	Ending Station	Expected Native Material/Trench Types
Start Reach 3 (3302+00)	3399+00	1
3399+00	3401+00	2
3401+00	3424+00	1
3424+00	3456+00	2
3456+00	3474+50	1
3474+50	3492+50	3
3492+50	3517+30	1
3517+30	3536+24	HDD
3536+24	3545+00	1
3545+00	3568+00	3
3568+00	3579+50	1
3579+50	3651+50	1
3651+50	3663+00	2
3663+00	End Reach 3 (3744+56.27)	1

PART 2 PRODUCTS

2.01 EXCAVATED MATERIALS

A. Operations in excavations shall be such that excavations yield as much suitable material for use in permanent construction required under these Specifications as practicable.

B. Place excavated materials too wet for immediate placement and compaction temporarily in stockpiles, and process until moisture content is reduced sufficiently to permit placement and compaction.

2.02 CONTROLLED LOW STRENGTH MATERIAL (CLSM) FOR BEDDING AND EMBEDMENT

A. Use for bedding.

B. Use for embedment as detailed on Drawing 1695-D-60795.

C. Controlled low strength materials (CLSM) in accordance with Section 31 23 70 - Controlled Low Strength Material (CLSM).

2.03 SOIL MATERIAL FOR PIPE EMBEDEMNT AND BACKFILL

A. Contractor shall provide processing equipment and perform work necessary to process excavated materials to produce materials meeting requirements of these Specifications.

B. Type and amount of material used for pipe embedment and backfill, and manner of depositing material, shall be subject to approval by OGR.

C. Obtain pipe embedment and backfill material from required excavations. If sufficient suitable material is not available from this source, obtain additional material from other sources approved by COR:

1. Government makes no guarantee that specified pipe embedment and backfill materials are contained in or can be processed from materials excavated.
2. All reasonable effort shall be expended to obtain suitable pipe embedment and backfill materials from required excavation prior to obtaining commercial sources.

D. Do not use material removed during topsoil stripping for pipe embedment and backfill materials.

E. Do not use organic material, frozen materials, or other deleterious material.

F. Do not use unprocessed expansive or dispersive materials (if encountered) for pipe embedment.

G. Select material in accordance with Drawing 1695-D-60795.

H. Material gradation and plasticity index (PI):

1. Embedment:

   a. As shown on Drawing 1695-D-60795.

   b. PI of processed and thoroughly mixed materials should be less than 15.

2. Compacted Backfill: Maximum particle size:

   a. 3/4 inches within 12 inches of the pipe.

   b. 1.5 inches within 12-inches of the Corrugated Metal Pipe (CMP) Culvert.

   c. All other locations, 3-inches.

3. Uncompacted Backfill: Maximum particle size:

   a. 3/4 inches within 12 inches of the pipe.

   b. 1.5-inches within 12-inches of the CMP Culvert.

   c. All other locations, 5-inches.

4. Backfill placed where pipelines cross under open irrigation ditches and other watercourses: Use Silty or Clayey material with a Plasticity Index (PI) of 8 or more.

5. Where compaction or special compaction is required, perform in accordance with Section 31 23 02 – Compacting Earth Materials.

   a. In these instances, the backfill gradational requirements are identical.

2.04 WARNING TAPE:

A. Polyethylene tape.

B. Thickness: 4 mils.

C. Non-detectable.

D. Width, minimum: 6 inches.

E. Color: Blue with silver lettering.

F. Legend repeated at least every 3 feet: "CAUTION: WATERLINE BURIED BELOW – FOR MORE INFORMATION CONTACT THE NAVAJO TRIBAL UTILITIES AUTHORITY".

PART 3 EXECUTION

3.01 GENERAL

A. Perform operations so that land can be restored to original conditions.

B. Do not excavate or keep pipe trench open more than 300-feet ahead, or 100-feet ahead when groundwater is present, of pipelaying, placement of bedding and embedment, or backfill operations, until otherwise approved by OGR.

C. If backfill operations fall behind pipelaying operations, stop excavation and pipelaying operations until sufficient progress has been made as directed by OGR.

D. Place temporary protective backfill over pipe and in open trenches, as approved by OGR, if backfilling operations are interrupted for more than 24 hours.

E. Fence open trench with temporary safety fencing in accordance with Section 01 56 32 – Temporary Safety Fence.

F. Install warning tape over center of pipe, at least 18 inches below ground, and at least 18 inches above pipe.

3.02 TRENCH BOX

A. Applicable linear feet per reach shall be on site prior to excavation.

B. Install in locations as shown on drawings and as directed by OGR.

C. Trench box shall be suitable for installation of line pipe within excavation up to 20-feet in depth.

D. Minimize ground disturbing activities to minimum required to install pipeline and to provide access in the area where trench box is used:

1. No supplemental excavations shall be performed outside the vertical, shored trench excavation.
2. Safely route construction traffic on either side of excavation to minimize impacts to sensitive areas as directed by OGR.
3. CO will consider adjusting costs for site restrictions in accordance with FAR 52.243-04.

3.03 EXCAVATION

A. Excavate pipe trenches for pipelines, accessories, and appurtenances to lines, grades, and dimensions shown on drawings.

B. Comply with Occupational Safety and Health Administration (OSHA) requirements for temporary excavations.

C. Finish bottom of excavated trench to lines and grades shown on drawings. Trench foundation shall be approved by COR.

D. Government may, during progress of work, vary slopes, grades, and dimensions of excavations from those specified.

E. Government does not represent that excavation performed under these Specifications can be made to or maintained as shown on the drawings or described in these Specifications.

F. Perform excavation in the dry.

G. Do not excavate in frozen materials without written approval of COR.

H. Blasting: Not allowed.

I. Preserve material below and beyond established lines of excavation in soundest possible condition:

1. Damage to work due to Contractor's operations shall be repaired by and at expense of Contractor.
2. Material beyond required or prescribed excavation lines which is loosened by Contractor's operations shall be removed at expense of Contractor.

3.04 ADDITIONAL EXCAVATION

A. Perform additional excavation within pipe trench, beyond specified lines, as directed by COR to remove unsuitable trench wall and foundation material.

3.05 OVER-EXCAVATION

A. If foundation material is excavated beyond specified or directed lines, fill over-excavation with suitable materials as directed by COR and compact in accordance with Section 31 23 02 – Compacting Earth Materials.

B. If foundation material is disturbed or loosened during excavation or otherwise, either compact material in-place or remove and replace with suitable material as directed by COR and compact in accordance with Section 31 23 02 – Compacting Earth Materials.

3.06 PROCESSING AND STOCKPILING SOIL MATERIAL FOR EMBEDMENT AND BACKFILL

A. Stockpile excavated materials which meet, or will be processed to meet, material requirements for embedment and backfill in pipe trenches.

B. Stockpile material in maximum 12-inch lifts as it is removed from excavation.

C. Do not compact stockpile material.

D. Wet material as it is stockpiled to minimum of optimum moisture content.

E. Test moisture content in accordance with Section 31 23 02 – Compacting Earth Materials prior to placement.

F. Excavated materials may require crushing, screening, and/or other processing to meet requirements of Part 2.03. Contractor shall provide all processing equipment and

perform work necessary to process excavated materials to produce materials meeting the requirements of these Specifications.

G. All pipe embedment and backfill material shall be thoroughly mixed and moistened to achieve uniform material and avoid pockets or lenses of variable material.

H. Earthwork equipment should be used to uniformly blend, moisture condition, aerate if necessary) the stockpile material in order to achieve uniform fill material before it is placed as pipe embedment material.

3.07 EXCAVATION SURFACES

A. Vertical offsets within rock surfaces shall not extend more than 2-inches unless surfaces are to be covered with concrete or surfacing materials.

3.08 PREPARATION OF PIPE TRENCH FOUNDATION

A. Prepare pipe trench foundation by methods which will provide firm foundations for pipe:

1. Finish bottom and side slopes of excavation, upon or against which pipe is to be placed, to prescribed dimensions shown on drawings.
2. Moisten and compact prepared surfaces with suitable tools to form firm foundations upon or against which to place pipe.

B. Where unsuitable material is encountered in pipe trench, COR will direct performance of additional excavation to remove unsuitable material:

1. Replacement of materials where additional excavation is performed will be directed by COR in accordance with Section 31 23 02 – Compacting Earth Materials and/or Section 31 23 70 – Controlled Low Strength Material (CLSM).

C. Keep exposed surfaces of shale, claystone, and/or mudstone (if encountered) exposed by excavation moist until CLSM or earthen backfill materials are placed on or against them.

3.09 PLACING CONTROLLED LOW STRENGTH MATERIAL (CLSM) FOR PIPE BEDDING AND/OR EMBEDMENT

A. Place CLSM in accordance with Section 31 23 70 – Controlled Low Strength Material (CLSM) and as shown on Drawing 1695-D-60795.

B. Allow CLSM to obtain required strength in accordance with Section 31 23 70 – Controlled Low Strength Material (CLSM) before placing pipe and backfill.

3.10 PIPE INSTALLATION

A. Install pipe in accordance with the following applicable Section:

1. Section 33 11 10 – Pipeline General Requirements,
2. Section 33 11 12 – Steel Line Pipe,

3. Section 33 11 13 – Ductile Iron Pipe,
4. Section 33 11 16 – PVC Pressure Pipe,
5. Section 33 11 18 – HDPE Pressure Pipe,
6. Section 33 21 95 – Metal Piping for Line Pipe Installations,
7. Section 33 42 30 – Corrugated Metal Pipe Culverts,
8. Section 35 21 95 – Steel Manifold Piping.

3.11 PLACING SOIL MATERIAL FOR PIPE EMBEDMENT AND BACKFILL

A. Place to lines, grades, widths, and depths shown on drawings, unless otherwise directed by OGR.

B. Do not drop soil materials directly on pipe at heights exceeding 3.0 feet.

C. Do not place CLSM bedding, embedment, or earthen backfill materials when either material or surfaces on which it is to be placed are frozen or contain ponded water.

D. Place embedment material at same elevation on both sides of pipe to prevent unequal loading and displacement of pipe. Elevation difference on sides of pipe shall not exceed 6-inches.

E. Subsequent layers of compacted embedment or backfill may be placed as soon as compaction of previous layers is completed. Placement backfill materials may be delayed by OGR at designated locations for procurement of bedding or embedment CLSM samples for testing.

F. Place backfill carefully and spread in uniform layers so that backfill, once compacted, is homogeneous and free from lenses, pockets, voids, laminations, or other imperfections.

G. Additional information for compacted embedment and backfill is provided in Section 31 23 02 – Compacting Earth Materials.

H. Uncompacted backfill: Maximum lift height: 1-foot.

I. Place uncompacted backfill over pipe as approved by OGR, if backfilling operations are interrupted for more than 24 hours.

J. For Wash Crossing backfill: See Section 35 42 35 – Wash Crossing Bank Protection.

3.12 IRRIGATION CROSSINGS

A. At locations shown on drawings.

B. Return to original ground surface. Compact as shown on drawings.

3.13 COMPACTION

A. Perform compaction work in accordance with Section 31 23 02 – Compacting Earth Materials.

B. Compact to lines, grades, widths, and depths shown on drawings, unless otherwise directed by COR.

C. Place, moisten, and compact materials for backfill as provided in Section 31 23 02 – Compacting Earth Materials.

D. Compacted backfill layers that do not meet the requirements of these Specifications, based on field quality test results, shall be removed and replaced at Contractor's expense.

E. For special compaction, there should be at least 1.0 foot of cover over pipe before using hand-held impact tampers or walk-behind small tamping equipment.

1. The first 2.0 feet of compacted backfill material shall be considered special compaction as provided in Section 31 23 02 – Compacting Earth Materials.

F. Location of Compacted Backfill:

1. As shown on drawings.
2. Where utility pipelines cross pipeline: Compact to horizontal centerline of utility pipeline, or as required by utility owner, whichever is more stringent.
3. At tees with horizontal outlets, pipe bends, encasements, collars including collar-type blocking, and pipe plugs as shown on drawings.
4. Around valve boxes, vaults and manholes as shown on drawings.
5. Where additional excavation for pipe trenches is directed by COR to remove unsuitable foundation material or other material, compact backfill within limits for this additional excavation.

3.14 PROTECTION

A. To provide adequate protection for CLSM bedding and embedment, compacted backfill, and pipe within the pipe trenches, Government may direct the Contractor to place uncompacted backfill material over embedment or compacted backfill within 72-hours after compaction of embedment and/or backfill.

B. Place uncompacted backfill to a minimum thickness of 3.0-feet or compacted backfill to a minimum thickness of 2.0 feet above top of pipe before allowing construction equipment to travel over pipe.

1. After these minimum earth covers are in-place, maximum equipment loading allowed over the pipe shall be HS-20 loading (16,000-pound wheel load) in accordance with AASHTO SSHB.

2. If construction equipment that exerts a larger wheel load is proposed to be used, submit construction equipment loadings to COR for analysis and determination of required backfill depths or other protective measures.

3. Limit construction equipment passing over pipe to 5 mph until at least 3.5 feet of cover is achieved.

3.15 DISPOSAL OF EXCAVATED WASTE MATERIALS

A. Dispose of excavated waste materials which are unsuitable for or are in excess of earthwork requirements, as determined by COR, as provided in Section 31 23 39 - Disposal of Excavated Waste Materials.

END OF SECTION

SECTION 31 23 39
DISPOSAL OF EXCAVATED WASTE MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items of work requiring disposal of excavated waste materials.

1.02 DEFINITIONS

A. Waste material: Material from required excavation not suitable or required for compacted backfill, miscellaneous backfill, embedment, bedding, or topsoil.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DISPOSAL OF EXCAVATED MATERIALS

A. Dispose of excavated waste material within right-of-way (ROW) unless prior approvals of cultural and environmental clearance have been obtained outside of ROW.

B. Place excavated waste material as directed by COR, in layers of 6-inches or less.

C. Do not place excavated waste material in wetlands, within 12 feet of drainage channels, within 12 feet of edge of prescribed or actual cuts for laterals, wasteways, or drains.

D. Do not waste material by dumping from top of slope.

E. Grade waste banks to drain, with reasonably even and uniform surfaces that blend with natural terrain:

1. Minimum slope: 2 percent.
2. Maximum slope: 4H:1V (horizontal:vertical).

F. Seed surface in accordance with Section 32 92 20 - Seeding.

END OF SECTION

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SECTION 31 23 70
CONTROLLED LOW STRENGTH MATERIALS (CLSM)

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of controlled low strength materials (CLSM) in prices offered in Price Schedules for applicable items of work.
   a. Includes:
      1) Applicable Line Pipe:
         a) Includes pipe bedding and embedment zones.
      2) Corrugated Metal Pipe Culvert.
      3) Road and utility crossing requirements.
      4) San Juan Lateral Water Treatment Plant Regulating Tanks.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 306.1-90 (2002)	Cold Weather Concreting
2.	ACI 318-19	Building Code Requirements for Structural Concrete

B. ASTM International (ASTM)

1.	ASTM C33/C33M-24a	Concrete Aggregate
2.	ASTM C94/C94M-24c	Ready-Mixed Concrete
3.	ASTM C143/C143M-20	Slump of Hydraulic-Cement Concrete
4.	ASTM C1602/C1602M-22	Mixing Water Used in the Production of Hydraulic Cement Concrete
5.	ASTM D4832-23	Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
6.	ASTM D6024/D6024M-24	Ball Drop on Control Low Strength material (CLSM) to determine Suitability for Load Application

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 23 70-1, Approval Data for CLSM Mix:

1. Mix Design: For each CLSM mix:

   a. Mixture proportions.

   b. Material sources:

      1) Name and manufacturer of each cementitious material.

      2) Name of aggregate sources.

      3) Product name and manufacturer of admixtures to be used in mix.

      4) Government reserves right to require submission of samples of CLSM materials for testing before or during use in concrete.

   c. Physical properties:

      1) Trial mixtures:

         a) Results from trial batches made within past 6 months.

         b) Trial mix test results, three 6-inch-diameter cylinders, each at 7 and 28 days.

         c) Average compressive strength of trial batch cylinders at specified design age.

   d. Resubmit mix design for change in material source or type.

   e. Cementitious materials manufacturer's certifications and test reports within last 6 months.

   f. Aggregate test reports for gradation, less than 6 months old.

   g. Method to determine moisture and consistency of materials to maintain specified strengths. Provide testing frequency.

2. NRMCA Certification of Production Facilities:

   a. Automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures.

   b. Verification that facility meets requirements for furnishing concrete in subfreezing weather.

   c. ACI Personnel Certification(s):

      1) Aggregate Testing Technician.

      2) Concrete Field-Testing Technician.

      3) Concrete Strength Testing Technician.

3. If Quality Control test results show CLSM does not meet requirements, submit revised mix design.

C. RSN 31 23 70-2, Cold Weather Protection Plan

1. In accordance with ACI 306.

2. Detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of CLSM during cold weather. Include procedures to be implemented upon abrupt changes in weather conditions or equipment failures. Do not begin cold weather placements until these procedures have been reviewed and accepted.

D. RSN 31 23 70-3, Quality Control Test Results:

1. Notify COR within 2-hours if testing does not meet specified requirements.
2. If Quality Control Test Results show CLSM does not meet specified requirements, submit a revised mix design.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Furnish complete and legible batch ticket with each batch of CLSM in accordance with ASTM C94. Deliver ticket to COR at jobsite during batch delivery.

1.05 QUALIFICATIONS

A. References for foreman in charge of CLSM placement:

1. Minimum three projects within last 3 years.

PART 2 PRODUCTS

2.01 BACKFILL FOR PIPE TRENCHES

A. See Sections 31 23 22 – Pipe Trench Earthwork and 31 23 02 – Compacting Earth Materials.

2.02 STEEL PIPE

A. See Section 35 21 95 – Steel Manifold Piping.

2.03 CORRUGATED METAL PIPE CULVERT

A. See Section 33 42 30 – Corrugated Metal Pipe Culvert.

2.04 CEMENTITIOUS MATERIALS

A. Cementitious Materials Options:

1. Specified portland cement plus 20 to 80 percent by weight of total cementitious (cement plus pozzolan) specified pozzolan, in accordance with ACI 318.

B. Portland Cement:

1. Meet requirements listed in 03 30 00 – Cast-in-Place Concrete.

C. Pozzolan:

1. Meet requirements listed in 03 30 00 - Cast-in-Place Concrete.

D. Blended hydraulic cement:

1. Meet requirements listed in 03 30 00 – Cast-in-Place Concrete.

2.05 WATER

A. ASTM C1602.

2.06 AGGREGATE

A. Native material is not allowed.

B. Aggregate:

1. ASTM C33.
2. Maximum particle size: 1-1/2-inches or 1/8 of open distance between conduit and trench wall, whichever is less.

2.07 MIX

A. Mixture of Aggregate, Cementitious Materials, Water, and Admixtures:

1. Cementitious material content: Percent by dry weight of aggregate to obtain specified compressive strength.
2. Make trial mixes prior to placing CLSM to determine mixture adequacy:
   a. Determine compressive strength in accordance with ASTM D4832.
   b. Determine slump in accordance with ASTM C143.

B. Water Content: Not to exceed that required to provide mix that will flow and can be pumped.

C. Seven-day Compressive Strength, ASTM D4832: Not less than 50 pounds per square inch (lbs/in^2) and not more than 150 lbs/in^2.

D. Consistency:

1. Except, when a stiffer mix required to prevent CLSM from flowing down trenches on a steep slope:
   a. Slump, ASTM C143: 8- to 10-inches.

2.08 CLSM TEMPERATURE

A. CLSM Temperature at time of placement: 50 to 85 degrees F (10 to 30 degrees C).

PART 3 EXECUTION

3.01 BATCHING EQUIPMENT

A. Manufacture and deliver in accordance with ASTM C94. In addition to requirements of ASTM C94, use water meter approved by COR to measure and record mix water for each batch.

3.02 PREPARATION

A. Place pipe on soil pads or other approved material such as extruded polystyrene foam insulation or equal.

B. Soil pads shall maintain horizontal and vertical alignment during backfilling operations.

C. Do not create point loads on pipe:

1. Soil pads shall have lower compressible strength than surrounding CLSM.

3.03 PLACING

A. Notify COR at least 24-hours before batching CLSM. Include quantity of CLSM required for each daily placement. Unless inspection is waived, perform batching in presence of Government inspector.

B. Do not place CLSM during rain, snow, hail, or if excessive moisture is expected during placement.

C. Do not mix or place CLSM when ambient temperature is below 40 degrees F. Except when, ambient temperature is 35 degrees F and rising and daily high is predicted to be above 40 degrees F, CLSM may be placed, if approved by COR.

1. CLSM may be placed when ambient temperatures are below 40 degrees F if a Cold Weather Protection Plan has been approved prior to placement in cold weather.

D. Place CLSM to lines, grade, and dimensions shown on drawings:

1. Initially, place CLSM from one side of pipe. Where necessary, rod or vibrate CLSM so that CLSM flows under pipe and appears on other side.
2. Add CLSM evenly to both sides of pipe and rod or vibrate until CLSM completely fills space between pipe and trench.
3. Do not disturb pipe trench or allow foreign material to become mixed with CLSM.

E. Restrain pipe to prevent flotation during placement of CLSM per approved plan.

1. Do not point load pipe.

F. Do not place backfill material over CLSM until CLSM has reached initial set:

1. As determined by ASTM D6024 (ball drop test) in presence of OGR.
2. Do not place greater than 10-feet of backfill over pipe until CLSM has compressive strength of 50 lb/in^2 or greater.

G. Discharge CLSM within 2 hours of batching.

3.04 CONTRACTOR FIELD QUALITY TESTING

A. Testing:

1. Independent testing laboratory shall perform sampling, testing, and reporting:
   a. Independent testing laboratory shall meet requirements specified in Section 01 46 20 – Testing Agency Services.
   b. Government may inspect testing laboratory facilities. COR will notify testing facilities 72-hours before inspection. Periodic inspection may be required by COR.
2. Obtain samples and test to determine compressive strength in accordance with ASTM D4832 and slump in accordance with ASTM C143:
   a. Testing frequency:
      1) At least once for each shift when placing CLSM.
      2) Once every 100 cubic yards or,
      3) If consistency of materials change.
   b. Acceptance Criteria:
      1) 7-day compressive strength, ASTM D4832:
         a) Not less than 50 lb/in^2 and not more than 150 lb/in^2.
         b) 70 percent of test cylinders shall exceed 75lb/in^2.
   c. Make adjustments to mixture to comply with strength requirements.
   d. Stop work if specified requirements are not met.

3.05 FIELD QUALITY ASSURANCE

A. Government may obtain samples and test for compressive strength in accordance with ASTM D4832 and slump in accordance with ASTM C143.

3.06 PROTECTION

A. When subsequent lifts of CLSM are to be placed, maintain surface of CLSM in moist condition by use of tarps or water mist until subsequent lift of CLSM is placed.

B. If backfill will not be placed over CLSM within 8-hours, place 6-inch minimum cover of moist backfill over CLSM. Maintain moisture in 6-inch soil cover until additional backfill is placed.

C. If ambient temperature is forecast to be 50 degrees F or less within 8-hours of placing CLSM, place 12-inch minimum additional cover of loose backfill over 6-inch moist backfill cover before end of workday.

1. Do not allow CLSM to freeze.

END OF SECTION

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SECTION 31 24 18

GRAVEL DRAIN FOR WATER STORAGE TANKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C88/C88M-18	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
2.	ASTM C123/C123M-14	Lightweight Particles in Aggregate
3.	ASTM C127-15	Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
4.	ASTM C131/C131M-20	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
5.	ASTM C142/C142M-17	Clay Lumps and Friable Particles in Aggregates
6.	ASTM D4318-17e1	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.03 SUBMITTALS

A. Submit the following RSN in accordance with Section 01 33 00 – Submittals.

B. RSN 31 24 18-1, Laboratory Test Results:

1. Laboratory test results demonstrating gravel drain material meets Table 31 24 18A – Gravel Drain Material Gradation and Table 31 24 18B – Gravel Drain Material Requirements.

PART 2 PRODUCTS

2.01 GRAVEL DRAIN MATERIAL

A. Provide from commercial source.

B. Meet requirements specified in Table 31 24 18A – Gravel Drain Material Gradation and Table 31 24 18B – Gravel Drain Material Requirements.

Table 31 24 18A - Gravel Drain Material Gradation

U.S. Standard Sieve Size	Percent Passing by Weight
1/2-inch	100
3/8-inch	90 – 100
No. 4	20 – 55
No. 8	5 – 30
No. 16	0 – 10
No. 50	0 – 5

Table 31 24 18B - Gravel Drain Material Requirements

Item	Requirement	Reference Standard
Material passing No. 40 sieve	Non Plastic	ASTM D4318
Specific Gravity	Minimum 2.60	ASTM C127
Clay lumps and Friable Particles	Less than 1.0 percent by weight	ASTM C142
Loss due to Sodium Sulfate Soundness	Less than 10 percent	ASTM C88
Loss due to LA Abrasion	Less than 50 percent	ASTM C131
Chert	Less than 1.0 percent by weight	ASTM C123
Coal and Lignite	Less than 1.0 percent by weight	ASTM C123

C. Limestone or crushed/recycled concrete material sources are not allowed.

D. Material shall meet specified gradation requirements after fill placement and compaction.

PART 3 EXECUTION

3.01 COMPACTION EQUIPMENT

A. Walk-behind vibrating roller or tamper will be required for compaction of the gravel drain material.

3.02 PREPARATION OF FOUNDATION

A. Control water in all excavations before placing materials in accordance with Section 31 03 33 – Removal and Control of Water.

B. Conform to applicable requirements of Section 31 23 02 – Compacting Earth Materials.

3.03 MOISTURE CONTROL

A. Conform to applicable requirements of Section 31 23 02 – Compacting Earth Materials.

3.04 PLACING

A. Place in continuous, approximately horizontal layers not to exceed 6-inches in thickness after compaction.

B. Place material to lines, grades, and dimensions as shown on the drawings.

C. Minimize persons working on gravel drain material to prevent segregation, contamination, or breakdown of materials.

D. Control sloughing of any materials from excavated surfaces onto gravel drain material to minimize contamination.

E. Construction equipment is not allowed to travel directly on the HDPE geomembrane.

F. Place gravel drain material without damaging the HDPE geomembrane. See Section 31 32 36 – HDPE Geomembrane for Water Storage Tanks.

G. Damage to the HDPE geomembrane is sole responsibility of Contractor and shall be repaired immediately using approved repair techniques at Contractor's expense. See Section 31 32 36 – HDPE Geomembrane for Water Storage Tanks.

3.05 REQUIRED COMPACTION

A. Compact with four passes of walk-behind vibrating roller or tamper as approved by OGR. Compact in horizontal layers to compacted thickness of 6-inches.

B. Uniformly distribute effort.

C. Use caution when compacting gravel drain material within 2 feet adjacent to pipes.

3.06 PROTECTION

A. Protect material from erosion, contamination, excessive saturation, freezing, and surface drainage.

3.07 FIELD QUALITY ASSURANCE

A. Perform one test for every 6-inch layer (minimum of two tests total) to verify that gravel drain material meets gradation requirements in Table 31 24 18A – Gravel Drain Material Gradation, after compaction. Sample locations will be determined by OGR.

END OF SECTION

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SECTION 31 31 30
SOIL-APPLIED HERBICIDE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for Gravel Surfacing.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 31 30-1, Use Plan.

C. RSN 31 31 30-2, Applicator Certification.

1.03 QUALIFICATIONS

A. Applicators: Certified by appropriate Federal, State, Tribal, or local agencies, as required.

1.04 REGULATORY REQUIREMENTS

A. Comply with label directions, and applicable EPA, Federal, State, Tribal, or local laws and regulations.

PART 2 PRODUCTS

2.01 HERBICIDES

A. Label: EPA (Environmental Protection Agency) pesticide registration number.

B. Provide soil-applied herbicide conforming to one of the following:

1. Atrazine:

   a. Composed of a finely divided, wettable powder containing a minimum of 80 percent chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine and related compounds.

   b. Mix: Minimum of 2 gallons of water per pound of dry product.

2. Bromacil:

   a. Composed of a finely divided, wettable powder containing a minimum of 80 percent bromo-3-sec-butyl-6-methyluracil.

b. Mix: Minimum of 2 gallons of water per pound of dry product.

3. Prometon:

a. Composed of a liquid emulsifiable solution containing a minimum of 25 percent 2-methoxy-4, 6-bis isopropylamino-s-triazine.

b. Mix with water:

1) For small areas, add sufficient water to provide thorough and uniform coverage.

2) For large areas, add concentrate to 100 gallons of water per acre.

4. Commercial mixtures meeting requirements may be used.

PART 3 EXECUTION

3.01 PREPARATION

A. Apply herbicide after gravel surfacing has been placed.

3.02 APPLICATION

A. Apply herbicide to gravel surfacing placed under this section as directed by COR.

1. Select one herbicide from those specified.

2. Apply soil-applied herbicide at following rate:

a. Atrazine: Equivalent of 0.035 pound of dry product per 100 square feet (about 15 pounds per acre).

b. Bromacil: Equivalent of 0.035 pound of dry product per 100 square feet (about 15 pounds per acre).

c. Prometone: Equivalent of 0.017 gallon of herbicide concentrate per 100 square feet (about 7 1/2-gallons per acre).

B. Apply herbicide only with approval of COR.

C. Apply uniformly.

D. During application, continuously agitate suspension.

END OF SECTION

SECTION 31 32 36

HDPE GEOMEMBRANE FOR WATER STORAGE TANKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D792-20	Density and Specific Gravity (Relative Density) of Plastics by Displacement
2.	ASTM D1004-21	Tear Resistance (Graves Tear) of Plastic Film and Sheeting
3.	ASTM D1505-18	Density of Plastics by the Density-Gradient Technique
4.	ASTM D1603-20	Carbon Black Content in Olefin Plastics
5.	ASTM D3895-19	Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
6.	ASTM D4437-16(2018)	Non-Destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes
7.	ASTM D4833-07(2020)	Index Puncture Resistance of Geomembranes and Related Products
8.	ASTM D5323-19a	Determination of 2% Secant Modulus for Polyethylene Geomembranes
9.	ASTM D5397-20	Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
10.	ASTM D5596-03(2021)	Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
11.	ASTM D5617-04(2015)	Multi-Axial Tension Test for Geosynthetics
12.	ASTM D5721-08(2018)	Air-Oven Aging of Polyolefin Geomembranes

13.	ASTM D5820-95(2006)	Pressurized Air Channel Evaluation of Dual Seamed Geomembranes
14.	ASTM D5885-20	Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry
15.	ASTM D5994-10(2021)	Measuring Core Thickness of Textured Geomembrane
16.	ASTM D6497-02(2021)	Mechanical Attachment of Geomembrane to Penetrations or Structures
17.	ASTM D6693-20	Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
18.	ASTM D6706-01(2021)	Measuring Geosynthetic Pullout Resistance in Soil
19.	ASTM D7238-20	Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
20.	ASTM D7466-10(2015)e1	Asperity Height of Textured Geomembrane

B. Geosynthetics Research Institute Standards (GRI)

1.	GRI GM 13-2021	Test Methods, Test Properties, and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
2.	GRI GM 19- 2020	Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembrane/Barriers

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 32 36-1, Qualifications:

1. Installation company:
   a. Name and address.
   b. Documentation of previous experience with specified geomembrane:
      1) Project location, names of facility and owner(s), and purpose of completed facility.
      2) Contact person at facilities who can discuss projects listed, such as project manager or designer.

3) Geomembrane type and thicknesses, total square footage installed, and installation date.

4) Types of seaming and patching equipment used.

c. Installation personnel documentation of previous experience with specified geomembrane.

2. Manufacturer:

a. Name and address.

b. Name and address of panel fabricator, if different from manufacturer.

c. Documentation of previous experience with specified geomembrane:

1) Location, names of facility and owner(s), and purpose of completed facility.

2) Contact person at facilities who can discuss projects listed, such as project manager or designer.

3) Geomembrane type and thicknesses, total square footage installed, and installation date.

d. Descriptive documentation of manufacturer's quality control program.

C. RSN 31 32 36-2, Product Certificates, Test Reports, and Instructions:

1. Manufacturer's certification resin used in manufacture of HDPE geomembrane being furnished meets requirements of these specifications.

2. Quality control certificates issued by resin supplier.

3. Data and certification that project HDPE geomembrane and the extrusion welding rod or pellets produced have same properties and are compatible.

4. Manufacturer’s certified test results indicating that the physical properties tests and requirements listed in Table 31 32 36A – HDPE Geomembrane Physical Properties are met by the project geomembrane rolls.

5. Submit test results as specified in GRI GM 13. Include production date, lot and roll numbers, and quality control for project rolls.

6. Manufacturer’s Warranty.

7. Manufacturer's instructions for delivery, storage, and handling of geomembrane materials.

D. RSN 31 32 36-3, Geomembrane Installation Plan:

1. Work schedule, including number and size of crews.

2. Drawings and Panel Layout:

a. Location, size, orientation, and identification of panels and continuous seams.

b. Panel installation sequencing.

c. Location and details of geomembrane attachments to concrete structures.

d. Location of high point and low point of PVC pipe drain.

e. Location and details of geomembrane boots and pipe penetrations.

3. Equipment and procedures for:

a. Handling and installing panels.

b. Continuous seaming.

c. Geomembrane boots around penetrations.

d. Field testing adequacy of seaming equipment and seams.

e. Geomembrane attachment to concrete structures.

f. Cleaning, protecting, and repairing geomembrane and seams.

g. Wrinkle management.

4. Contractor's Quality Control (QC) Plan.

E. RSN 31 32 36-4, Construction:

1. Quality Control Test Results.

2. Surveyed panel layout drawings and deviations from panel layout drawings submitted as part of geomembrane installation plan.

3. Locations of patches, repairs, and destructive samples.

1.04 QUALIFICATIONS

A. Onsite Geomembrane Installation Supervisor:

1. Installed or supervised installation and seaming of a minimum of 1,000,000 square feet of specified geomembrane.

B. Onsite Geomembrane Master Welder (Seamer):

1. Within last 5 years, completed a minimum of 500,000 square feet of specified geomembrane seaming work using type of seaming apparatus proposed for use on this project.

2. Master welder (seamer) may also be installation supervisor/field engineer.

C. Other Onsite Geomembrane Welders (Seamers):

1. Within last 3 years, seamed a minimum of 100,000 square feet of specified geomembrane.

D. Geomembrane Manufacturer:

1. Completed facilities totaling at least 2,000,000 square feet of specified geomembrane.

E. Installer:

1. At least three separate and satisfactory installations totaling at least 1,000,000 square feet of the specified geomembrane.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ship, handle, store, and care for geomembrane in accordance with manufacturer's instructions.

B. Pack geomembrane rolls and panels in snug-fitting containers having smooth, abrasive-free interior to prevent damage to geomembrane during transit and handling:

1. Use containers with structural bottoms designed for lifting with forklift-type trucks or approved cables or slings.
2. Mark each container of geomembrane panels with name of material, approved roll good numbers, specifications number, quantity contained, name of Contractor, and order or purchase number.

C. Do not stack rolls more than 3 rolls high.

D. Cover rolls of geomembrane with tarp if onsite for more than 30-days.

E. Protect geomembrane rolls from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or cold, direct sunlight or other damage.

1.06 PROJECT ENVIRONMENTAL REQUIREMENTS

A. Do not perform field seaming when geomembrane is wet or when wind is displacing geomembrane panels.

B. Seam only when air temperature is above 35 degrees F and below 104 degrees F.

C. Expect wind and extreme temperature variations.

1.07 WARRANTY

A. Provide manufacturer’s warranty that HDPE geomembrane material is free of defects or failure for a period of 20-years.

PART 2 PRODUCTS

2.01 HDPE GEOMEMBRANE

A. HDPE Geomembrane:

1. 80-mil HDPE (High Density Polyethylene) Double Textured (textured on both sides) meeting requirements of GRI GM 13.
2. Stabilizers and biocides: Impart durability.
3. Pigment:

a. Carbon black to produce opaque film ranging from dark gray to black in color.

b. Disperse carbon black evenly to produce a uniform color.

4. Finish: Textured on both sides.

5. Roll edges: Smooth (non-textured) to facilitate seaming.

6. Uniform throughout and free from dirt, oil, foreign matter, scratches, cracks, creases, bubbles, tears, holes, pinholes, or other defects which may affect its serviceability.

7. Conform to requirements of Table 31 32 36A - HDPE-Geomembrane Physical Properties.

   a. Unless otherwise indicated, required values are minimum average values when tested in weaker principal direction.

   b. Test frequency in accordance with GRI GM 13.

8. Seam Strengths: 4 of 5 specimens must meet specified values.

   a. Fifth specimen must demonstrate 80 percent of listed value.

   b. Seam failure modes shall be Film Tear Bond (FTB).

Table 31 32 36A – HDPE-Geomembrane Physical Properties

Property	Test Method	Requirement
Thickness, minimum average Lowest individual, 8 of 10 readings Lowest individual of 10 readings	ASTM D5994	76 mils 72 mils 68 mils
Asperity Height[1]	ASTM D7466	10 mils
Sheet Density	ASTM D1505 ASTM D792	0.94 g/cc
Tensile properties[2]: Yield Strength Breaking Strength Yield Elongation Break Elongation	ASTM D6693	 168 lbs/inch 120 lbs/inch 12 percent 100 percent
Tear Resistance	ASTM D1004	56 lbs
Puncture Resistance	ASTM D4833	120 lbs
Stress Crack Resistance[3]	ASTM D5397	300 hours
Carbon Black Content[4]	ASTM D1603	2.0 to 3.0 percent
Carbon Black Dispersion	ASTM D5596	Note 5
Oxidative Induction Time (OIT) – Standard OIT	 ASTM D3895	 100 minutes
Oven Aging at 85°C High pressure OIT – Percent retained after 90 days	ASTM D5721 ASTM D5885	 80 percent
UV Resistance[6] High Pressure OIT – (Percent retained after 1600 hours)	ASTM D7238 ASTM D5885	 50 percent
Roll Dimensions Width Length Area Gross Weight		 23 feet 375 feet 8,625 square feet 3,470 lbs (approx.)

Notes:

1. Of 10 readings; 8 must be ≥ 7 mils and lowest individual reading must be ≥ 5 mils.
2. Machine direction (MD) and cross machine direction (XMD) average values should be based on 5 test specimens each direction. Yield elongation is calculated using a gauge length of 1.3-inches. Break elongation is calculated using a gauge length of 2.0-inches.
3. The yield stress used to calculate applied load for the SP-NCTL test should be the mean value via MQC testing.
4. Other methods such as ASTM D4218 or microwave methods are acceptable if an appropriate correlation can be established.
5. Carbon black dispersion for 10 different views. Nine in Categories 1 and 2 with one allowed in Category 3.
6. The condition of the test should be 20-hours UV cycle at 75 degrees C followed by 4-hours condensation at 60 degrees C.
7. UV resistance is based on percent retained value regardless of the original HP-OIT value.

2.02 HDPE-EMBEDMENT STRIP

A. HDPE-embedment strips (rondels) shall be 6-inch wide with anchor-fingers of 1-inch deep for embedment into the concrete structure/foundation (GSE PolyLock System or equal).

B. HDPE-embedment strips shall have a minimum tensile strength of 4,000 lb/in^2.

2.03 RUBBER GASKETS

A. Rubber gasket shall be type SCE-42 Neoprene/EPT/SBR Closed Cell Medium, 1/4-inch thick by 2-inch wide, with a hardness of 40 to 50 durometer, or solid Butyl Rubber Gasket meeting the same requirements.

2.04 STAINLESS STEEL CLAMPS

A. Stainless steel type 304 clamp, 1/8-inch thick by 1.5-inch wide.

2.05 FLEXIBLE POLYURETHANE SEALANT

A. Flexible polyurethane sealant with a hardness of 40 to 50 durometer, a minimum elongation of 500 percent, and a minimum joint movement of 30 percent (Sikaflex-1a or equal).

2.06 ACCESORIES

A. Other details in accordance with HDPE geomembrane manufacturer's recommendations.

2.07 SOURCE QUALITY ASSURANCE

A. OGR may inspect and obtain samples for testing during factory manufacture/fabrication at beginning of production and subsequently.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Prepare surface upon which HDPE geomembrane is to be placed to a firm surface, reasonably even and smooth, and free of abrupt indentations and protruding materials (offsets) greater than 3/4-inch.

B. Remove any objectionable foreign matter that may puncture HDPE geomembrane.

C. Obtain OGR approval of subgrade before installing HDPE geomembrane.

3.02 INSTALLATION

A. Install geomembrane in accordance with this Section, as shown on drawings, and in accordance with approved installation plan.

B. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).

C. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Do not smoke on the membrane.

D. Do not drive equipment on HDPE geomembrane.

E. Place protective cover on geomembrane in areas of heavy traffic.

F. Properly protect and maintain any completed geomembrane installations during periods of installation inactivity in accordance with approved installation plan.

G. Install geomembrane rolls with seams running up and down the slopes. Factory and field seams are not allowed perpendicular to the side slopes unless approved by OGR.

H. Place geomembrane in a slackened condition so it will conform to subgrade contour without being taut when covered with cover material.

I. Ballast to prevent relocation of compensating slack by wind and to prevent uplift by wind at edges, ends, and other locations as required.

J. Staking through geomembrane is not allowed.

K. Overlap adjacent sheets of geomembrane and shingle downstream.

L. Cover geomembrane as soon as possible after installation.

M. Damage to geomembrane is sole responsibility of Contractor and shall be repaired immediately using approved repair techniques at Contractor's expense.

N. Pre-fabricate complete HDPE-embedment strips (rondel) and attach to foundation structure before pouring foundation concrete. Prefabricated complete HDPE-embedment strips (rondel) will be composed of welded sections of HDPE-embedment strips, thereby eliminating any gaps between sections after concrete cures, as shown on drawing and in accordance with approved geomembrane installation plan.

O. Pre-fabricate HDPE pipe-penetration boots with welded seams as required in Section 3.03, in accordance with these specifications, as shown on drawings, with manufacturer's requirements, and in accordance with approved geomembrane installation plan.

P. Wrinkles:

1. Install geomembrane and cover materials so to minimize geomembrane wrinkles.
2. Cut-out and repair wrinkles or "fishmouths" in geomembrane and seams during coolest part of the day as determined by OGR before covering.
3. Install geomembrane and cover materials to achieve intimate contact (pressed fit) between subgrade, geomembrane and cover material.
4. Work geomembrane wrinkles upslope.
5. Install cover material over geomembrane during coolest part of the day or as approved by OGR.

3.03 FIELD SEAMS

A. Perform continuous field seaming in accordance with manufacturer's instructions, approved geomembrane installation plan and this Section.

B. Field seams shall form continuous, homogeneous connection between geomembrane panels.

C. Use dual-track hot wedge welds as primary field seeming method:

1. Use extrusion welds for patches and repairs where dual-track hot wedge welds are not possible.

D. Install and field seam geomembrane under direct guidance of geomembrane manufacturer's technical representative and in direct presence of installer's geomembrane installation supervisor/field engineer and/or master welder.

E. Ambient Conditions:

1. Do not perform field seaming when geomembrane is wet or when wind is displacing geomembrane panels.
2. Seam only when air temperature is above 35 degrees F and below 104 degrees F.

F. Contact surfaces to be field seamed shall be dry and thoroughly cleaned of all dirt, dust, grease, oil, and other foreign materials.

G. Where seaming of geomembrane panels is required to fabricate the connection between separate portions of geomembrane installation, Contractor shall remove any protective materials used, such as tape, and shall thoroughly clean geomembrane surface(s) to be seamed, using appropriate cleaning agents.

H. Joining adjacent panels:

1. Overlap geomembrane according to manufacturer's recommendations.
2. Fusion weld using only approved methods for primary field seaming method.
3. Finished overlap shall be a minimum of 4-inches, provided, that overlap is sufficient to allow peel tests to be performed on seam.
4. For cross seam tees associated with fusion welding: panel intersections consisting of three or more panels shall be patched and extrusion welded to a minimum distance of 6-inches on each side of the patch

I. Patching geomembrane:

1. Finished overlap shall be a minimum of 6-inches, provided, that overlap sufficient to allow peel tests to be performed on seam.
2. Use only rounded or oval patches.
3. Cut “fishmouths” or wrinkles along the ridge of the “fishmouth” (wrinkle) to achieve a flat overlap. Seam the cut “fishmouth” or wrinkle and patch any portion where the overlap is insufficient.

3.04 ATTACHMENT DETAILS

A. Attach geomembrane to HDPE-rondel (embedment strips) with welded seams as required in Article 3.03, these specifications, as shown on drawings, with manufacturer’s requirements, and in accordance with approved geomembrane installation plan.

B. No voids or spaces shall be left beneath the geomembrane where geomembrane attaches to concrete structures.

C. Attach geomembrane around existing pipe penetrations with geomembrane boots and using two stainless steel clamps, including a rubber gasket for each clamp, in accordance with drawings and manufacturer’s requirements.

D. Flexible polyurethane sealant shall be placed along the top edge of geomembrane boot and clamp attachment, as shown on drawings.

3.05 REPAIRS

A. Repair field seams and other damaged area according to manufacturer’s recommendations and as approved in geomembrane installation plan.

B. Repair geomembrane with oval or rounded patch, which overlaps undamaged geomembrane not less than 6-inches.

C. Test repairs using vacuum method.

D. Repair and retest unbounded areas detected by air pressure testing and by vacuum testing.

3.06 CONTRACTOR QUALITY CONTROL

A. Perform testing in presence of OGR.

B. Perform tests at locations and frequencies specified in this section and at other locations and times as determined by COR.

C. Test equipment:

1. Furnish a portable tensiometer with a load readout device.
2. Vacuum chamber (box): Apparatus manufactured by American Parts and Service Co., 2201 West Commonwealth Avenue, PO Box 702, Alhambra CA 91802, or equal, having the following essential characteristics:
   a. Vacuum box assembly consisting of rigid housing, transparent viewing window, and soft neoprene gasket attached to the bottom, port hole or valve assembly, and gauge to indicate chamber vacuum.
   b. Steel vacuum tank and pump assembly equipped with pressure controller and pipe connections.
   c. Rubber pressure/vacuum hose with fittings and connections.

D. Test seams:

1. Prepare test seams using excess geomembrane material to verify that field seaming conditions are satisfactory.
2. Conduct test seams at the beginning of each seaming shift, at a change of weather conditions, and at least once each 4-hour period during operation for each seaming crew.
3. If a test seam fails to meet seam specifications listed in Table 31 32 36A – HDPE-Geomembrane Physical Properties, seaming apparatus and seaming crew shall not be accepted and shall not be used for field seaming until deficiencies are corrected and two consecutive successful test seams have been achieved.
4. Test seam shall be at least 3 feet in length with seam centered lengthwise.
5. Specimens for testing:
   a. One-inch-wide specimens cut from opposite ends of test seam.
   b. Not obtained from first or last 6-inches of test seam.
6. Test five specimens in shear and five specimens in peel in accordance with GRI GM 19.

E. Destructive Test for Field Seams:

1. Remove 12-inch by 36-inch samples at locations selected by COR, or when conditions indicate concern for integrity of field seams:

   a. Standard testing frequency shall be every 500 linear feet of seam length or at a minimum one sample per day. Testing frequency may be increased or decreased at discretion of OGR depending on results of Destructive Tests.

   b. Repair resulting holes in geomembrane with rounded patches and vacuum test.

2. Take 1/3 of Destructive Test sample for Contractor testing. Test 5 shear and 5 peel specimens taken at random from each sample for conformance to values listed in Table 31 32 36A - HDPE-Geomembrane Physical Properties.

3. Overnight mail remaining 2/3 of Destructive Test sample for OGR testing and archiving to Bureau of Reclamation, Attn: Code 86-68314, Sixth and Kipling, Building 67, Denver CO 80225.

F. Air Pressure Test for dual-track hot wedge welds:

1. Dual-track hot wedge welds shall be non-destructively tested, evaluated and approved in accordance with ASTM D5820.

2. Demonstrate procedure for air pressure testing to OGR for approval before testing begins.

3. Test Procedures:

   a. Pressurize channel between the dual-track hot wedge welds.

   b. Minimum channel Pressure: 30 psi.

   c. Minimum Dwell time: 5-minutes.

   d. Allowable pressure drop: 2 psi.

G. Vacuum testing:

1. Non-destructive test extrusion weld seams by vacuum method in accordance with ASTM D4437.

2. Demonstrate procedure for vacuum seam testing to Government for approval before testing is begun.

3. Test procedures:

   a. Perform vacuum test with soapy solution.

   b. Maintain at least 5 psi vacuum for at least 15 seconds, without bubbles appearing from seam.

   c. Overlap 3-inches of seam with vacuum box between tests to ensure that all sections of seam are tested.

H. Recording Results:

1. Record results of test seam and field seam testing and provide daily documentation to OGR at end of each shift.
2. Identify field seams, by panel and location where applicable, that initially failed seam testing.
3. Include evidence that field seams or welding equipment were repaired and successfully retested.

I. Do not work above geomembrane layer until:

1. Testing is completed and approved.
2. OGR has approved work to begin.

END OF SECTION

SECTION 31 37 00
RIPRAP

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Riprap:

1. Measurement: Volume installed, or as directed by COR.
2. Payment: Unit price of cubic yard offered in Price Schedule 2.
   a. Includes:
      1) Riprap associated with San Juan Lateral Water Treatment Plant Regulating Tank Site.
      2) Geotextile.
   b. Does not include:
      1) Toe rock for Wash Crossing Bank Protection.
      2) Corrugated Metal Pipe Culvert.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C33-18	Concrete Aggregate
2.	ASTM C88/C88M-24	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
3.	ASTM C97/C97M-18	Absorption and Bulk Specific Gravity of Dimension Stone
4.	ASTM C150-18	Portland Cement
5.	ASTM C260-17	Air-Entraining Admixtures for Concrete
6.	ASTM C494-19	Chemical Admixtures for Concrete
7.	ASTM C535-16(2024)	Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
8.	ASTM C1017-13	Chemical Admixtures for Use in Producing Flowing Concrete
9.	ASTM C1602-18	Mixing Water Used in the Production of Hydraulic Cement Concrete

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 37 00-1, Approval Data and Test Results:

1. Name and location of commercial rock source.
2. Gradation of rock used for riprap.
3. Certified laboratory test results demonstrating rock meets specified material requirements.

PART 2 PRODUCTS

2.01 ROCK

A. Rock from approved sources shall be excavated, selected, and processed to meet specified quality and grading requirements at the time rock is installed.

B. Consist of hard, dense, durable stone, angular in shape and resistant to weathering to ensure permanence in structure and climate in which it is used.

C. Riprap physical properties:

1. Specific Gravity, ASTM C97, Minimum: 2.50.
2. Absorption, ASTM C97, Maximum: 2 percent.
3. Loss, Sulfate Soundness, ASTM C88, Maximum: 10 percent.
4. Percent wear of not more than 60 as determined by ASTM C535.

D. Rounded stone or boulders shall not be used as riprap material.

E. Individual rock shape:

1. Maximum dimension not greater than 3 times minimum dimension.

F. Conform to gradation requirements given in Table 31 37 00A – Riprap Gradation Requirements. Control of gradation will be by visual inspection.

Table 31 37 00A – Riprap Gradation Requirements

Riprap Type	Stone Size D_{50} (Inches)	Typical Stone Dimensions (Inches)	Percent of Material Smaller than Typical Stone Size by Weight
Type VL	6	12 9 6 2	100 50 - 70 35 - 50 2 - 10
Type L	9	15 12 9 2	100 50 -70 35 - 50 2 – 10
Type H	18	30 24 18 6	100 50 -70 35 - 50 2 – 10

2.02 GEOTEXTILE

A. Geotextile material in accordance with Section 32 15 10 – Gravel Surfacing.

B. Place geotextile as shown on drawings.

PART 3 EXECUTION

3.01 AREAS TO RECEIVE RIPRAP

A. Clear vegetation/debris from placement area.

B. Place riprap to thicknesses as shown on drawings or a minimum of 1.5 times the D_{50} stone size.

C. Place riprap:

1. Type VL: On fill slopes 3:1 (H:V) or steeper at the San Juan Lateral Water Treatment Plant Regulating Tank Site,
2. Type H: As shown on drawings for wash crossing bank protection, or
3. Type L: As shown on drawings for corrugated metal pipe culvert.

3.02 PLACING

A. Bed riprap on geotextile as shown on drawings.

B. Rock in riprap need not be hand placed or compacted.

C. Begin riprap placement at toe of slope and proceed up slope.

D. Rock drop height, maximum: 1-foot.

E. Dump/drop rocks and smooth by moving rocks into position so material is stable when in place.

F. Place rocks so larger rocks are evenly distributed, and small rock fragments fill spaces:

1. Include rock spalls or gravel in an amount to fill voids in riprap, but not more than an amount to be determined by COR.

G. Before placing riprap, demonstrate that placing technique will not damage geotextile:

1. If demonstration does not show riprap can be installed without damaging geotextile materials, modify riprap placing technique.
2. Possible modifications to placing technique include reducing drop height, installing layer of sacrificial geotextile, or installing gravel cushion.

H. Leave no unreasonable large unfilled spaces within riprap.

END OF SECTION

SECTION 32 12 22
ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Asphalt Concrete Pavement:

1. Measurement: Volume measured in place to lines, grades, and dimensions as shown on drawings or directed by OGR.
2. Payment: Cubic yard price offered in the Price Schedules.
   a. Includes:
      1) Tack coat.

B. Cost:

1. Include in unit prices offered in the Price Schedules for applicable Line Pipe:
   a. Includes:
      1) Compacted backfill.
      2) CLSM.

1.02 REFERENCE STANDARDS

A. New Mexico Standard Specification (NMDOT)

1. NMDOT – 2019 Standard Specification for Highway and Bridge Construction

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 32 12 22-1, Job Mix Formula (JMF):

1. Comply with NMDOT Specification Section 417.2.4 – Job Mix Formula.

PART 2 PRODUCTS

2.01 TACK COAT

A. Comply with NMDOT Specification Section 417.2 – Materials.

2.02 ASPHALT

A. Comply with NMDOT Specification Section 417.2.2 – Asphalt.

2.03 RECLAIMED ASPHALT PAVEMENT (RAP)

A. Comply with NMDOT Specification Section 417.2.3 – RAP.

2.04 AGGREGATE

A. Comply with NMDOT Specification Section 417.2.1 – Aggregate.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. In accordance with NMDOT Specification Section 417.3 – Construction Requirements.

3.02 MAINTENANCE

A. Maintain paved areas until acceptance of work by Government.

END OF SECTION

SECTION 32 15 10
GRAVEL SURFACING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Gravel Surfacing:

1. Measurement: Volume measured in place to lines, grades, and dimensions shown on drawings or directed by OGR.
2. Payment: Square yard price offered in Price Schedules.
   a. Includes:
      1) Geotextile.
      2) Herbicide.

B. Cost: Include excavation costs in applicable bid item listed in the Price Schedules.

1.02 REFERENCE STANDARDS

A. American Association of State Highway Transportation (AASHTO):

1.	AASHTO T 26-08	Test for Quality of Water to Be Used in Concrete

B. ASTM International (ASTM)

1.	ASTM D4632/D4632M-15a (2023)	Grab Breaking Load and Elongation of Geotextiles
2.	ASTM D4751-21a	Determining Apparent Opening Size of a Geotextile
3.	ASTM D6241-22a	Static Puncture Strength of Geotextiles and Geotextile-related Products Using a 50 mm Probe

C. New Mexico State Department of Transportation (NMDOT)

1.	NMDOT SS 2019	Standard Specifications for Highway and Bridge Construction

1.03 GENERAL

A. Place gravel surfacing at the following locations as shown on drawings:

1. San Juan Lateral Water Treatment Plant Regulating Tank Site.

2. Access Road.
3. Restoring existing gravel roads after Line Pipe installation.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 32 15 10-1, Gravel Certification:
1. Gravel gradation range with percent passing by weight of respective sieve sizes.
2. Representative 300-lb (150 kg) sample.

C. RSN 32 15 10-2, Geotextile Installation:
1. Manufacturer's recommendation.

D. RSN 32 15 10-3, Geotextile Certification:
1. Geotextile meets specified requirements.

PART 2 PRODUCTS

2.01 GRAVEL

A. NMDOT SS Table 303.2.2:2 – Type II Base Course Gradation Band.

B. NMDOT SS Table 303.2.2:3 – Base Course Physical Properties.

C. Limestone or crushed/recycled concrete material sources are not allowed.

2.02 WATER

A. In accordance with AASHTO T 26 and Section 01 51 00 – Temporary Utilities.

B. Do not use residual water, wash water, or recycled water generated by equipment, mixer trucks, or central mixers.

2.03 GEOTEXTILE

A. 170N non-woven geotextile, manufactured by Mirafi, www.tencate.com or equal with the following essential characteristics:
1. Grab Tensile Strength (ASTM D4632): 180 pounds (lbs).
2. Elongation (ASTM D4632): 50 percent.
3. Puncture Strength (ASTM D6241): 400 lbs.
4. Apparent Opening Size (ASTM D4751): 70 US Sieve size.

PART 3 EXECUTION

3.01 PREPARATION AND EXCAVATION

A. Clear surface of loose and deleterious material.

B. Ensure top 6 inches of roadbed is free from depressions and soft spots.

C. Excavate limits shown on the drawings or as determined by COR.

D. Excavate in dry conditions.

E. Remove unsuitable or unstable material below finished subgrade.

F. Finish subgrade to smooth and uniform surface.

G. Obtain Government approval of subgrade prior to placing gravel surfacing.

3.02 PLACING GEOTEXTILE

A. As directed at locations shown on drawings, or as determined by COR.

B. Place in accordance with manufacturer's recommendations.

C. Do not tear geotextile during placement and compaction of gravel surfacing.

3.03 PLACING AND COMPACTING GRAVEL

A. At locations shown on drawings, or as determined by COR.

B. Place in layers and compact in accordance with Section 31 23 02 – Compacting Earth Materials.

C. Route hauling equipment uniformly over full width of surface to minimize rutting or uneven compaction.

3.04 DISPOSAL

A. Dispose of excess and unsuitable materials in accordance with Section 31 23 39 – Disposal of Excavated Waste Materials.

END OF SECTION

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SECTION 32 31 10
CHAIN LINK FENCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Chain Link Fence:

1. Measurement: Horizontal length from centerline to centerline of posts:
2. Payment: Linear foot priced offered in Price Schedule 2.
   a. Includes:
      1) Design and installation of fence, gates, fence posts, rails, fabric, ground connections, and accessories for complete installation.
      2) Excavation, backfill and concrete for fence post footings.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A121-22	Metallic-Coated Carbon Steel Barbed Wire
2.	ASTM A392-11a(2022)	Zinc-Coated Steel Chain-Link Fence Fabric
3.	ASTM A824-01(2017)	Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence
4.	ASTM F567-14a(2019)	Installation of Chain-Link Fence
5.	ASTM F626-14(2019)	Fence Fittings
6.	ASTM F900-11(2017)	Industrial and Commercial Swing Gates

B. Chain Link Fence Manufacturers Institute (CLFMI)

1.	CLFMI PM0610-2017	Product Manual, available at: http://www.chainlinkinfo.org/

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 32 31 10-1, Certification:

1. Manufacturers' certification that fence materials, fittings, and accessories meet specified requirements.
2. Include manufacturers' names and product designations and specified product standards in the certification.

1.04 PERFORMANCE REQUIREMENTS

A. In accordance with Standarad Drawing 40-D-7016.

PART 2 PRODUCTS

2.01 CHAIN LINK FABRIC

A. Zinc-Coated Steel Fabric: ASTM A392:

1. Size of mesh: 2-inch.
2. Coat before weaving.
3. Diameter of coated wire: 0.148-inch (No. 9-gauge).
4. Coating weight: Class 1.

2.02 INTERMEDIATE POSTS

A. CLFMI 2445, Type I round pipe.

2.03 TERMINAL POSTS, BRACES, AND RAILS

A. CLFMI 2445, Type I round pipe.

2.04 TENSION WIRE

A. Zinc-coated Steel Marcelled Tension Wire: ASTM A824.

1. Coating: Type II, Class 4.

2.05 BARBED WIRE

A. Steel Barbed Wire: ASTM A121:

1. Coating: Type Z, Class 3.
2. Design Number: 12-2-4-14R.

2.06 FITTINGS

A. Post and Line Caps, Rail and Brace Ends, Braces, and Bands: ASTM F626, zinc-coated steel or zinc-coated cast iron.

B. Toprail Sleeves, Tension Bars, and Truss Rods: ASTM F626, zinc-coated steel.

C. Tie Wires, Clips, and Bands: ASTM F626:

1. Standard round wire ties:
   a. Nine gage steel.

b. Zinc coating, minimum: 1.2 ounces per square foot.

D. Barbed wire arms: ASTM F626, Type I.

2.07 GATES

A. Gates: ASTM F900:

1. Vehicle Access:

a. Double-swing type.

b. Directions of swing: 180 degrees inward opening.

B. Frame: CLFMI 2445, Type I round pipe:

1. Corners:

a. Welded or heavy fittings.

b. Rigid and watertight.

C. Fabric: Same type used in fence.

D. Accessories:

1. ASTM F900.

2. Gate hinges, latches, stops, and keepers: Zinc-coated steel or zinc-coated cast iron.

2.08 MISCELLANEOUS METALWORK

A. Plates, bars, adhesive anchors, expansion anchors: In accordance with Section 05 50 00 – Metal Fabrications.

2.09 CONCRETE

A. Manufacture and delivery: In accordance with Section 03 30 00 – Cast-In-Place Concrete.

B. Fine and coarse aggregates: ASTM C33:

1. Coarse aggregate size, maximum: 3/4-inch.

C. Compressive strength at 28-days, minimum: 2,500 pounds per square inch.

PART 3 EXECUTION

3.01 PREPARATION

A. Clear and remove trees, brush, ground surface irregularities, and other obstacles which interfere with erection of fence in advance of starting fencing work.

B. Dispose of removed material in accordance with Section 31 11 00 – Clearing and Grubbing.

3.02 INSTALLATION

A. Erect chain link fence and gates at locations shown on drawings.

B. Install chain link fences of heights shown on drawings:

1. Fence heights indicated on the drawings are the fence fabric height required, excluding barbed wire arms and barbed wire attachement.

C. Install fence and gates as shown on drawings, complete with fabric, posts, braces, rails, 3-strand barbed wire, fittings, accessories, concrete footings, and other materials required for complete installation of the fence and gates.

D. Install chain link fence in accordance with ASTM F567 and CLF PM0610, except as shown on the drawing or specified.

E. Terminal Posts:

1. Maximum intervals: 500-feet.
2. At vertical and horizontal changes in alignment equal to or greater than 30 degrees.

3.03 GROUND CONNECTIONS

A. Provide ground connections for fence and gate in accordance with Section 26 05 20 – Grounding and Bonding.

3.04 REPAIR

A. Repair damage to zinc coatings in accordance with Section 09 96 20 – Coatings.

3.05 TESTING AND ADJUSTING

A. After installation, test and adjust gates for proper operation.

END OF SECTION

SECTION 32 91 60
EROSION CONTROL BLANKET

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Erosion Control Blanket:

1. Measurement: Surface area required to be covered, except no allowance will be made for overlaps, repairs, or waste.
2. Payment: Square yard prices offered in Price Schedules:
   a. Includes:
      1) Erosion Control Blanket Anchors.
      2) Coir Wattles.
      3) Surface Flow Diversion Berms.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO))

1.	AASHTO T310-13	Standard Method of Test for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
2.	AASHTO T99-15	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. ASTM International (ASTM)

3.	ASTM D698-12e2	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-.bf/ft^3)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 32 91 60-1, Manufacturer's Information:

1. Literature listing specified essential characteristics.
2. Installation instructions.

PART 2 PRODUCTS

2.01 EROSION CONTROL BLANKET

A. AEC Premier Coconut erosion control blanket, as manufactured by American Excelsior Company, 850 Avenue H East, Arlington TX, telephone: 800-777-7645; or equal, having the following essential characteristics:

1. Machine-assembled mat with 100 percent aspen or coconut excelsior within 2 layers of netting stitched to form a 3-dimensional matrix:
   a. Netting: Jute or other natural biodegradable fiber.
2. Consistent thickness with aspen or coconut excelsior curled, interlocked, and evenly distributed over entire area of mat.
3. Excelsior Color: Sand.
4. Unit Weight: 8 ounces per square yard.
5. Thickness, Minimum: 1/2-inch.
6. Thread Pattern: 4-inch wide by 4-inch long.

B. Supply blanket in protected, rolled mat form.

2.02 EROSION CONTROL BLANKET ANCHORS

A. Biodegradable staples, 6-inch minimum length, as recommended by manufacturer.

2.03 COIR WATTLES

A. BioD-Watl 9, as manufactured by Rolanka International, 155 Andrew Drive, Stockbridge, GA 30281, telephone: 770-506-8211; or equal, having the following characteristics:

1. 100% coconut fiber filler material in cylindrical shaped rolls with 2-inch by 2-inch high strength outer netting made of 60-lbs. strength machine spun bristle coir twines.
2. Unit Weight: 1.5 lb/ft.
3. Density: 3.4 lb/cu ft.
4. Diameter: 9-inch.
5. Length: 15-feet.

PART 3 EXECUTION

3.01 EROSION CONTROL BLANKET INSTALLATION

A. Site Preparation:

1. Compact bank line excavated for pipe trench backfill beneath erosion control blanket bank protection:
   a. Compact to 85 percent of maximum density obtained in accordance with Section 31 23 02 – Compacting Earth Materials.
2. Remove large, sharp objects which include but are not limited to rocks, cut trees, roots, shrubs, glass that may damage erosion control blanket.
3. Grade wash crossing bank slope to the natural topography prior to pipe installation.

B. Erosion Control Blanket:
1. Install erosion control blanket on ground surface slopes steeper than 2.5:1, at locations shown on drawings or as directed by OGR.
2. At overlaps, shingle upstream matting over downstream matting.
3. Secure topsoil erosion control matting in a 6- by 6-inch anchor trench at top and bottom of berms and at upstream and downstream ends of mats.
4. Before backfilling anchor trenches, pin or staple erosion control blanket into anchor trench with no more than 12-inch spacing.
5. Outside anchor trench, anchor topsoil erosion control matting with 3 to 4 staples per square yard.
6. No vehicular traffic shall be permitted directly on erosion control blanket.

3.02 COIR WATTLE INSTALLATION

A. Anchoring system: Adequate to seat coir wattle securely in contact with adjacent ground:
1. Place coir wattles on upslope side of ground surface slopes steeper than 2.5:1, at locations shown on drawings, or as directed by OGR.
2. Minimum 1-foot overlap between adjoining wattles.
3. Crisscross pair of wooden construction stakes through coir wattle as shown on drawings, minimum every 2 feet.

B. To form continuous unit, coir wattles can be tied together end-to-end or overlapped at joints:
1. Use strong synthetic rope to stitch ends together, with knots tied at frequent intervals to ensure reliable connection.
2. Alternatively, ensure ends of rolls overlap by a minimum of 1-foot, using two wooden stakes at all roll ends and joints.

3.03 SURFACE FLOW DIVERSION BERM INSTALLATION

A. Install surface flow diversion berms on ground surface slopes steeper than 2.5:1, at locations shown on drawings, or as directed by OGR.

3.04 REPAIR

A. Repair or replace products damaged during installation at Contractor's expense.

END OF SECTION

SECTION 32 92 20
SEEDING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Seeding:

1. Measurement: Area of surface disturbance seeded, or as determined by OGR.
2. Payment: Acre price offered in Price Schedules.

1.02 DEFINITIONS

A. Pure live seed content: Weight of seed times percent purity times percent germination.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 32 92 20-1, Seeding Plan:

1. Method and equipment used for seeding.
2. Date for seeding.
3. Mulch type and application equipment.
4. Qualifying experience of person responsible for supervision of seeding, and approval.
5. Names, addresses, and telephone numbers of references.
6. Name and address of seed suppliers.

C. RSN 32 92 20-2, Certifications:

1. Origin of seed.
2. Percent purity and germination.
3. Prohibited and restricted weed seed content.

1.04 DELIVERY STORAGE AND HANDLING

A. Seed Containers:

1. Sealed.
2. Labeled:
   a. Identify seed origin on label:

1) Intrastate shipping: In accordance with New Mexico State Seed Laws and Regulations.

2) Interstate shipping: In accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.

1.05 AMBIENT CONDITIONS

A. Do not seed when ambient temperature is below 38 degrees F without approval of OGR.

B. Do not seed when ground is snow covered or frozen.

C. Do not seed, mulch, or hydroseed when wind velocities prevent uniform application of materials or would drift materials.

PART 2 PRODUCTS

2.01 SEED

A. Weed seeds classified by State Seed Department:

1. Prohibited noxious weeds: None allowed.
2. Restricted noxious weeds: 0.5 percent maximum by weight.

B. Seed Mixture:

1. Purity, minimum: 85 percent.
2. Germination, minimum: 85 percent.
   a. Germination test: Less than 1-year old at time of seeding.
3. Uniform mixture shown in Table 32 92 20A – Seed Mixture.
4. Uniform mixture shown in Table 32 92 20B – Secondary Seed Mixture for Mesa Verde Cactus Habitat Area from Station 2163+00 to Station 2052+00 or as directed by COR.
5. Seed in accordance with Section 51 00 35 – Site Specific Revegetation Plan for Navajo-Gallup Water Supply Project and this section.

Table 32 92 20A – Seed Mixture

Common Name	Scientific Name	Cultivar	Seeding Rate (Pounds pure live seed per acre)
Sterile triticale	Triticum aestivum X Secale cereale 'Quickguard'	VNS	2.0
Fourwing saltbush	Atriplex canescens	VNS	3.0

Shadscale			
Winterfat	Krascheninnikovia lanata	VNS	2.0
Indian ricegrass	Achnatherum hymenoides	Paloma or Rimrock	3.0
Western wheatgrass	Pascopyrum smithii	Arriba	2.0
Galleta	Pleuraphis jamesii	Viva or Florets	2.0
Purple threeawn	Aristida purpurea	VNS	2.0
Sand dropseed	Sporobolus cryptandrus	VNS	0.25
Alkali sacaton	Sporobolus airoides	VNS	0.25
Scarlet globemallow	Sphaeralcea coccinea	VNS	0.25
Narrowleaf penstemon	Penstemon angustifolius	VNS	0.25
Rocky Mountain beeplant	Cleome serrulata	VNS	0.25
Hairy false goldenaster	Heterotheca villosa	VNS	0.25
Shadscale	Krascheninnikovia lanata	VNS	2.0

Table 32 92 20B – Secondary Seed Mixture for Mesa Verde Cactus Habitat

Common Name	Scientific Name	Cultivar	Season	Form	Seeding Rate* (Pounds pure live seed per acre)
Mat saltbush	Atriplex corrugata	VNS	-	Shrub	2.0
Winterfat	Krascheninnikovia lanata	VNS	Cool	Subshrub	2.0
Indian ricegrass	Achnatherum hymenoides	Paloma or Rimrock	Cool	Bunch	2.0
Galleta	Pleuraphis jamesii	Viva or florets	Warm	Bunch/Sod	2.0
Purple threeawn	Aristida purpurea	VNS	Warm	Bunch	2.0
Sand dropseed	Sporobolus cryptandrus	VNS	Warm	Bunch	0.25
Scarlet globemallow	Sphaeralcea coccinea	VNS	Warm	Forb	0.25
Narrowleaf penstemon	Penstemon angustifolius	VNS	Cool	Forb	0.25
Rocky Mountain beeplant	Cleome serrulata	VNS	Warm	Forb	0.25
Sand verbena	Abronia villosa	VNS	Warm	Forb	0.50

* Based on 60 pure live seeds (PLS) per square foot, drill seeded. Double this rate (120 PLS per square foot) if broadcast or hydroseeded.

2.02 STRAW MULCH

A. Wheat or barley straw.

B. Free of mold or other evidence of decomposition.

C. Free from weed seed.

2.03 HYDROMULCH

A. Mat-Fiber Plus, manufactured by Mat Inc.,12402 Hwy 2, Floodwood, MN 55736, 1 888 477-3028; Spray Mulch X-80 manufactured by Pacific Wood Fibers, PO Box 2109, Redmond WA 98052; or equal, having the following essential characteristics:

1. Wood cellulose fiber.
2. No germination or growth inhibiting factors.
3. Dyed appropriate color to allow visual metering of application.
4. Evenly dispersed and suspended when agitated in water.
5. Forms blotter like ground cover that readily absorbs water and allows infiltration to underlying soil.

2.04 TACKIFIER

A. Mixture of at least three specially blended compatible hydrocolloids:

1. One hydrocolloid will act as a slippery agent during suspension.
2. Will form loose, long-chain-like film on drying
3. No growth or germination inhibiting factors.
4. Hydrates and disperses in circulating water to form homogeneous slurry.
5. Equilibrium air dry moisture content at time of manufacture of 8 percent, ±2 percent.
6. Minimum water holding capacity: 6 1/2 times weight of dry material.

PART 3 EXECUTION

3.01 SEEDBED PREPARATION

A. Complete prior to seeding, and mulching or hydromulching:

1. Rip, till, and disc compacted areas to create suitable medium for reseeding prior to spreading topsoil.

2. Respread topsoil and scarify or harrow and rake topsoil to minimum depth of 3-inches.
3. Remove stiff clods, lumps, roots, litter, stones, and other foreign material greater than 6-inches in size from surface.
4. Dispose of removed materials in accordance with Section 01 74 00 – Cleaning and Waste Management.
5. Fill or smooth topsoil surface to remove rills, gullies, and depressions.
6. Protect prepared topsoil surfaces from erosion and washouts. Repair damaged surfaces as required.

3.02 SEEDING APPLICATION

A. Seeding in Project Areas:

1. Apply seed and mulch by one of the following methods:
   a. Broadcast seeding followed by mulching or hydromulching.
   b. Drilling seed followed by mulching or hydromulching.
   c. Hydroseeding.
2. Apply seed mixture at rate specified in applicable Table 32 92 20A – Seed Mixture. Double rate of seed application if broadcast seeding.
3. Seed between July 15 and November 15.

B. Seeding Under Erosion Control Blanket:

1. Prior to placing erosion control blankets apply seed mixture at rate specified in Table 32 92 20A – Seed Mixture. Double rate of seed application if broadcast seeding.
2. Seed between July 15 and November 15.

3.03 BROADCAST SEEDING

A. Broadcast seed only in areas not accessible for drilling or hydroseeding.

B. Mechanical Broadcasting:

1. Equipment: Centrifugal type.
2. Designed and regulated to apply seed uniformly at proper rate per acre.

C. Hand Broadcasting:

1. By hand broadcaster.
2. By hand.
3. Uniformly applied.

D. Cover seed with soil to depth of 1/4-inch to 1/2-inch immediately after broadcasting:

1. Use hand rake or float.
2. Do not use log chain or similar devices.

3.04 DRILLING SEED

A. Drill:
1. Disc-type seed drill.
2. Space rows 1-foot or less apart.
3. Perform on contour, perpendicular to slopes to minimize runoff, rilling, and erosion.

B. Regulate drill to uniformly distribute seed at rate specified in Table 32 92 20A – Seed Mixture and at proper seed depth:
1. Smaller seed depth: 1/4- to 1/2-inch.
2. Larger seed depth: 1- to 2-inches.

3.05 MULCHING

A. Certified weed-free straw or native grass hay.

B. Spread and crimp within 24-hours of seeding.

C. Rate: 1 to 2 tons/acre uniformly spread

D. Anchor with threader:
1. Operate crosswise to slope.
2. Depth: 3- to 4-inches.
3. Interval: 6- to 12-inches across slope.

3.06 HYDROSEEDING AND HYDROMULCHING

A. Slurry:
1. Mix to keep homogeneous.
2. Ingredients:
   a. Water.
   b. Tackifier.
   c. Seed.
   d. Wood cellulose fiber mulch:
      1) Rate: 4,000 pounds per acre at 10 percent moisture content.
      2) Add to water slurry after seed.
3. Maximum time between batching slurry and application: 1-hour.

B. Spray apply slurry mix uniformly.

C. Use mulch coloring as metering agent.

END OF SECTION

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SECTION 33 05 21
BORED CROSSINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Bored Crossings:

1. Measurement: Length of bored crossings with Casing Pipe installed.
2. Payment: Linear foot prices offered in Price Schedules.
   a. Casing Pipe and installed components.
   b. Associated earthwork, support elements, and disposal of excess excavated material.

B. Cost:

1. Include cost of carrier pipe in prices offered in Price Schedules for items of work requiring Carrier Pipe (line pipe).

1.02 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1.	AASHTO M133-08	Preservatives and Pressure Treatment Processes for Timber

B. American Society of Civil Engineers (ASCE)

1.	ASCE/CI 27-17	Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction
2.	ASCE MoP 106-2017	Horizontal Auger Boring Projects, 2nd Edition
3.	ASCE MoP 133-2017	Pilot Tube and Other Guided Boring Methods

C. ASTM International (ASTM)

1.	ASTM A1097-16	Steel Casing Pipe, Electric-Fusion (Arc)-Welded (Outside Diameter Of 10 In. and Larger)

D. American Water Works Association (AWWA)

1.	AWWA C200-17	Steel Water Pipe 6-in (150 mm) and Larger

E. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions posted at: https://www.usbr.gov/safety/rshs/index.html

F. Western Wood Products Association (WWPA)

1. WWPA G5-21 — Western Lumber Grading Rules

1.03 DEFINITIONS

A. Bored Crossing:

1. Pressurized or partially full pipeline(s) and utilities crossing under surface obstructions such as roadways, railroads, or waterways using trenchless boring installation methods such as jack-and-bore, auger boring, guided auger boring, and pilot tube guided boring.
2. Does not apply to non-boring trenchless crossing methods including pipe jacking, pipe ramming, utility moling or piercing, horizontal directional drilling (HDD), microtunneling, or bore-and-jack.

B. Over-boring Space: Void space between excavated hole diameter and outside of Casing Pipe created during excavation or installation processes.

C. Annular Space:

1. Void space between outside of Carrier Pipe and inside of Casing Pipe.
2. Use space to facilitate installation of Carrier Pipe with spacers/runners.

D. Line Pipe: Adjacent segments of pipe outside extents of bored crossing as shown on drawings.

E. Casing Pipe:

1. Larger diameter pipe installed in bored hole to facilitate Carrier Pipe installation, support the ground for construction, and permit future repair/replacement if necessary.
2. Casing Pipe does not convey water.

F. Carrier Pipe: Smaller diameter pipe usually installed inside Casing Pipe which conveys water.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 05 21-1, Material Certification:

1. Certification signed by material producer and Contractor that material complies with specified requirements.
2. Drill Fluid and Additives details and manufacturer data sheets for proposed drill fluid mixture, if used. Include the following minimum details:
    a. Percent concentration of each component in proposed drill fluid mixture.
    b. Control Plan for the procurement, use, handling, and disposal of each material or additive.
    c. Statement confirming additives:
        1) Are suitable for intended use and do not interfere or interact with other planned materials or additives.
        2) Do not adversely impact the natural environment when used as intended.
3. Mill or manufacturing certificates for production materials to ensure materials are new, suitable for intended use, and meet required standards listed in this Section.

C. RSN 33 05 21-2, Boring and Placement Plan:
1. Narrative of work detailing steps, materials, equipment, and methods necessary to safely excavate, install, test, and complete each bored crossing.
2. Drawings, figures, or sketches as necessary to clearly show limits, extents, sequence, and other details of the work. Include at minimum the following details:
    a. Staging and assembly working areas and details of this work.
    b. Shaft or pit bracing, shoring, or sloping designed by a licensed Professional Engineer familiar with similar soil support systems.
        1) Include details for the temporary bulkhead design at the excavation face should boring not be completed in a single continuous operation.
    c. Site preparation activities and work required to prepare for boring.
    d. Boring excavation size, with over-boring space identified (if used). Include details and sizes of pilot boring and final excavation extents.
    e. Cross-section of permanent crossing, show grouting of over-boring space (if used) of annular space. Include location of end caps, spacers/runners, and connection details to Carrier or Casing Pipes.
    f. Equipment:
        1) Manufacturer data, operating and safety manuals, and other details for listed pieces.
        2) Specialty training requirements and certificates for operators if required by equipment manufacturer.

g. Entry/exit pit locations, shaft excavation, dewatering, shoring, locations and extents of equipment, materials, and personnel, and surface support items.

h. Pre-installation, assembly, and installation preparation work.

i. Crossing site completion and restoration steps.

3. Provide relevant details of the equipment, personnel, and methods used to survey and monitor the position of the excavation and ensure line-and-grade control along the bored alignment.

a. Equipment data sheets, figures or sketches of installation locations, all applicable safety documentation, and a narrative detailing how survey and position/location/orientation control will be maintained and monitored during the work.

4. If grouting of over-boring space is required, as defined in this Section, submit Grouting Plan as a supplement to the Boring and Placement Plan. Include at a minimum:

a. Comprehensive listing of materials, methods, equipment, and personal required to install grout safely and completely in over-boring space.

b. Clearly identify:

1) Type of grout to be used, any admixtures required, anticipated density/viscosity, and other relevant details of grout mix required to complete the work. Clearly identify minimum and maximum installation pressures required.

2) All installation hardware (e.g., grout ports, lines, couplings, manifolds, etc.) required to complete the work, and ensure over-boring space is completely filled.

3) Potential impacts to installed Casing Pipe (e.g., grouting pressures, displacement of installed pipe, etc.), and list steps taken to prevent adverse effects from occurring during grouting operations.

D. RSN 33 05 21-3, Monitoring Plan:

1. Provide relevant details of the equipment, personnel, and methods used to monitor the surface and the position of adjacent infrastructure such as roads, structures, or utilities during the work to ensure that heave, settlement, and displacement tolerances are not exceeded and to avoid all other adverse impacts.

a. Provide equipment data sheets, figures or sketches of installation and monitoring locations, all applicable safety documentation, and a narrative detailing how monitoring will be performed during the work.

b. Include actions to be taken should monitoring identify that movements above listed tolerances be measured.

2. Narrative of methods for monitoring bore excavation spoil volumes compared to theoretical volumes. Include template for reporting of bore advance length, theoretical in-situ volume, theoretical bulked spoil volume, and actual measured spoil volume removed.

E. RSN 33 05 21-4, Draft Drill Logs:

1. Submit after completion of both the pilot hole boring (where applicable) and the primary drilling to the COR.
2. Adobe PDF or Microsoft Excel format (latest editions) electronic versions.

F. RSN 33 05 21-5, Final Drill Logs:

1. Use same format as Draft Drill Logs, showing relevant details of drilling to complete the work.

G. RSN 33 05 21-6, Copy of Application for Crossing Permit.

1.05 SITE CONDITIONS

A. Bedrock or other conditions, such as groundwater, may be encountered during boring operations. Refer to Section 53 10 00 – Geologic Investigations Geology.

1.06 QUALIFICATIONS

A. Crew foreman, drill fluid engineer/technician, and drill rig operator:

1. Demonstrate at least 3 years of experience (within award date) or 3 projects of similar size, scope, complexity, and installation methods (within 12-inches of pipe diameter).

1.07 PERMITS

A. Obtain permits from appropriate authorities to install bored crossings.

B. Contractor will be responsible for all required utility owner's inspection fees and related traffic control fees to construction across non-government owned ROW or facilities.

PART 2 PRODUCTS

2.01 CASING PIPE

A. Pipe shall be straight-seam, longitudinally welded smooth steel. Each adjacent pipe segment shall be rotated at least 90-degrees to avoid a continuous welded seam following installation.

B. Material:

1. Comply with ASTM A1097, using ASTM A572 Grade 50 or equal.
2. Minimum yield strength: 50,000 psi

C. Pipe ends:

1. Flush, straight, and even in accordance with ASTM A1097.
2. Suitable for a bored, jacked installation method.
3. Pipe ends may use either interlocking or welded (full penetration butt weld) joints:
   a. Utilize only one weld method per crossing, unless otherwise approved by COR.
   b. Interlocking joint systems with supplemental fillet welds may be required, at the discretion of the COR, if joint movement or loss of engagement occurs during installation.
      1) If required, place stitch welds inside pipe and extend around entire perimeter of pipe.
   c. Joint system: Capable of safely withstanding all handling and installation forces.

D. Hydrostatic test not required.

E. Do not apply lining and coating to Casing Pipe.

F. Thickness shall be determined by the Contractor, based upon all factored loads, such as handling and jacking, required to complete the work and the details shown on the drawings.

G. Joints shall not extend more than 2 inches beyond the outside diameter of the Carrier Pipe, to avoid an interference with the inside diameter of the Casing Pipe.

H. Steel pipe lining shall be in accordance with Section 09 96 20 – Coatings.

I. Inside diameter of the Casing pipe shall be not less than 4 inches larger than the outside diameter of the Carrier pipe, to allow sufficient annular space for spacers/runners and fiber optic conduit.

J. Final dimensions subject to approval by the Government, subject to requirements listed above.

2.02 CARRIER PIPE

A. See Section 33 11 10 – Pipeline General Requirements.

B. Fully restrain joints.

C. Capable of being installed using jacking, pull-in, or combination of the two methods.

D. Lining and coating shall be in accordance with Section 09 96 20 – Coatings, for the pipe material used. Coating system used shall be compatible with the spacers and runners (selected by Contractor).

2.03 SPACERS AND RUNNERS

A. Model SSI Stainless Steel Bank Casing Spacers or Model CI Polyethylene Spacers & Insulators, manufactured by Advance Products & Systems, Incorporated (www.apsonline.com) or equal with the following essential characteristics:

1. Durable and capable of withstanding handling and pipe installation requirements.
2. Materials shall not deteriorate in wet or submerged environments.
3. Spacer/runner materials shall not adversely affect Casing or Carrier pipe materials, coating, or lining systems.
4. Wet service life of at least 25 years.

2.04 END SEAL

A. Model AW Wrap Around End Seal, Manufactured by Advance Products & Systems, Incorporated, www.apsonline.com or equal with the following essential characteristics:

1. Rubber end seal with stainless steel clamps.
2. Rubber seal manufactured with butyl mastic strips.

2.05 DRILL FLUID AND ADDITIVES

A. Non-toxic, safe for use on public facilities, and suitable for use in typical bored crossings.

B. Drill fluids shall contain minimum 2-percent of high-grade processed Bentonite.

C. If changes are made and/or required by field Drill Fluid ("mud") Engineer or Technician, additional additives shall be submitted for approval as soon as practical:

1. Do not use unapproved additives, or other materials, without verbal or written approval from COR.
2. If verbal approval is provided during work, obtain written approval as soon as practicable thereafter, but no more than 14-days following verbal approval.

D. Other gel-forming colloidal drilling fluids may be used.

2.06 SURVEYING, MONITORING, AND MEASUREMENT EQUIPMENT

A. Conduct all surveying in accordance with Section 01 71 20 – Surveying.

B. Any commercially available surveying, monitoring, and tracking equipment may be used, provided it meets the following maximum tolerances:

1. Capable of measuring and recording horizontal and vertical positions to a maximum 0.01-foot accuracy.

2. Capable of measurement distances to a 0.01-foot accuracy, with a range from 0.00-feet to the maximum distance of the crossing.

a. Tolerances for all measurements shall be ±0.005-feet.

C. The use of multiple concurrent systems (e.g., lasers, radio/RF, magnetic, wireless, inertial guidance systems, gyroscopes, etc.) is permissible, provided they are interoperable and can relay data between systems without loss of accuracy or tolerances.

D. Grout pressure monitoring gauge shall be capable of measuring pressure to a resolution of 0.5 pounds per square inch or less.

E. Spoil volume measurement methods shall be capable of measuring to a resolution of 0.5 cubic yards or less.

F. Grout volume measurement methods shall be capable of measuring to a resolution of 1 cubic foot or less.

G. All systems used shall be capable of calibrating to the established Project benchmarks, survey coordinate systems, datums, and other control points established for the work. Electronic or hard copy records of the initial setup and calibration check shots shall be made available to the COR upon request.

PART 3 EXECUTION

3.01 GENERAL

A. Verify utility locations prior to excavation in accordance with Section 01 56 15 – Protection of Existing Utilities. Verify and protect existing infrastructure in accordance with Section 01 56 10 – Protection of Existing Installations.

1. Coordinate any required temporary protection, relocation, or re-establishment of existing utilities and infrastructure in accordance with the Sections identified above.

B. Remove and replace fence in accordance with 01 56 20 – Existing Fences.

C. Excavate suitable pits or trenches for boring operations:

1. Strip in accordance with Section 31 14 10 – Topsoil Stripping, Stockpiling and Placement.

2. Earthwork in accordance with Section 31 23 11 – Earthwork for Structures and Section 31 23 22 – Pipe Trench Earthwork.

D. Where excavation extends below ground water levels, dewater portion below water line in advance of excavation in accordance with Section 31 03 33 – Removal and Control of Water:

1. Conduct all work in the dry, except for removal of water.

2. Government may waive this requirement, depending upon the crossing boring and installation method proposed.

E. Do not interfere with normal or emergency operations of maintained roadways, utilities, or other facilities:

1. Coordinate and manage traffic access to the site in accordance with Section 01 55 20 – Traffic Control.

F. Do not weaken or damage highway, street, or facility. Repair at Contractor's expense, as determined by COR.

G. Remove and replace, without additional cost to Government, pipe damaged during boring operations.

H. Repair, remove, or replace any other utilities, installations, or features encountered during boring work at the direction of the COR.

I. Install Casing Pipes to lines and grades shown on drawings:

1. Final position of pipe:

a. Equal to or less than 1 percent of pipe length, laterally or vertically.

J. If annular space between outside of casing pipe and excavated boring exceeds 1-inch, completely fill annular space using pressure grout.

K. No pit or trench, excavated to install pipe, shall remain open longer than 5-days after installation, unless otherwise approved by COR.

L. Install safety fencing around excavations and borings in accordance with Section 01 56 32 – Temporary Safety Fence. Remove as required for construction.

3.02 BORING

A. Method(s) employed shall not cause:

1. Surface displacement (heave or settlement) in excess of 1/2-inch.

2. Noticeable damage to the surrounding soil/rock formation, as determined by the COR, beyond the extents shown on the drawings.

B. Immediately cease work and notify COR if surface displacement < 1 inch or excessive damage is observed, whether inside or outside the work extents shown on drawings, or if the excavation spoil volumes removed from the bored crossing are 0.5 cubic yards greater than theoretical volumes. Do not proceed with boring until the causes are determined and the situation remedied to the satisfaction of the COR.

C. Water or other fluids, other than drill fluid, may be used to lubricate equipment and flush/separate cuttings outside of bored crossing:

1. Water jetting the boring is not permitted.
2. If drilling methods are used, drill fluid shall be used to lubricate boring equipment inside hole, as well as capture and flush cuttings to entry pit.

D. Pipe ramming is not permitted.

E. Use Pilot Hole/Boring, Auger or Pipe Jacking Method, subject to approved Plan.

F. Pilot Hole/Boring:

1. Bore pilot hole entire length of crossing.
2. Continuously monitor pilot boring position and location during excavation and correct as necessary to maintain tolerances while following line and grade shown on the drawings.
3. Use pilot hole as centerline for larger diameter hole to be bored.
4. Maintain a drill log for the pilot hole boring noting location, depth, length, drill thrust and torque, encountered materials, and other items of note. Submit drill log to COR upon completion of the pilot hole boring.
5. If casing pipe tolerances are exceeded, COR may require redrilling the pilot bore hole.
   a. Immediately notify COR if boring tolerances are exceeded before proceeding with additional drilling.
   b. Immediately notify COR if it is necessary to re-drill any segment more than once to maintain tolerances.

G. Auger Method:

1. Approved diameter steel pipe equipped with a cutter head or other appropriate tooling to mechanically perform excavation.
2. Used to facilitate installation of Casing pipe, with Carrier pipe and other appurtenances following.
   a. Augers and tooling shall be of sufficient size, strength, and capacity to convey excavated materials to the entry pit.
   b. A combination of augers and conveyors is acceptable for use in excavation material (“muck”) handling.

3. Immediately notify the COR of any deviations from the approved Plan. Unless otherwise approved by COR, do not proceed with work following a deviation from the approved Plan.

H. System components, including thrust/reaction frame and anchorages, shall be in accordance with approved Plan.

I. Operate equipment according to the manufacturer's recommendations and safety documents, and in accordance with the approved Plan.

J. Dispose of drilling fluid in accordance with approved plan and Section 01 74 00 – Cleaning and Waste Management.

3.03 CASING PIPE INSTALLATION

A. Install to lines and grades shown on drawings and in accordance with manufacturer's recommendations.

B. Install as soon as practicable following boring of the crossing, depending upon approved method:

1. Notify COR at least 24-hours prior to installation.
2. If installation of Casing Pipe is not completed within 72-hours of boring completion, notify OGR immediately.

C. Utilize installation methods that do not exert excess stress, strain, or deformation on casing pipe.

D. Place casing pipe to lines and grades shown on drawings.

1. Do not deviate more than 1 percent total (horizontal or vertical) per length from lines and grades shown on drawings.
2. Remove and replace Casing pipe not meeting tolerances listed above.

E. If over-boring space between outside of casing pipe and excavated boring exceeds 1-inch, fill over-boring space using pressure grout.

3.04 CARRIER PIPE

A. Install carrier pipe, spacers, runners and end seals per manufacturer's recommendations and approved Plan.

B. Install as soon as practicable following boring of the crossing, depending upon approved method:

1. Notify COR at least 24-hours prior to installation.
2. If installation of Carrier Pipe is not completed within 5-days of boring completion, notify OGR immediately.

C. Fabricate joints and connections in accordance with Section 33 11 10 – Pipeline General Requirements.

3.05 PIPELINE APPURTENANCE INSTALLATION

A. Spacers/runners:

1. Install in accordance with approved Plans and manufacturer's installation recommendations, except:
   a. Install one spacer/runner within the lesser of 5-feet or 2 pipe outside diameters from the end of the Carrier Pipe at each end of the crossing.
   b. Install spacers/runners no greater than the lesser of 10-feet or 3 pipe outside diameters between support points.
2. Provide sufficient spacers/runners to fully support the Carrier Pipe throughout the crossing length without excess settlement or sag, defined as greater than 0.2-feet along any segment.
3. Install in such a manner as to avoid damage to Casing or Carrier Pipe coatings and lining, as well as all other installed elements (e.g., grout ports, cathodic protection system elements, etc.).

B. End Seals:

1. Install in accordance with approved Plans and manufacturer's installation recommendations.
2. Install in the dry, removing all groundwater or nuisance water inside the Casing Pipe prior to final seal.
3. Orient clamps, screws, tightening bands, or other fasteners such that they are readily accessible for future maintenance.
4. If Line Pipe connections are not made within 3-days of Carrier Pipe installation, install temporary bulkheads at each end to the satisfaction of the COR.
   a. Mark both ends of Carrier Pipe at surface using high visibility markers or stakes to allow for future locating and connection of Line Pipe.
   b. Do not damage installed or existing components when installing markers or stakes.

3.06 BACKFILL

A. If pit or trench is backfilled prior to installation of Carrier or Line Pipe, install a bulkhead at ends of casing to keep backfill material out of Casing Pipe. Mark ends of Casing Pipe with utility markers to allow for relocation.

B. Backfill in accordance with accordance with Section 31 23 22 – Pipe Trench Earthwork.

1. Compact earthen backfill at both shafts (where used) of each crossing to a minimum 85% density in accordance with Section 31 23 02 – Compacting Earth Materials.

C. Reconstruct highway slopes and embankments with same materials excavated, and to existing dimensions.

3.07 TESTING

A. Hydrostatic testing of the Casing Pipe is not required.

B. Perform all hydraulic testing of the Carrier Pipe in accordance with Section 33 11 10 – Pipeline General Requirements.

1. All work inside the pipes (Casing and Carrier) including but not limited to testing, reaming, and flushing shall be completed using pressurized water in accordance with Section 01 51 00 – Temporary Utilities unless the pipeline materials themselves cannot tolerate the presence of water.

2. At no time shall pressurized or compressed air be utilized for this work due to the inherent safety risks posed by unconfined pressure vessels.

3.08 CLEAN-UP AND SITE RESTORATION

A. Dispose of all drill fluids, work byproducts, and leftover materials in accordance with approved Plans, applicable permit requirements, and in accordance with Section 31 23 39 – Disposal of Excavated Waste Materials.

B. Restore the site to original conditions as shown on drawings in accordance with Section 01 74 00 – Cleaning and Waste Management.

C. Reconstruct any damaged or displaced elements using like materials to match or exceed pre-existing conditions to the satisfaction of the COR.

END OF SECTION

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SECTION 33 05 23

MAINTAINED AND UN-MAINTAINED ROAD CROSSINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in unit prices offered in Price Schedules for applicable Line Pipe:

   a. Includes:

      1) Compacted backfill.

      2) CLSM.

B. Cost:

1. Include in unit price offered in Price Schedules for items of work requiring Gravel Surfacing:

   a. Includes:

      1) Gravel.

      2) Geotextile.

      3) Herbicide.

C. Cost:

1. Include in unit prices offered in Price Schedules for items of work requiring Asphalt Concrete Pavement:

   a. Includes:

      1) Asphalt Concrete Pavement.

      2) Tack Coat.

1.02 REGULATORY REQUIREMENTS

A. Conform to Federal, State, Tribal, and local ordinances, rules, and regulations for operations at roadway crossings.

B. Obtain permits, at Contractor's expense, for work on Federal, Tribal, State and County.

C. At permitted crossings, Contractor shall provide letter of acceptance from permitter to COR assuring work has been satisfactorily completed.

PART 2 PRODUCTS

2.01 COMPACTED BACKFILL

A. In accordance with Section 31 23 02 – Compacting Earth Materials.

2.02 GRAVEL SURFACING

A. In accordance with Section 32 15 10 – Gravel Surfacing.

2.03 CLSM

A. In accordance with Section 31 23 70 – Controlled Low Strength Materials (CLSM).

2.04 GEOTEXTILE

A. In accordance with Section 32 15 10 – Gravel Surfacing.

2.05 HERBICIDE

A. In accordance with Section 31 31 30 – Soil-Applied Herbicide.

2.06 MARKERS

A. In accordance with Section 10 14 26 – Utility Markers.

2.07 ASPHALT CONCRETE PAVEMENT

A. In accordance with Section 32 12 22 – Asphalt Concrete Pavement.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to pipeline crossing excavation, slope ground to edge of shoulder as shown on drawings.

B. Remove and control water in accordance with Section 31 03 33 – Removal and Control of Water.

3.02 PIPELINE CROSSING

A. Construct pipeline crossings as shown on drawings:

1. Keep existing roadways open:

   a. Keep portion of roadway disturbed by crossing as small as practicable.

   b. Traffic control: See Section 01 55 20 – Traffic Control.

2. Provide detours: See Section 01 55 20 – Traffic Control.

END OF SECTION

SECTION 33 11 10
PIPELINE GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Line Pipe (Reach 2), 48-Inch Line Pipe (Reach 3), and 42-Inch Line Pipe (Reach 3):

1. Measurement: Horizontally along pipe centerline, without allowance for slope, between ends of pipe in place. Continuous through fittings, outlets, wash crossings, casing pipes, end collars, thrust restraints, and road crossings with no allowance for lap at joints:

   a. Measurement for pipe from pipe outlets will begin at downstream face of valve or flange.

2. Payment: Linear foot prices offered in Price Schedules:

   a. Includes, but not limited to the following:

      1) Pipe trench excavation in accordance with Section 31 23 22 – Pipe Trench Earthwork.

      2) Furnishing and placing materials, including but not limited to the following:

         a) Fittings, bedding, embedment, utility markers, concrete, reinforcing steel, blocking and collars, not included elsewhere.

         b) Asphalt concrete pavement.

         c) Laying pipe.

      3) Connections of Line Pipe to existing Horizontal Directionally Drilled (HDD) Pipe, and existing Steel Manifold Piping at Pumping Plant No. 1 and San Juan Lateral Water Treatment Plant Regulating Tanks.

         a) Construct pipe connections as restrained pipe lengths between Line Pipe and existing HDD Pipe and Steel Manifold Piping.

         b) Different pipe materials may exist between Line Pipe and existing HDD Pipe and Steel Manifold Piping. Connections must accommodate different pipe materials.

         c) A miter bend, at each end of existing HDD Pipe, to transition from HDD Pipe slope to Line Pipe slope as constructed.

      4) Carrier Pipe for Bored Crossings.

5) Saw-cut, removal, and disposal of abandoned 36-inch buried waterline crossings, as shown on drawings.

b. Does not include:

1) Steep pipe.

2) Installation of Bored Crossings.

3. Linear foot price shall be an average price of pipe pressure class shown on drawings.

B. Steep Line Pipe (Reach 2):

1. Measurement: Horizontally along pipe centerline, without allowance for slope, between ends of pipe in place. Continuous through fittings, outlets, wash crossings, casing pipes, end collars, thrust restraints, anchor blocks and road crossings with no allowance for lap at joints:

2. Payment: Linear foot prices offered in Price Schedule 1:

a. Includes cost of the following:

1) Pipe trench excavation in accordance with Section 31 23 22 – Pipe Trench Earthwork.

2) Furnishing and placing materials, including but not limited to the following:

a) Fittings, bedding, embedment, utility markers, concrete, reinforcing steel, blocking and collars, not included elsewhere.

b) Laying pipe.

3) Does not include rock excavation.

3. Linear foot price shall be an average price of pipe size and pressure class shown on drawings.

C. Buried Manhole:

1. Measurement: Number of buried manholes installed.

2. Payment: Unit price offered in the Price Schedules.

a. Includes all items shown on Drawing 1695-D-60805.

D. Filling and Testing Pipe:

1. Payment: Lump sum prices offered in Price Schedules.

a. Includes: One pipe volume of water used for filling and testing or as approved by COR.

b. Additional water required for flushing and testing is at Contractor's expense.

E. Repair Kits:

1. Payment: Lump sum prices offered in Price Schedules.

F. NTUA 4-inch Waterline Relocation:

1. Measurement: Horizontally along pipe centerline,
2. Payment: Linear foot prices offered in Price Schedule 2:
   a. Includes the cost of the following:
      1) Pipe trench excavation in accordance with Section 31 23 22 – Pipe Trench Earthwork.
      2) Removal and disposal of existing waterline.
      3) Furnishing and re-placing materials, including but not limited to the following:
         a) Isolation valves, fittings, bedding, embedment.
         b) Laying pipe.
      4) Disinfection of installed pipeline, in accordance with 51 00 42 -. NTUA Waterline Relocation Requirements.

1.02 DEFINITIONS

	Piping Types			
Material	Size (Inch)	Location	Specification	Drawings
PVC, HDPE, Ductile Iron, or Steel	Greater than 36-inches	Line Pipe	As per material type.	
Steel only	36-inches and less	Assembly Piping and Vaults	33 21 95 – Metal Piping for Line Pipe Installations	60798, 60799, 60800, 60801, 60802, 60804, and 60812

A. Line Pipe:

1. Water transmission pipe.
2. Unless otherwise specified, does not include piping for appurtenances such as blowoffs, air valves, or manholes.
3. Includes pipe from:
   a. Reach 2:
      1) Start of Reach 2 (2002+00) to start of Shumway Arroyo HDD,
      2) End Shumway Arroyo HDD to Start of San Juan River HDD,
      3) End of San Juan River HDD to start of Pumping Plant No. 1,

4) End of Nenahnezad Bluff HDD to end of Reach 2 (2287+67.49).

b. Reach 3:

1) Start of Reach 3 (3302+00) to Chaco River HDD,

2) End of Chaco River HDD to end of Reach 3 (3744+56.27).

B. Horizontal Directionally Drilled (HDD) Pipe:

1. Previously installed water transmission pipe, by others.

C. Pipe sizes and classes: Line Pipe is designated on plan and profile drawings by an alphanumeric symbol:

1. Symbol identifies pipe diameter, cover class and hydraulic transient head as follows:

a. First number in symbol indicates nominal diameter in inches.

b. Alphabetic character represents cover class of pipe where; B < 10 feet, C < 15 feet, and D < 20 feet:

1) K Class pipe: Metallic pipe with a special design at locations shown on the drawings:

a) Joints shall be butt welded if steel pipe is used.

b) Joints shall be restrained if ductile iron is used.

c. Second number in symbol is maximum hydraulic transient head measured to centerline of pipe.

d. A symbol of 42C600 means pipe is 42-inches in diameter with a cover between 10- and 15-feet and a hydraulic transient head of 600-feet at centerline of pipe.

2. Unless specific reference is made to outside or inside diameter of pipe, pipe diameters shown on drawings and used in this section are nominal pipe diameters.

D. Metal Piping for Line Pipe Installations:

1. In accordance with Section 33 21 95 – Metal Piping for Line Pipe Installations:

a. Piping in vaults, turnouts, or piping for appurtenances such as blowoffs, bypasses, air valves or manholes including air vent piping in manholes.

b. Includes, buried manholes, outlets, and associated flanges from the line pipe to which metal piping for line pipe is attached.

E. Steel Manifold Piping:

1. In accordance with Section 35 21 95 – Steel Manifold Piping:

a. Piping in San Juan Lateral Water Treatment Plant Regulating Tanks site.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C150/C150M-17	Portland Cement
2.	ASTM F2164-13	Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems using Hydrostatic Pressure.

B. American Water Works Association (AWWA)

1.	AWWA C205-12	Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100mm) and Larger - Shop Applied
2.	AWWA C600-10	Installation of Ductile Iron Water Mains and Their Appurtenances
3.	AWWA C604-11	Installation of Steel Water Pipe 4 In. (100mm) and Larger
4.	AWWA C605-13	Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

C. International Organization for Standardization (ISO)

1.	ISO 9001-15	Quality Management

D. National Sanitation Foundation (NSF)

1.	NSF Standard 61-16	Drinking Water System Components - Health Effects

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals:

B. RSN 33 11 10-1, Qualifications:

1. Certification of line pipe layers (Foreman).
2. Certification of line pipe and fitting manufacturers.
3. Certification of NSF 61 compliance of line pipe materials.

C. RSN 33 11 10-2, -3, -4, -5, Pipelaying Diagrams:

1. RSN 33 11 10-2, Reach 2, Start of Reach 2 to Start of San Juan River HDD.
2. RSN 33 11 10-3, Reach 2, End of San Juan River HDD to end of Reach 2.
3. RSN 33 11 10-4, Reach 3, Start of Reach 3 to Start of Chaco River HDD.

4. RSN 33 11 10-5, Reach 3, End of Chaco River HDD to end of Reach 3.

   a. Submit each reach in sections, not to exceed 5-miles, after utility crossing investigation and wash crossing field information has been submitted and approved for that section:

      1) If additional sections and/or reaches are submitted within 21-days, Government will require an additional 21-days for review of each additional section.

   b. Submit concurrently with applicable corresponding RSN in the following Sections:

      1) 33 11 12 – Steel Line Pipe, RSN 33 11 12-2 through RSN 33 11 12-5.

      2) 33 11 13 – Ductile Iron Pipe, RSN 33 11 13-1 through RSN 33 11 13-4.

      3) 33 11 16 – PVC Pressure Pipe, RSN 33 11 16-1 through RSN 33 11 16-4.

      4) 33 11 18 – HDPE Pressure Pipe, RSN 33 11 18-2 through RSN 33 11 18-5.

      5) 33 21 95 – Metal Piping for Line Pipe Installations, RSN 33 21 95-1 through RSN 33 21 95-4.

   c. For each type of pipe furnished.

   d. Show position and marking of pipe sections.

   e. Include centerline and invert stationing and elevations at horizontal and vertical changes in alignment, and subgrade elevation for each pipe segment and fitting.

   f. Include pipe thickness, Dimension Ratio (DR) or pressure class of pipe segment or fitting.

   g. For alignment changes not using a miter bend (pulling joints) provide station at point of curvature and point of tangent, and deflection angle at each pulled joint.

   h. Fittings or insulating flange gasket kit used to isolate dissimilar metals.

D. RSN 33 11 10-6, Filling and Testing Plan:

   1. Provide a narrative describing the proposed rates, time, procedures and methods for filling and testing each section of pipe:

      a. Include:

         1) Cleaning.

         2) Filling.

         3) Field and pressure testing.

a) Include:

i. Methods and materials for thrust restraint at each temporary testing flange(s) or valve(s).

ii. Leak testing equipment, data sampling plan, and equipment locations.

4) Draining pipeline.

b. Method for disposing of water drained from pipeline to enable repair of leaks.

E. RSN 33 11 10-7, Flotation Prevention Plan:

1. Show location and describe method of preventing pipe from floating.

2. Provide supporting calculations.

F. RSN 33 11 10-8, Pipe Deflection Measurements.

G. RSN 33 11 10-9, NTUA Waterline Relocation Work Plan:

1. Show position and marking of pipe sections.

2. Include centerline and invert stationing and elevations at horizontal and vertical changes in alignment, and subgrade elevation for each pipe segment and fitting.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ship pipe after receiving COR approval as per Section 2.03 – Source Quality Assurance.

B. Prevent damage to pipe and fittings during loading, transporting, unloading, storing, and laying.

C. Transport metallic pipe and fittings on padded bolsters curved to fit outside of pipes. Use heavy padding under ties.

D. Tightly close open ends of shop-applied, cement-mortar-lined pipe with plastic wrap for protection of cement-mortar lining during shipment:

1. Plastic Wrap:

a. At least 2 thicknesses of 6-mil sheet polyethylene plastic.

b. Remain on pipe until installation.

E. Support and store pipe above ground surface. Do not allow bells and spigots to contact each other or the ground.

F. Government will inspect pipe once it is delivered.

G. Replace or repair, as approved by COR, any pipe that is damaged during shipment, storage, or installation at Contractor's expense. Include linings and coatings.

1.06 QUALIFICATIONS

A. Pipe manufacturers shall be certified in accordance with ISO:9001 or similar nationally certified program approved by COR.

B. Line pipe and specials manufacturers:

1. 10-years successful experience producing products as specified.
2. Provide references for at least 3 completed projects with similar pipe diameters (within 12-inches) and pressures.

C. Pipe Layers: Skilled and experienced in laying pipe with joints as needed for each material type of pipe used. Minimum 2-years installing pipe with similar pipe diameters (within 12-inches), pipe material, and pressures:

1. In the absence of specific pipe material experience, substitution of onsite pipe manufacturer training and quality control is allowed:
   a. Provide manufacturer's representative certified in pipeline installation, including all applicable joints, for training pipe layers and pipe foreman prior to installation.
   b. In lieu of specific pipe material installation experience, pipe layers and pipe foreman shall still have experience with installing similar pipe diameters and pressures.

D. Qualify welding procedures and welders in accordance with code under which welding is specified.

1.07 REPAIR KITS

A. Furnish 1 repair kit, per Reach, for each material type and size of pipe used.

B. Repair kit:

1. 4 restrained joint couplings.
2. 5 gaskets for each size of pipe used.
3. 5 butt straps for each size of pipe used.
4. At highest loading and pressure rating for each material type and nominal size of pipe provided.

C. Place repair kits in storage within 150-miles from site, as designated by COR.

PART 2 PRODUCTS

2.01 PIPE OPTIONS

A. In accordance with the following Sections:

1. 33 11 12 – Steel Line Pipe,
2. 33 11 13 – Ductile Iron Pipe,
3. 33 11 16 – PVC Pressure Pipe,
4. 33 11 18 – HDPE Pressure Pipe.

B. Locations:

1. Reach 2:
   a. HDPE Pressure Pipe allowed with pipe head class 275 or less.
   b. PVC Pressure Pipe allowed with pipe head class 350 or less.
   c. Metallic Pipe required for pipe head class above 350.
2. Reach 3:
   a. HDPE Pressure Pipe allowed with pipe head class 275 or less.
   b. PVC Pressure Pipe allowed with pipe head class 350 or less.
   c. Metallic Pipe required for pipe head class above 350.

C. No more than one metallic line pipe type and one non-metallic line pipe type may be used, except as shown on drawings.

D. Materials and chemicals that may come into contact with drinking water shall be certified by NSF 61.

E. Rubber Gaskets:

1. Manufactured and tested in accordance with applicable AWWA standard for pipe type.
2. Petroleum-Resistant Gaskets: Use in pipe joints in accordance with Section 33 11 50 – Pipe Crossings at Existing Utility Pipelines.
3. Lubricant: Approved for potable water use.

F. Transitions between differing pipe materials:

1. Transitions between HDPE and PVC are not allowed.
2. All transitions between line pipe materials shall be fully restrained.
3. Steel:
   a. In accordance with 33 11 12 – Steel Line Pipe.
   b. Allowable connection types:
      1) Mechanical Joint: Series 1100 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.
      2) Flanged.
4. Ductile Iron:

a. In accordance with 33 11 13 – Ductile Iron Pipe.

b. Allowable connection types:

1) Mechanical Joint: Series 1100 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.

2) Restrained Flange Adapter: Series 2100 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.

5. PVC:

a. In accordance with 33 11 16 – PVC Pressure Pipe.

b. Allowable connection types:

1) Mechanical Joint: Series 2200 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.

6. HDPE:

a. In accordance with 33 11 18 – HDPE Pressure Pipe.

b. Allowable connection types:

1) Flanged with backing ring.

2.02 FITTINGS

A. Fittings should resist same loading conditions as adjacent pipe.

B. Refer to applicable line pipe section for allowed fittings.

C. Each transition between the Line Pipe and HDD Pipe shall have a miter bend installed to align the pipeline to create a continuous segment.

1. The miter bends and connections shall be in accordance with the appropriate Section below, based upon the HDD and Line Pipe material at each location:

a. 33 11 12 – Steel Line Pipe,

b. 33 11 13 – Ductile Iron Pipe,

c. 33 11 16 – PVC Pressure Pipe,

d. 33 11 18 – HDPE Pressure Pipe.

2. At the extreme ends of the miter bends, either:

a. A thrust block, with two restrained flexible couplings and a 10-foot articulating pipe segment between the couplings shall be installed on each end of the Line Pipe to allow for a flexible connection to the HDD Pipe, or

b. Restrain pipe joints, if allowed, as shown on drawings.

D. Fittings and connections used to connect HDD Pipe to Line Pipe shall conform to Section 33 11 10 – Pipeline General Requirements. Transitions are required to connect pipes with material, diameter, and wall thickness differences.

E. Fittings and connections used to connect to Pumping Plant 1 shall conform to Section 33 11 10 – Pipeline General Requirements. Transitions are required to connect pipes with material, diameter, and wall thickness differences.

F. Fittings and connections used to connect to manifold piping at the San Juan Lateral Water Treatment Plant Regulating Tanks shall conform to Section 33 11 10 – Pipeline General Requirements. Transitions are required to connect pipes with material, diameter, and wall thickness differences.

2.03 NTUA WATERLINE

A. Replace per NTUA Requirements. Re-route around San Juan Lateral Water Treatment Plant Regulating Tank Site as shown on Drawing 1695-D-60809.

2.04 SOURCE QUALITY ASSURANCE

A. Approval for Shipment:

1. Pipe and fitting approval will be determined by inspection, during and after manufacture.
2. Notify Technical Service Center, Attn: 86-68140, and COR at least 14-days before manufacturing pipe and fittings and 3-days before shipping pipe and fittings.
3. Government will inspect pipe units and fittings and will approve for shipment those which have been manufactured and tested in accordance with these specifications, unless Contractor is notified in writing.
4. Further inspection of pipe units and fittings will be in accordance with clause at FAR 52.246-12 Inspection of Construction.

2.05 PIPE ACCESSORIES

A. Sectionalizing Valve, Air Valve, and Blowoff Assemblies: In accordance with Section 33 12 15 – Valves and Equipment for Line Pipe Installations.

1. Precast Concrete Manhole as shown on Drawing 1695-D-60806, in accordance with Section 03 48 00 – Precast Concrete Structures.

B. Buried Manhole:

1.
2. Cement-mortar lining: AWWA C205, in accordance with shop applied mortar for lining of specials, except:
   a. Reinforcement required for pipe larger than 24-inch diameter.
   b. Cement: ASTM C150, Type V.
3. Required at locations shown on drawings.

C. Warning Tape:

1. Polyethylene tape.
2. Thickness: 4 mils.
3. Magnetically detectable.
4. Width, minimum: 6-inches.
5. Color: Blue with silver lettering.
6. Legend repeated at least every 3-feet: "CAUTION: WATERLINE BURIED BELOW - FOR MORE INFORMATION CONTACT THE NAVAJO TRIBAL UTILITY AUTHORITY".

D. Tracer Wire for Non-Metallic Pipe:

1. Type: High strength copper clad steel.
2. Size: 10 AWG, minimum.
3. Insulation:
   a. High density, high molecular weight, polyethylene (HDPE).
   b. Jacket Color: Blue.
   c. Rated for direct burial.

E. Tracer Wire Terminal Post:

1. Designed and manufactured for specific application.
2. Temperature and ultraviolet light stable.
3. Color: Blue.
4. Terminals: Two, minimum, per post.
5. Provide terminal jumpers to interconnect lengths of trace wire as needed.
6. Space as recommended by manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. Perform cleaning, filling, and testing after backfill has been placed to finished grade or as approved by OGR.

B. Responsible Surveyor licensed in State of New Mexico or a certified Construction Surveyor, as defined in and in accordance with Section 01 71 20 – Surveying, shall be onsite during excavation and pipelaying.

C. Protect pipe from contamination, damage, and elements during storage on-site by covering with tarp as directed by OGR.

D. Install pipe based on these specifications or pipe manufacturer's recommendation, whichever is more stringent.

E. Isolate dissimilar metals.

F. Saw-cut, remove, and plug ends of abandoned 36-inch buried waterline:

1. At least 40-feet either side of pipe centerline.
2. Abandoned line may be filled with flowable fill.
3. Dispose in accordance with Section 31 23 39 – Disposal of Excavated Waste Materials.

3.02 INSTALLATION

A. Install pipe in accordance with appropriate Section for pipe option installed.

B. Keep openings to installed pipe closed with watertight inflatable plugs during work stoppage, including end of work day, breaks, and work delays.

C. If pipe is flooded during construction, clear floodwater by draining and flushing with water, or other approved method, until pipe is clean.

D. Lubricant:

1. Keep clean.
2. Apply with dedicated, clean applicator brushes.
3. Apply lubricant as specified by pipe manufacturer:
   a. Use only lubricant supplied by pipe manufacturer.
   b. Lubricate spigot end of pipe as recommended by manufacturer.
   c. Do not lubricate either gasket or gasket groove in bells where gaskets are field installed.
   d. Lubricate factory-installed, non-removable-type gaskets as recommended by pipe manufacturer.

E. Coat buried manholes with cement mortar as shown on drawings.

F. Install tracer wire for non-metallic pipe.

G. Install warning tape over center of pipe at least 18-inches below ground and at least 18-inches above pipe.

3.03 LAYING PIPE

A. Excavate pipe trench in accordance with Section 31 23 22 – Pipe Trench Earthwork.

1. Grade pipe trenches to provide uniform slope along bottom of pipe.

2. At joints involving bells or collars, provide holes at joint of ample size to prevent bells or collars from coming in contact with subgrade and to allow for bedding placement.

B. Keep pipe trenches free of water during pipelaying operations.

C. Lower pipe into trench and place pipe in position such that no soil gets inside pipe and pipe is not damaged.

D. Install pipe to line and grade as shown on drawings and approved lay diagrams.

E. On grades exceeding 10 percent, lay pipe uphill.

F. When pipelaying is not in progress, keep ends of pipelines closed with watertight inflatable plugs.

G. Joining Pipe:

1. Assemble push-on or mechanical joints in accordance with applicable AWWA standard for pipe type and manufacturer's recommendations.
2. If adjustment of the position of length of pipe is required after installation, remove and relay length of pipe as new pipe.
3. Maintain pipe firmly in final position.
4. Placing Elastomeric Gasket:
   a. Clean gasket, bell, especially the groove, and spigot with rag, brush, or paper towel to remove any dirt or foreign material.
   b. Use only gaskets which are designed for and supplied with pipe.
   c. Lubricate pipe as recommended by manufacturer.
   d. Spigot Groove Method:
      1) Follow manufacturer's recommended practices for gasket installation.
      2) After placing elastomeric gasket in spigot groove, equalize elastomeric gasket cross section by inserting tool such as a large screwdriver under elastomeric gasket and moving it around periphery of pipe spigot.
   e. Coupling Groove Method: Follow manufacturer's recommended practices for gasket installation. Typically, factory installed.
5. Fit pipe unit's together, spigot to bell or coupling, and draw joints together so that bells or couplings and spigots are fully engaged with uniform contact to gasket.
6. Do not swing or "stab" joint and do not suspend pipe and swing into bell or coupling.
7. Fit pipe units together in a manner to avoid twisting or otherwise displacing or damaging elastomeric gasket.

8. After joining pipe units, insert feeler gauge between pipe bell and pipe spigot, move it around periphery of pipe to determine that position of elastomeric gasket is correct and there are no fish-mouth problems. If adjustment of position of a length of pipe is required after installation, remove and relay length of pipe as new pipe.

H. Changes in Alignment and Grade:

1. Make changes in alignment and grade with miter bends as shown on drawings.
2. Make other minor changes in alignment and grade by providing small deflections between adjacent pipe:
   a. Do not exceed manufacturer's deflection tolerances.
   b. Pipelaying diagrams shall only deflect joints no more than 50-percent of manufacturer's maximum deflection tolerances.
3. Provide restrained joint lengths upstream and downstream of bends or thrust blocks as shown on drawings. Ductile iron fittings with restrained joint lengths as limited by drawings may be used if Contractor submits revised plan and profile drawings for approval.
4. Do not encase rubber gasket joints in concrete.
5. Refer to individual pipe Sections for additional requirements. If requirements conflict, use most stringent requirement.

I. After pipelaying and joining operations are completed, clean inside of pipe and remove debris.

J. Schedule work so that at no time pipe remains in trench more than 7-days before backfill is placed to original ground surface or to other specified backfill limits shown on drawings.

K. Joints under Maintained and Unmaintained Road Crossings, and Wash Crossing banks and waterway shall be restrained for length shown on drawings. Joints shall have hoop stress and longitudinal stress capacity equal to or greater than adjacent pipe.

3.04 THRUST RESTRAINT

A. Restrained joint couplings or concrete blocking and collars as shown on drawings. Refer to Section 03 30 00 – Cast-in-Place Concrete and in accordance with applicable sections listed in 2.01.A.

B. Plan, profile, and restraint system shown on drawings require modification if alternate methods are used.

C. Alternate methods of restraint may not be used unless submitted and approved by COR.

3.05 TRACER WIRE

A. Install continuous length of tracer wire for full length of each run of non-metallic pipe,

B. Attach wire to top of pipe using suitable methods to ensure tracer wire will not be displaced during construction operations.

C. Locate tracer wire terminal posts at suitable locations to provide testing and/or jumper points for entire length of non-metallic pipe.

D. Verify tracer wire continuity prior to performing backfill operations.

3.06 BACKFILL

A. Backfill pipe in accordance with Section 31 23 22 – Pipe Trench Earthwork:

1. Place backfill about pipe carefully to avoid lateral displacement of pipe and damage to joints.
2. In certain pipeline reaches, where determined necessary by COR to prevent possibility of flotation, do not lay more than 300-linear feet of pipe ahead of backfilling operations.
3. If pipelaying operations are interrupted for more than 24-hours, cover pipe laid in trench with backfill.

3.07 PIPE DIAMETER DEFLECTION

A. For pipe greater than 24-inches:

1. Measure short term deflection of internal diameter:
   a. Within 2-weeks after completion of backfill.
   b. When interior bracing required, remove before making measurements.
2. Measurement Frequency:
   a. One pipe unit out of 3 for first 30 units laid. 1 pipe unit out of 10 thereafter.
   b. In deep burial or problem areas, frequency of measurements may be increased at discretion of COR.
3. Measurements:
   a. Measure vertical and horizontal diameter at approximate midpoint of pipe unit.
   b. Record pipe deflections and station where measurements were taken.
   c. Mark inside of pipe so that future comparisons can be made.

B. Deflection limitations apply per individual pipe sections.

C. Take corrective action if required limits are not meet, including removing and replacing pipe that exceeds allowable deflection tolerance.

3.08 FIELD EXAMINATION

A. Flush pipe before filling.

1. Flush foreign material from pipeline prior to testing.
2. Flush using a minimum velocity of 3-feet per second toward low points in reach.
3. Flush minimum of 1 pipe volume until water is clean or approved by OGR.
4. Dispose of flush water in accordance with permits in Section 01 57 30 – Water Pollution Control.
5. Operate valves several times during flushing period.

3.09 FILLING AND DRAINING PIPELINE

A. Notify COR 4 days before filling and testing.

B. Water for filling and testing pipeline in accordance with Section 01 51 00 – Temporary Utilities.

C. Pipeline fill rate, maximum: 2 cubic feet per second.

D. Maintain pipeline completely filled for at least 72-hours before testing.

E. Dispose of testing water by approved method.

3.10 DISINFECTION

A. Disinfect NTUA 4-inch waterline in accordance with Section 51 00 42 – NTUA Waterline Relocation Requirements.

3.11 CONTRACTOR FIELD QUALITY TESTING

A. Leak testing pipeline:

1. Notify COR at least 7-days before applying pressure to pipeline.
2. Do not start leak testing when snow or standing water is on the ground. Suspend testing as directed by OGR if precipitation accumulates on the ground.
3. Furnish pumps, power, pressure gages, calibrated flow meters and air valves as needed each end of pipeline test segment, including through the San Juan Lateral Water Treatment Plant Regulating Tanks site. Contractor may utilize water storage tanks to maintain pressure during testing.
4. Comply with applicable test standard except as noted below:
   a. AWWA C605 for PVC.

b. AWWA C600 for Ductile Iron.

c. AWWA C604 for Steel.

d. AWWA C906 and M55 for HDPE.

5. Test pipeline with hydrostatic pressure equal to hydraulic grade line elevations listed for each Reach segment:

a. Reach 2;

1) Upstream of Pumping Plant No. 1: Elevation 5,280 feet.

2) Downstream of Pumping Plant No. 1: Elevation 5,460.9 feet.

b. Reach 3; Elevation 5,460.9 feet.

c. Test Segment: Each pipe segment between sectionalizing valves.

d. First test segment: Between start of Reach 2 pipeline and first sectionalizing valve.

e. Last test segment: From last sectionalizing valve and end of Reach 3 pipeline.

f. Manifold pipe for the San Juan Lateral Water Treatment Plant Regulating Tanks to be tested with the connecting line pipe.

g. Sectionalizing valves shall be removed for testing unless test pressures are less than rated pressure for valve.

6. Prior to starting test, maintain pressure in pipe for 24-hours.

7. Test for 96-hours or as approved by COR.

8. Measure volume of water required to maintain pressure during test:

a. Acceptance criteria:

1) Zero leakage:

a) Test using digital gauge with data logger.

b) Test pressure shall not drop by more than 5 psi during test period.

c) Repair any pipeline leakage detectable by any means as approved by COR.

b. If criteria are not met, repair or replace pipe or fitting and repeat test until acceptance criteria is achieved.

9. Drain pipe using both gravity flow and sump pump at blowoffs or as approved by COR.

10. Seal openings to pipe as approved by COR.

B. Pipeline leakage discovered after leak testing:

1. Repair any pipeline leakage detectable by any means as approved by COR.

2. Retest pipeline test segment containing repair to prove zero leakage at test pressure for 96-hours.

C. Locate tracer system testing:

1. Perform test of tracer wire system using applicable equipment along entire length of pipe to ensure proper performance.
2. Repair any identified breaks or separations and retest applicable section of system.

END OF SECTION

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SECTION 33 11 12
STEEL LINE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing steel line pipe in prices offered in Price Schedules for Pipeline General Requirements.

   a. Does not include pipe specified in Section 33 21 95 – Metal Piping for Line Pipe Installations or Section 35 21 95 – Steel Manifold Piping.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A139/A139M-16	Electric-Fusion (Arc) - Welded Steel Pipe (NPS 4 and Over)
2.	ASTM A283/A283M-18	Low and Intermediate Tensile Strength Carbon Steel Plates
3.	ASTM A1011/A1011M-15	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Allow and High-Strength Low-Allow with Improved Formability
4.	ASTM A1018/A1018M-16a5	Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability
5.	ASTM E165/E165M-12	Liquid Penetrant Examination for General Industry
6.	ASTM E709/E709M-15	Standard Guide for Magnetic Particle Testing

B. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-15	Structural Welding Code – Steel

C. American Water Works Association (AWWA)

1.	AWWA C200-12	Steel Water Pipe - 6 Inch (150mm) and Larger

2.	AWWA C205-12	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100mm) and Larger - Shop Applied
3.	AWWA C206-17	Field Welding of Steel Water Pipe
4.	AWWA C208-12	Dimensions for Fabricated Steel Water Pipe Fittings
5.	AWWA C227-11	Bolted, Split-Sleeve Restrained and Non-restrained Couplings for Plain-End Pipe
6.	AWWA C604-11	Installation of Buried Steel Water Pipe 4 Inch (100 mm) and Larger
7.	AWWA M11-04	Steel Pipe: A Guide for Design and Installation, Fourth Edition

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 11 12-1, Steel Line Pipe Thicknesses:

1. Show straight line pipe fabrication details.
2. Provide steel thickness and yield stress tables for each pipe size, depth, and head class.
3. Show details of factory epoxy lining of joint cement mortar hold back area if alternate epoxy joint recess lining is proposed.

C. RSN 33 11 12-2, Field Welder Qualifications:

1. Welder certifications.

D. RSN 33 11 12-3, -4, -5, -6, Shop Drawings:

1. RSN 33 11 12-2, Reach 2, Start of Reach 2 to Start of San Juan River HDD.
2. RSN 33 11 12-3, Reach 2, End of San Juan River HDD to end of Reach 2.
3. RSN 33 11 12-4, Reach 3, Start of Reach 3 to Start of Chaco River HDD.
4. RSN 33 11 12-5, Reach 3, End of Chaco River HDD to end of Reach 3.
5. Submit concurrently with applicable corresponding Reach section of pipelaying diagrams submitted until Section 33 11 10 – Pipeline General Requirements.
6. Show pipe and fitting fabrication details.
7. Show exact dimensions of joints and proposed joint restraint.
8. Show exact dimensions of welding lead holes and repair method.
9. Show details of factory epoxy lining of joint cement mortar hold back area if alternate epoxy joint recess lining is proposed.

10. See RSN 33 11 10-2 through -5 for further details.

E. RSN 33 11 12-7, Ventilation Plan:

1. Method for ventilating inside of pipe when placing mortar lining for joints.

F. RSN 33 11 12-8, Single Lap Weld Stress Calculations:

1. In accordance with Article 3.01 B. 5.

1.04 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

1.05 QUALIFICATIONS

A. Steel Pipe Welders: Welders and Welding Operators to be qualified in accordance with AWS D1.1.

PART 2 PRODUCTS

2.01 STEEL LINE PIPE

A. Pipe:

1. Electric fusion (arc) welded helical-seam steel pipe: ASTM A139, Grade C, D, or E.
2. Fabricated in accordance with AWWA C200:
   a. Except:
      1) Steel plate: ASTM A283, Grade C or D.
      2) Steel Sheet or coil: ASTM A1011, designation SS, Grade 40, 45, or 50; or ASTM A1018, designation SS, Grade 40 or designation HSLAS-F, Grade 50.
3. Apply heat sheet shrink sleeve as detailed in Section 09 96 20 – Coatings. Install weld seam tape prior to applying sleeve.

B. Inside diameter measured to inside of lining shall not be less than nominal diameter shown on drawings.

C. Minimum Steel Wall Thickness:

1. Greater thickness from the following requirements:
   a. Steel Wall Thickness for Handling:
      1) Equal to inside diameter (inches) of pipe steel shell divided by 240 for mortar lined and flexible coated steel pipe.
   b. Steel Wall Thickness for Internal Pressure:

1) Hoop stress of pipe shell. Not to exceed:

a) 50 percent yield strength as defined by steel grade of steel using the Barlow formula. With pressure defined by Hydraulic Grade Line as shown on pipeline plan and profile drawings.

b) 75 percent yield strength as defined by grade of steel using the Barlow formula. With pressure defined by pipe head class as shown on pipeline plan and profile drawings.

2) Barlow formula as defined by AWWA M11 Equation 4-1.

c. Steel Wall Thickness for Steep Pipe ("K"): Minimum 0.25-inches or greater as required for Internal Pressure.

D. Steel shall be fully killed and conform to fine grain practice.

E. Rubber gaskets: In accordance with AWWA C200.

2.02 FITTINGS

A. Steel: ASTM A283, Grade C or D or ASTM A1011, designation SS, Grade 40, 45, or 50; or ASTM A1018, designation SS, Grade 40 or designation HSLAS-F, Grade 50.

B. Minimum steel wall thickness and fitting dimensions: In accordance with AWWA C200, AWWA C208 and AWWA M-11.

C. Minimum pressure rating of fittings shall match adjacent pipe.

D. Welding:

1. AWS D1.1.

E. Lifting eyes and other handling devices: Made part of fitting before lining and coating are applied.

F. Bolts and Nuts: ASME B18.2.1 and FS FF-N-836.

G. Coating and lining in accordance with Section 09 96 20 – Coatings.

H. Cement-Mortar Lining for Specials and Bends Larger than 24-inches:

1. In accordance with AWWA C205.

2. Apply lining with a resultant surface finish, including joints, equal to finish of adjacent pipe.

I. Joints between fittings and ductile iron pipe:

1. Rubber gasket joints.

2. Joint dimensions and tolerances: Same as pipe manufacturer's joint design.

J. Miter Bends: Fabricate steel bends in accordance with AWWA C208, AWWA M-11 and as shown on drawings. Radius of miter bends for line pipe shall be 2.5 times the pipe outside diameter.

K. Pipe Couplings:

1. Coupling types as shown on drawings.
2. Suitable for line pipe materials used.
3. Suitable for cold water pressures of pipe head classes on drawings.
4. Refer to Section 33 21 95 – Metal Piping for Line Pipe Installations for coupling requirements.

L. Closure Section Joints

1. Restraint requirements shown on drawings.
2. Field welded butt strap joints.
3. Bolted and Split-Sleeve Restrained Couplings for Plain – End:
   a. In accordance with AWWA C227.
   b. Refer to Section 33 21 95 – Metal Piping for Line Pipe for coupling requirements.

M. Tees:

1. Tees for air valves, blowoffs, manholes, and turnout as shown on drawings.
2. Tee length, minimum: As shown on drawings, required for blocking, or in accordance with AWWA C208 whichever is greater.

2.03 LININGS AND COATINGS

A. In accordance with Section 09 96 20 – Coatings.

B. Do not field apply mortar lining without COR approval.

C. Fill inside joint recess of cement mortar lined pipe with cement mortar per AWWA C205.

2.04 CONCRETE

A. Concrete in Thrust Blocks and Collars: Section 03 30 00 – Cast-in-Place Concrete.

2.05 FLANGES:

A. In accordance with AWWA C207.

B. Class: Working pressure meets or exceeds head class of attached pipe

C. Flange bolt pattern shall match bolt pattern of mating flange.

2.06 INSULATED FLANGE

A. Full face gasket insulating kit as manufactured by Pipeline Seal and Insulator, Inc., 6525 Goforth Street, Houston, TX 77021, complete with Linebacker type gasket, Advanced Products and Systems, Inc., P.O. Box 60399, Lafayette, LA 70596-0399, complete with Trojan type gasket, or equal with the following essential characteristics:

1. Gasket:
   a. Full face, Type E.
   b. Outside diameter same as outside diameter of flange.
   c. Retainer:
      1) Phenolic or other material suitable for water service as recommend by the manufacturer.
      2) Thickness, minimum: 1/8-inch.
      3) Dielectric strength, minimum: 500-volts per mil.
   d. Sealing ring: Nitrile.
2. Bolt isolating sleeves:
   a. Full length. Extends halfway into both steel washers when installed.
   b. Tube thickness: 1/32-inch.
   c. Mylar or other suitable material recommended by the manufacturer.
3. Washers:
   a. Isolating washers:
      1) Phenolic or other material suitable for water service as recommend by the manufacturer.
      2) Thickness, minimum: 1/8-inch.
      3) Dielectric strength, minimum: 500-volts per mil.
      4) Inside diameter: Fit over isolating sleeve.
   b. Steel washers:
      1) Thickness: 1/8-inch.
      2) Inside and outside diameters: Same as isolating washers.
4. No asbestos.

2.07 FLANGE GASKETS

A. Multi-Swell Style 3760-U as manufactured by Garlock, www.garlock.com or equal with the following essential characteristics:

1. AWWA C207 or ASME B16.21.
2. Flat, full face or ring type.

3. NSF 61 Certified.
4. Suitable for cold water service.
5. Provide flanges suitable for line pipe pressure locations.

2.08 CONTRACTOR SOURCE QUALITY TESTING

A. Pipe and Fittings:

1. Hydrostatic Test:
   a. Perform shop hydrostatic test on pipe which stresses steel to 75 percent of minimum yield point of the steel.
   b. Hold pressure long enough to allow thorough inspection of welded joints.
   c. Repair leaks by rewelding and retesting joints.
   d. Test sections prior to forming bell and spigot joints.
   e. Repair defects and retest section before applying lining and coating.
   f. Government may witness hydrostatic testing and calibration of pressure gauges. Notify Government 30 days prior to performing hydrostatic test.
2. Fittings fabricated from tested steel pipe do not require hydrostatic testing if welds are tested.
   a. Weld test: Dye penetrant test in accordance with ASTM E165 or Magnetic Particle in accordance with ASTM E709.
   b. Weld defect repair. Chip, flame gouge, or grind to sound metal; reweld; and test repaired weld.

B. Joint Testing: Assemble one joint for each pipe diameter to check bell and spigot to check fit prior to coating or lining.

PART 3 EXECUTION

3.01 INSTALLATION

A. Joining Pipe:

1. In accordance with AWWA C604.
2. Verify inside joint gap meets manufacturer's tolerances as work progresses.

B. Joints for Pipe with Welded Joints:

1. In accordance with AWWA C206. Welded joints after backfill not allowed.
2. Perform dye penetrant test on welds in accordance with ASTM E165 and repair any defects.
3. Welded Butt Joints:
   a. As required for pipe on steep slopes as shown on drawings.

4. Double Lap Weld Joints:
   a. Provide joint with full fillet welds.
   b. Air test double lap welds in accordance with AWWA C206 and repair any defects.
   c. Required on thrust restrained joints greater than 30-degree bend deflection angles, unless butt welded joints are required, and within steel casing pipe.
5. Single Lap Weld Joints: May be used if calculations sealed by professional engineer in the State of New Mexico show allowable stresses of weld and pipe materials shall not be exceeded for each head class:
   a. May be used on thrust restrained joints with 30-degree bend deflection angles or less.
   b. Road and wash crossings unless butt or double-lap welded joints are required.
   c. Perform Vacuum Box Test and repair any defects in accordance with AWWA C206.
6. Joint Thrust Restraint: As shown on drawings.
7. Joints within casings: Double lap or full penetration butt welded.

C. Connections at Thrust Blocks and Structures: As shown on drawings

D. Closure Sections:
   1. Where necessary as determined by Contractor, subject to approval of COR.
   2. Ambient temperature when closure section is welded, maximum: 60 degrees F.

3.02 TOLERANCES

A. Lay pipe to lines and grades shown on drawings or established by COR to following tolerances:
   1. Departure from and return to established alignment and grade, maximum: 1/16-inch per foot of pipe.
   2. Total departure from established alignment and grade, maximum: 1-inch.

3.03 ADJUSTMENTS IN ALIGNMENT AND GRADE FOR PULLED JOINTS

A. Per approved pipe laying diagrams.

B. Refer to Section 33 11 10 – Pipeline General Requirements.

C. Make small minor changes in alignment and grade by providing small deflections between adjacent pipe sections as follows:
   1. Pulling rubber gasket bell-and-spigot joint:

a. A total 1-inch joint deflection may be permitted by reducing normal 1/2-inch inside mortar space to 1/4-inch and pulling opposite side of pipe 3/4-inch from normal closure.

b. Provide unsymmetrical closure at welded lap joint up to maximum pullout of 1-inch.

2. Maximum deflection angle between adjacent pipe sections: Manufacture's recommendations but shall not exceed 5 degrees.

D. Lay ends of each section of steel line pipe on theoretical centerline of curve and to grade shown on drawings within laying tolerances prescribed above.

3.04 JOINT LINING AND COATING

A. Field joints for pipe with shop applied cement-mortar lining.

1. Line field joints with cement-mortar in accordance with AWWA C205.
2. Coat exterior joints as specified in Section 09 96 20 – Coatings.
3. Do not backfill field joints until coating is approved by OGR.
4. Welding after backfill not allowed.

B. Apply shrink sleeves to field joints in accordance with Section 09 96 20 – Coatings.

3.05 BACKFILL

A. Keep internal supports in place until embedment has been placed and compacted above bottom of pipe to minimum height of 0.7 times diameter.

3.06 PIPE DIAMETER DEFLECTION

A. Allowable short-term vertical pipe diameter deflection after backfilling is complete.

1. Decrease, maximum: 2 percent of nominal pipe diameter.
2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.
3. Short term is within 2 weeks after backfilling is complete.

B. Allowable long-term vertical pipe diameter deflection, at end of warranty period:

1. Decrease, maximum: 3 percent of nominal pipe diameter.

END OF SECTION

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SECTION 33 11 13
DUCTILE IRON PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing ductile iron line pipe in prices offered in Price Schedules for Pipeline General Requirements.

1.02 REFERENCE STANDARDS

A. American Water Works Association (AWWA)

1.	AWWA C104-16	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2.	AWWA C110-12	Ductile-Iron and Gray-Iron Fittings for Water
3.	AWWA C111-17	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
4.	AWWA C151-09	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 11 13-1, -2, -3, -4, Shop Drawings:

1. RSN 33 11 13-1, Reach 2, Start of Reach 2 to Start of San Juan River HDD.
2. RSN 33 11 13-2, Reach 2, End of San Juan River HDD to end of Reach 2.
3. RSN 33 11 13-3, Reach 3, Start of Reach 3 to Start of Chaco River HDD.
4. RSN 33 11 13-4, Reach 3, End of Chaco River HDD to end of Reach 3.
5. Submit concurrently with applicable corresponding Reach section of pipelaying diagrams submitted until Section 33 11 10 – Pipeline General Requirements.
6. Show pipe and fitting fabrication details.
7. Show exact dimensions of joints, and inside and outside pipe diameters, and diameter of rubber gasket including tolerances, other major dimensions, proposed restraint. Include all details of adjacent equipment if ductile iron fittings are used in place of steel fittings.

8. Submit, for approval, Ductile Iron pipe design elements and details which vary from steel pipeline design shown on drawings.

9. See RSN 33 11 10-2 through -5 for further details.

C. RSN 33 11 13-5, Commercial Products:

1. Joint restraint products.

1.04 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

PART 2 PRODUCTS

2.01 PIPE

A. AWWA C151: Nominal laying length: 20-feet.

B. For allowable pipe size and classes, refer to Section 33 11 10 – Pipeline General Requirements and drawings.

C. Minimum DI Pressure Class of Pipe shall be the greater class from the following requirements:

1. Pressure defined by Hydraulic Grade Line as shown on pipeline plan and profile drawings.

2. Increase pipe pressure class as required so transient pressure defined by pipe head class as shown on pipeline plan and profile drawings is within transient allowance of pipe.

a. Allowable transient pressure is equal to rated working pressure plus 100 psi.

D. Rubber Gaskets: AWWA C111.

E. Coatings and linings in accordance with Section 09 96 20 – Coatings. Cement mortar lining shall be double thickness as defined by AWWA C104.

2.02 FITTINGS

A. Joints between fittings and ductile iron pipe:

1. Rubber gasket joints.

2. Restrained joints.

3. Joint dimensions and tolerances: Same as pipe manufacturer's joint design.

B. Ductile Iron Fittings:

1. AWWA C110 and C111.
2. Coatings and Lining:
   a. Refer to Section 09 96 20 – Coatings.
   b. Cement mortar lining: Double thickness as defined by AWWA C104.
3. Tees, Bends, or Adaptors:
   a. Lengths: AWWA C110 or as shown on drawings.
   b. Ends: Fit type of joint in adjacent pipeline.
4. Plan, profile and restraint system shown on drawings require modification if ductile iron fittings are used.
5. Minimum pressure rating of fittings shall match adjacent pipe.
6. Joints between fittings and other pipe types:
   a. PVC Pipe:
      1) Unrestrained: Rubber gasket joints.
      2) Restrained: Megalug Series, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716, or equivalent
      3) Joint dimensions and tolerances: Same as PVC pipe manufacturer's joint design.
   b. HDPE and Fiberglass Pipe:
      1) Flanged:
         a) Bolt patterns on flanges must match AWWA C110.
7. Joint Restraint Products: AWWA C110
   a. Between pipe sections: Push on joints with ductile iron locking elements
      1) US Pipe HP Lok Restrained Joint Pipe, U.S. Pipe Two Chase Corporate Drive, Suite 200, Birmingham, AL 35244, telephone 866-347-7473 or equivalent.

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. Ductile Iron Pipe: AWWA C151:
   1. Test per manufacturer's quality control program and certify tests.
   2. Tests may be witnessed by Government. Notify COR 30-days prior to testing.

B. Ductile Iron Fittings: Test in accordance with AWWA C110:
   1. Test per manufacturer's quality control program and certify tests. Additionally, perform hydrostatic proof test on every 50th fitting per AWWA C110.
   2. Tests may be witnessed by Government. Notify COR 30-days prior to testing.

PART 3 EXECUTION

3.01 JOINING PIPE

A. Assemble push-on or mechanical joints in accordance with AWWA C111 and the manufacturer's recommendations.

B. Coat exterior joints as specified in Section 09 96 20 – Coatings:

1. Do not backfill field joints until coating is approved by COR.

C. Thrust Restraint:

1. Push-on restrained joints per pipe manufacturer's design for the restrained length shown on drawings.
2. US Pipe HP Lok Restrained Joint Pipe, or equal; up to size and pressure limitations of restraint.
3. Concrete in encasements, blocking and collars in accordance with Section 03 30 00 – Cast-in-Place Concrete and as shown on drawings.

D. Connections at Collars and Thrust Blocks: As shown on drawings.

E. Connections to Other Types of Pipe:

1. Use rubber gasket or flanged joints to make connections between ductile iron pipe and other types of pipe.

3.02 ADJUSTMENTS IN ALIGNMENT AND GRADE FOR PULLED JOINTS

A. Per approved pipe laying diagrams.

B. Refer to Section 33 11 10 – General Pipeline Requirements.

C. Make other adjustments in alignment and grade by providing deflections at joints.

1. Maximum deflection angle between adjacent pipe sections is 3 degrees or manufacturer's recommendation whichever is less.

3.03 TOLERANCES

A. Lay pipe to lines and grades shown on drawings or established by COR to the following tolerances:

1. Total departure from established alignment and grade, maximum: 1-inch.

3.04 PIPE DIAMETER DEFLECTION

A. Allowable short-term vertical pipe diameter deflection after backfilling is complete:

1. Decrease, maximum: 2 percent of nominal pipe diameter.

2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

B. Allowable long term vertical pipe diameter deflection, at end of warranty period:

1. Decrease, maximum: 3 percent of nominal pipe diameter.

END OF SECTION

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SECTION 33 11 16
PVC PRESSURE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing PVC pressure pipe in prices offered in Price Schedules for Pipeline General Requirements.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM F1674-11	Joint Restraint Products for Use with PVC Pipe

B. American Water Works Association (AWWA)

1.	AWWA C605-13	Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
2.	AWWA C900-16	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-In. through 60-In. (100 mm through 1,500 mm)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 11 16-1, -2, -3, -4, Shop Drawings:

1. RSN 33 11 16-1, Reach 2, Start of Reach 2 to Start of San Juan River HDD.
2. RSN 33 11 16-2, Reach 2, End of San Juan River HDD to end of Reach 2.
3. RSN 33 11 16-3, Reach 3, Start of Reach 3 to Start of Chaco River HDD.
4. RSN 33 11 16-4, Reach 3, End of Chaco River HDD to end of Reach 3.
5. Submit concurrently with applicable corresponding Reach section of pipelaying diagrams submitted until Section 33 11 10 – Pipeline General Requirements.
6. Show pipe and fitting fabrication details. Include:
   a. Lengths of pipe, joint type and overlap lengths, restrained lengths, inside pipe diameters and dimension ratios.

7. Dimensions of joints, diameter of rubber gasket including tolerances, other major dimensions, proposed restraint, and location which include station and elevation.
8. Connections details to other pipe types (coupling information and dimensions).
9. Submit, for approval, PVC Pressure Pipe pipeline design elements and details which vary from steel pipeline design shown on drawings.
10. See RSN 33 11 10-2 through -5 for further details.

C. RSN 33 11 16-5, Pipe Manufacture Certification:

1. Pipe meet AWWA C900.

D. RSN 33 11 16-6, Fused Pipe Information:

1. Manufacturer's instructions for fusing and installation.
2. Fusing technician's qualifications.

1.04 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

1.05 QUALIFICATIONS

A. Fusers: Certified within last 12-months by pipe manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide sun protection for PVC pipe stored outside.

1. At minimum, wrap pipe with fastened opaque covering.
2. In warm climates, allow air circulation through and around pipe by puncturing or cutting covering in area of pipe ends.

PART 2 PRODUCTS

2.01 PIPE

A. PVC Pressure Pipe: AWWA C900: Elastomeric joint or fused joints where shown on drawings:

1. Nominal laying length: 20-feet.
2. PVC pipe dimensions: Based on AWWA Cast Iron (CI) sizes for diameters.
3. Minimum Pressure Rating of Pipe: Higher pressure rating from the following requirements:
   a. Pressure defined by steady state Hydraulic Grade Line as shown on pipeline plan and profile drawings.

b. Increase pipe pressure class as required so transient pressure defined by pipe head class as shown on pipeline plan and profile drawings is within transient allowance of pipe:

1) Allowable transient pressure is equal to 110 percent of continuous pressure rating of pipe.

B. Rubber Gaskets: Manufactured and tested in accordance with AWWA C900.

2.02 FITTINGS

A. Allowable:

1. Steel: In accordance with Section 33 11 12 – Steel Line Pipe.
2. Ductile Iron: In accordance with Section 33 11 13 – Ductile Iron Pipe.

B. Minimum pressure rating of fittings shall match adjacent pipe.

C. Rubber Gaskets: Manufactured and tested in accordance with AWWA C605 or C900.

D. Joint Restraint Products: ASTM F1674:

1. Joint Restraint:

a. Not allowed where thrust restraint requires more than 2 pipe joints:

1) Maximum, 2 PVC restrained pipe joints allowed each side of thrusting element.

b. Allowed for road and wash crossings where thrust restraint limitation is not reached.

2. Between pipe sections up to size and pressure limitation of restraint product:

a. Megalug Series, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716 www.ebaa.com or equivalent

3. Between pipe and fittings:

a. Megalug Series, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716 www.ebaa.com or equivalent

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. PVC Pipe: AWWA C900:

1. Tests may be witnessed by Government. Notify COR 30-days prior to testing.

PART 3 EXECUTION

3.01 JOINING PIPE

A. Join pipe in accordance with AWWA C605 or as directed by COR.

B. Apply firm, steady pressure either by hand or using bar and block until spigot easily slips through gasket. Mechanical equipment such as come-alongs may be used to join pipe.

C. Spigot end of pipe: Marked by manufacturer to indicate proper depth of insertion.

D. Push spigot until reference mark on spigot end is flush with bell end.

E. Connections between PVC Pressure Pipe and Other Types of Pipe: Use rubber gasketed mechanical joints to make connections.

F. Cathodic protection required for metallic miter bends and metallic joint restraint.

G. Fusible PVC pipe joints per manufacturer's instructions.

3.02 ADJUSTMENTS IN ALIGNMENT AND GRADE FOR PULLED JOINTS

A. Make small adjustments in alignment and grade by providing deflections at joints:

1. Maximum Deflection: 1 degree or deflection recommended by pipe manufacturer, whichever is less.

B. Longitudinal bending of pipe to obtain deflection: Not permitted.

C. Other methods of providing curves in pipelines may be submitted. If approved, use these methods to install curves.

3.03 TOLERANCES

A. Lay pipe to lines and grades shown on drawings or as established by COR with the following tolerances:

1. Total departure from established alignment and grade, maximum: 1-inch.

3.04 PIPE DIAMETER DEFLECTION

A. Allowable short term vertical pipe diameter deflection after backfilling is complete:

1. Decrease, maximum: 3 percent of nominal pipe diameter.
2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

B. Allowable long-term vertical pipe diameter deflection, at end of warranty period:

1. Decrease, maximum: 5 percent of nominal pipe diameter.

END OF SECTION

SECTION 33 11 17

PVC GRAVITY DRAIN FOR SAN JUAN LATERAL WATER TREATMENT PLANT REGULATING TANKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks:

   a. Includes:

      1) Pipe bedding and backfill for gravity drain.

      2) Solid and Slotted PVC pipe for gravity drain.

      3) Fittings for gravity drain.

      4) Flexible coupling for gravity drain.

      5) Metallic warning tape for gravity drain.

      6) Outfall screen for gravity drain.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A240/A240M-17	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
2.	ASTM C33/C33M-16e1	Concrete Aggregates
3.	ASTM C1173-18	Flexible Transition Couplings for Underground Piping Systems
4.	ASTM D882-12	Tensile Properties of thin Plastic Sheeting
5.	ASTM D1785-15	Rigid Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80 and 120
6.	ASTM D2103-15	Polyethylene Film and Sheeting
7.	ASTM D2466-15	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
8.	ASTM D2564-12	Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
9.	ASTM D2672-96a(2009)	Joints for IPS PVC Pipe Using Solvent Cement

10.	ASTM D5926-15	Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
11.	ASTM F480-14	Thermoplastic Well Casing Pipe and Couplings made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80
12.	ASTM F656-10	Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

1.03 SYSTEM DESCRIPTION

A. This specification section covers the gravity drain around perimeter of the San Juan Lateral Water Treatment Plant Regulating Tanks and continuing to a daylight termination point at the site riprap lined drainage channel.

B. Gravity drain conveys water collected from the concrete tank gravel drain system to site riprap lined drainage channel through 6-inch PVC pipeline.

C. General routing of the gravity drain is shown on drawing 1695-D-62473.

D. Pipe connection locations, see drawings.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 11 17-1, Certification:

1. Submit manufacturer's certification that pipe meets specified requirements.

C. RSN 33 11 17-2, Pipe Layout Drawings:

1. Contractor's drawings of piping covered by this specification.
2. Plan view drawing showing dimensions and distances of all system components.
3. Profile view drawing showing elevations, centerlines and depth of cover.

D. RSN 33 11 17-3, Product Approval Data:

1. Shipping, handling and installation procedures.
2. Manufacturers name, commercial products data and drawings, illustrations and dimensions for all pipe, fittings, and components.

E. RSN 33 11 17-4, Final Data:

1. As-built drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle equipment and components in accordance with manufacturer's recommendations to prevent damage.

B. Do not use rope, cable, or chain slings to handle drain pipe. Fabric slings not less than 12-inches in width may be used to handle drain pipe.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Solid Polyvinyl Chloride (PVC) Pipe, Schedule 40, 6-inch:

1. ASTM D1785.
2. End Style: Socket solvent cement.

B. Slotted PVC Underdrain Pipe, SDR17:

1. ASTM F480.
2. Slot Requirements:
   a. Width: 0.085-inch.
   b. Spacing: 0.25-inch.
   c. Open Area: 43.0 square inches, minimum, per foot of pipe.
3. End Style: Socket solvent cement.

C. PVC Extruded or Injection-Molded Pressure Fittings:

1. ASTM D2466.
2. Pressure rating equal to pipe.

D. Solvent cement ASTM D2564.

E. Primer ASTM F656.

F. Metallic Warning Tape:

1. Compliant with ASTM D882 and ASTM D2103.
2. Standard 6-inch wide, commercial quality, detectable underground warning tape.
3. Continuous tape with message "Caution Buried Waterline Below."
4. Color: Blue.

2.02 COMPONENTS

A. Flexible Coupling:

1. Fernco 1056 Series manufactured by Fernco, Incorporated, 300 S. Dayton Street, Davison, MI, 48423; or equal, having the following essential characteristics:
    a. Compatible with the pipe material and fittings.
    b. Positive seal against infiltration and exfiltration.
    c. Leakproof and resistant to chemicals and fungus growth.
    d. Conforms to ASTM D5926 and C1173.
    e. Connects pipes of same or different sizes and materials quickly and easily.
    f. Stainless steel clamps are corrosion resistant and rustproof.

2.03 OUTFALL SCREEN

A. Stainless Steel Wire Cloth:

1. Stainless steel, ASTM A240, Type 304 or 316.
2. Mesh openings per linear inch: 4 by 4.
3. Wire diameter, minimum: 0.080-inch.

B. Bands for Screen:

1. Stainless steel: ASTM A240, Type 304 or 316.
2. Thickness, minimum: 10 gauge.
3. Width, minimum: 1/2-inch.

2.04 PIPE BEDDING

A. ASTM C33, coarse sand 100 percent passing 3/8-inch screen and 95 percent passing No. 4 screen.

2.05 PIPE TRENCH BACKFILL

A. Per Section 31 23 02 – Compacting Earth Materials.

PART 3 EXECUTION

3.01 INSTALLATION

A. Laying of slotted wall pipe:

1. In accordance with 31 24 18 – Gravel Drain for Water Storage Tanks.

B. Laying of solid wall pipe:

1. Install water pipes in conformity to the approved design plan and in coordination with OGR.
2. Clean each section of pipe and each fitting before installation.
3. Lower pipe and fittings into the trench preventing damage to pipe. Use approved slings when required.
4. Lay pipe true and uniform to line and grade, with no visible change in alignment at any joint unless curved alignment is called for on the drawings:
   a. If deflection is required, maximum deflection must not exceed the manufacturer's recommendation for the type of pipe and joint being used.
5. Whenever pipe laying is discontinued for an hour or more, close open ends of pipe with water-tight plugs.
6. Pipe shall not be laid when condition of trench or weather is unsuitable or when there is the possibility of foreign material entering the pipe.
7. Keep pipe interior free of dirt, filter material, and foreign material. Provide temporary closure at open pipe ends during work shutdown.

C. Flexible coupling:

1. Install on the gravity drain polyvinyl chloride pipe, beyond the tank foundation liner, as shown on drawing 1695-D-60163.

D. Joining Methods:

1. Solvent cement pipe sections in accordance with ASTM D2467, and ASTM D2672.

E. Slope gravity drain lines to daylight above riprap lined drainage channel. Slope shall be 0.01 minimum.

F. Install stainless steel metal cloth on open ends of pipes at site drainage channel.

3.02 EARTHWORK AND TRENCHES

A. Pipe Bedding and Backfill:

1. Minimum 4-inches below pipe and 6-inches above.
2. Place initial fill in even layers not exceeding 4-inches in depth and hand tamped to the spring line of the pipe, before proceeding to next layer.
3. Place backfill in even layers not exceeding 6-inches in depth and compacted, before proceeding to next layer.

B. Gravel Drain Material: In accordance with Section 31 24 18 – Gravel Drain for Water Storage Tanks.

C. Metallic Detectable Warning Tape:

1. Lay continuous metallic warning tape above runs of nonmetallic pipe to facilitate locating pipe later.

2. Warning tape shall be laid directly above the underground pipe, approximately 1-foot below finished yard elevation.

3.03 CLEANING

A. Clean or replace gravity drains that become clogged, damaged, or obstructed from any cause before acceptance of work. Use methods approved by COR to clean or replace pipe.

3.04 PROTECTION

A. Protect gravity drain pipe from vehicular and equipment traffic during installation.

B. Protect installed gravity drain pipes from equipment, wheel loads, and other concentrated loads until gravity drain is protected by permanent construction.

END OF SECTION

SECTION 33 11 18
HDPE PRESSURE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing HDPE pressure pipe in prices offered in Price Schedules for Pipeline General Requirements.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B16.1-15	Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
2.	ASME B16.5-13	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B. ASTM International (ASTM)

1.	ASTM D2513-16a	Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
2.	ASTM D3350-14	Polyethylene Plastics Pipe and Fittings
3.	ASTM F2206-14	Fabricated Fittings of Butt-Fused Polyethylene (PE)
4.	ASTM F2620-13	Heat Fusion Joining of Polyethylene Pipe and Fittings
5.	ASTM F2634-15	Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method

C. American Water Works Association (AWWA)

1.	AWWA C906-15	Polyethylene (PE) Pressure Pipe and Fittings, 4-In. through 65-In. (100 mm through 1,650 mm), for Waterworks

D. National Sanitation Foundation (NSF)

1.	NSF Standard 61-16	Drinking Water System Components – Health Effects

E. Plastic Pipe Institute (PPI)

1. TR-33-2012 Generic Butt Fusion Joint Procedure for Field Joint of Polyethylene Pipe

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 11 18-1, Heat Fusion Joint Operator Qualifications:

1. Certifications from manufacturer.
2. Inspection results.
3. Date of Certification.

C. RSN 33 11 18-2, -3, -4, -5, Shop Drawings:

1. RSN 33 11 18-2, Reach 2, Start of Reach 2 to Start of San Juan River HDD.
2. RSN 33 11 18-3, Reach 2, End of San Juan River HDD to end of Reach 2.
3. RSN 33 11 18-4, Reach 3, Start of Reach 3 to Start of Chaco River HDD.
4. RSN 33 11 18-5, Reach 3, End of Chaco River HDD to end of Reach 3.
5. Submit concurrently with applicable corresponding Reach section of pipelaying diagrams submitted until Section 33 11 10 – Pipeline General Requirements.
6. Show pipe and fitting fabrication details such as dimensions and location which includes station and elevation.
7. Connections details to other pipe types and appropriate expansion and contraction blocking.
8. Include pipe thickness, Dimension Ratio (DR) or pressure class of pipe segments and fittings
9. Submit, for approval, HDPE Pressure Pipe pipeline design elements and details which vary from steel pipeline design shown on drawings.
10. Provide coupling and restraint details.
11. See RSN 33 11 10-2 through -5 for further details.

D. RSN 33 11 18-6, Certification:

1. Pipe meets AWWA C906.
2. Test reports correlated to shipping bills.

E. RSN 33 11 18-7, Fusion Procedures:

1. Fusion temperature.
2. Interface pressure.
3. Cooling time.

4. Record of pipe size and DR being joined and each joint fusion temperature, interface pressure and cooling time.

1.04 QUALIFICATIONS

A. Heat Fusion Joint Machine Operator:

1. Certified by machine manufacturer or representative.
2. Trained on specific fusion machine and bonding procedure and shall:
   a. Perform 1 pipe-to-pipe bond and,
   b. One pipe-to-fitting bond on each machine to be used.
   c. Bonds made as part of operator certification:
      1) Visually inspected and tested in accordance with PPI and ASTM standards.
3. Qualification remains in effect for 6-months from date of qualification:
   a. Ability to be revoked by certifying entity.

1.05 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store HDPE pipe in unprotected, outside storage for more than 2-years.

PART 2 PRODUCTS

2.01 PIPE

A. HDPE Pressure Pipe: AWWA C906, except;

1. PE material:
   a. Standard PE code designation: PE 4710.
   b. Minimum cell Classification, ASTM D3350: PE 445574C or E.
   c. Chlorine resistance classification: CC3
2. Pipe:
   a. Minimum continuous pressure rating of pipe: Higher pressure from the following requirements:
      1) Pressure defined by steady state Hydraulic Grade Line as shown on pipeline plan and profile drawings.

2) Increase pipe pressure class so transient pressure defined by pipe head class as shown on pipeline plan and profile drawings is within 110 percent of continuous pressure rating of pipe.

b. Each production lot of pipe: Tested for melt index, density, percent carbon, dimensions and ring tensile strength and results recorded.

c. Approved for potable water in accordance with NSF Standard 61.

d. Color: Black with 2 to 3 percent carbon black by weight.

e. Not less than 4 permanent co-extruded, equally spaced, blue color stripes in outside surface of pipe.

2.02 FITTINGS

A. Allowable:

1. Steel: In accordance with Section 33 11 12 – Steel Line Pipe.
2. Ductile Iron: In accordance with Section 33 11 13 – Ductile Iron Pipe.
3. As shown on drawings.

B. HDPE fittings:

1. Minimum size and pressure rating of fittings shall match adjacent pipe.
2. Shop manufactured fittings constructed of HDPE PE 4710 in accordance with AWWA C906, ASTM F2206 and as shown on drawings.
3. Shop made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings:
   a. Rated for internal pressure service at least equal to full service pressure rating of mating pipe.
   b. Tested in accordance with AWWA C906.
4. HDPE flange and mechanical joint adaptors: Rated to at least same pressure as mating pipe.
5. Polyethylene flange or mechanical joint adapters made with sufficient through-bore to be clamped in a butt fusion-joining machine without use of a stub-end holder, as per pipe manufacturer's instructions.
6. HDPE fabricated mechanical adapters shall have steel stiffeners.

C. Adaptors, couplings, bends, and connections at encasements and thrust blocks:

1. Fabricated from HDPE in factory or steel unless shown otherwise on drawings.
2. HDPE pipe and fittings shall not be embedded in concrete thrust blocks.
3. Miter bend individual miter deflection angles shall not exceed 22.5 degrees:
   a. 0° to 22.5^{o} miter bends shall be two-piece elbows.

b. 22.6° to 45° miter bends shall be three-piece elbows.

c. 45.1° to 67.5° miter bends shall be four-piece elbows.

d. 67.6° to 90° miter bends shall be five-piece elbows.

4. Radius of miter bend fittings for HDPE line pipe shall be equal to or greater than 2.5 times the outside diameter of the pipe.

D. Metal Back-up Flange:

1. Material: Ductile iron, Class 150, ASME B16.1 or ASME B16.5, coat in accordance with Section 09 96 20 – Coatings.

E. Joints between HDPE pipe and metallic fittings: Flanged with backing ring.

2.03 CONCRETE COLLARS

A. In accordance with Section 03 30 00 – Cast-in-Place Concrete.

2.04 CONTRACTOR SOURCE QUALITY TESTING

A. HDPE Pipe and Fittings:

1. Notify Technical Service Center, Attn: 86-68140, and COR 14-days before HDPE pipe and fittings are tested.

2. General: AWWA C906 testing of HDPE pipe and fittings and ASTM F2634 testing of HDPE factory test fusions:

a. Completed and documented by qualified personnel.

b. Government reserves right to:

1) Observe testing while in process and to receive testing documentation.

2) Inspect materials both during and after manufacture.

c. Testing reports shall have unique identifiers with shipping bills to verify that pieces shipped belong to same as those tested.

3. Test in accordance with AWWA C906:

a. Perform 1 butt fusion in accordance with ASTM F2620 and PPI Technical Report TR-33 on each run of pipe and from each batch of material feedstock:

1) Test using Tensile Impact Test in accordance with ASTM F2634 prior to shipping pipe.

b. Joints exhibiting yield point lower than unfused pipe or that fails in a brittle mode is considered unacceptable.

c. Unacceptable test result, Government may reject pipe manufactured in same run and from same batch of material feedstock represented by

unacceptable test. Manufacturer may, at own expense, supply additional testing to COR.

d. Acceptable test results do not:

1) Mean pipe from pipe run or material feedstock batch will be acceptable.

2) Relieve pipe manufacturer or supplier from liability for defects in material or workmanship of pipe discovered during installation or warrantee period.

4. HDPE pipe out-of-roundness tolerances shall not exceed maximum allowances in ASTM D2513, Table 2:

a. HDPE pipe ovality: Plus, or minus 3 percent at pipe manufacturing facility.

B. HDPE Fittings:

1. Each HDPE fitting shipped to job site to be tested in accordance with AWWA C906.

PART 3 EXECUTION

3.01 LAYING PIPE

A. Plowing and planting: Not allowed.

B. Joining Pipe:

1. HDPE pipe butt fusions: In accordance with PPI Technical Report TR-33 (TR-33-12) and ASTM F2620.

2. Pipe may be joined above ground and then lowered into position, provided pipe is supported and handled in manner that prevents damage.

3. To avoid damage, do not join fabricated fittings larger than 16-inch diameter to more than one pipe before placement in trench.

4. Connections between HDPE pressure pipe and other types of pipe: Flange joints or as shown on drawings or per approved submittals.

5. Tied Joint Restraint System:

a. Clean surfaces of pipe and fittings to receive tied joint restraint system.

b. Install joint restraint system so joints are mechanically locked together to prevent joint separation.

6. Polyethylene Pipe Fusion Machine Data Loggers:

a. Used during joint fusions.

b. Record:

1) Joint temperature,

2) Pressure,

3) Time.

c. Supply data on fusion joints prior to backfill, in CDMS for OGR approval.

7. Thermal Contraction and Expansion of HDPE Pipe:

a. COR may unbolt flange at transition between HDPE and steel to check for tensile or compressive loading due to thermal contraction of HDPE pipe.

b. Excessive tension or excessive compression of flange beyond design limit:

1) Cause for Contractor to excavate HDPE pipe,

2) Lengthen or shorten and re-bury at own cost.

8. Concrete blocking as required for connections to other pipe types.

9. Electrofusion joints are not allowed unless approved by COR.

3.02 ADJUSTMENTS IN ALIGNMENT AND GRADE

1. Where shown as miter bends on drawings, make changes in alignment and grade with miter bends or submit proposal to COR for approval.

2. Make other adjustments in alignment and grade by bending pipe:

a. Minimum cold (field) bend radius shown in Table 33 11 18A – Minimum Cold Bending Radius.

Table 33 11 18A – Minimum Cold Bending Radius

Pipe DR	Minimum Cold Bending Radius
>13.5 to 21	27 times Pipe OD
>21	30 times pipe OD
Fitting or flange present or to be installed in bend	100 times pipe OD

B. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipelines closed.

C. Closure sections:

1. Last fusion joint for HDPE pipe to HDPE pipe closure sections:

a. Make during coolest part of day.

b. Air temperature, maximum: 65 degrees F.

3.03 CONNECTION AT CONCRETE THRUST RESTRAINT

A. Connect pipe to structures as shown on drawings:

1. Locate flange connections as shown on drawings.

2. Suitably block flange connection to prevent pipe movement due to temperature changes, unless design incorporates pipe restraint.

3.04 TOLERANCES

A. Lay pipe to lines and grades shown on drawings or established by COR to the following tolerances:

1. Total departure from established alignment and grade, maximum: 1-inch.

3.05 PIPE DIAMETER DEFLECTION

A. Measure deflections in pipe with diameters equal to and greater than 27-inches

B. Allowable short-term vertical pipe diameter deflection after backfilling is complete:

1. See Table 33 11 18B – Allowable Vertical Deflections.

2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

C. Allowable long-term vertical pipe diameter deflection, at end of warranty period: See Table 33 11 18B – Allowable Vertical Deflections.

Table 33 11 18B – Allowable Vertical Deflections

Pipe Dimension Ratio (DR)	Short Term Vertical Deflection Decrease, %	Long Term Vertical Deflection Decrease, %
DR greater than or equal to 21	3	7.5
DR greater than or equal to 13.5 and less than 21	2.4	6

3.06 CONTRACTOR FIELD QUALITY TESTING

A. Fusion Quality Testing on Polyethylene pipe:

1. Frequency:
   a. Minimum: 1 per crew per week or at request of COR.
   b. Maximum: 10 percent of welds.
   c. Additional testing may be required during changes in:
      1) Weather.
      2) Fusion machine.
      3) Fusion crew.
2. Procedure:
   a. Cool trial fusion, then:
      1) Cut out test coupons.
      2) Test using Tensile Impact Method accordance with ASTM F2634.
3. Rejection of Fusion Joints:
   a. Exhibits a yield point lower than unfused pipe or,
   b. Fails in brittle mode.
   c. Field fusions represented by failed trial fusion shall be rejected:
      1) Make corrections at Contractor expense and re-make rejected fusions.

END OF SECTION

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SECTION 33 11 50

PIPE CROSSINGS AT EXISTING UTILITY PIPELINES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of polyethylene encasement and petroleum-resistant gaskets in prices offered in Price Schedules for applicable Line Pipe.

1.02 REFERENCE STANDARDS

A. American Water Works Association (AWWA)

1. AWWA C105-10 — Polyethylene Encasement for Ductile-Iron Pipe Systems

B. ASTM International (ASTM)

1. ASTM C1619-11 — Elastomeric Seals for Joining Concrete Structures

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 33 11 50-1, Rubber Gasket Data:

1. In accordance with ASTM C1619

PART 2 PRODUCTS

2.01 MATERIALS

A. Polyethylene Film: AWWA C105

1. Minimum width for flat tube: 1.65 times outside diameter of pipe bell.
2. Minimum width for sheet: 3.30 times outside diameter of pipe bell.

B. Gaskets: ASTM C1619

C. Roofing Felt: 15-pound roofing felt

PART 3 EXECUTION

3.01 PIPE PROTECTION

A. Protect pipe and fittings at utility pipeline crossings in accordance with requirements of Table 33 11 50A - Protection for Pipe Crossings at Existing Utility Pipelines.

Table 33 11 50A - Protection for Pipe Crossings at Existing Utility Pipelines

Type of Line Pipe	Existing Utility Pipeline	Protection Required
The following types of pipe with rubber gasket joints: Reinforced concrete Pretensioned concrete cylinder Reinforced concrete cylinder Cement-mortar-coated steel line pipe	Metallic gasoline, oil, or sanitary sewer	Encase line pipe with polyethylene for 200 feet on each side of utility. Install petroleum-resistant gaskets in joints within 100 feet on each side of utility.
	Metallic water, storm sewer, or natural gasline	Encase line pipe with polyethylene for 200 feet on each side of utility.
	Nonmetallic gasoline, natural gasline, oil, or sanitary sewer	Encase line pipe with polyethylene for 100 feet on each side of utility.* Install petroleum-resistant gaskets in joints within 100 feet on each side of utility.**
	Nonmetallic water or storm sewer	None
The following types of pipe with rubber gasket joints: Polyethylene encased ductile-iron line pipe	Metallic or nonmetallic gasoline, oil, or sanitary sewer	Install petroleum-resistant gaskets in joints within 100 feet each side of utility.

Table 33 11 50A - Protection for Pipe Crossings at Existing Utility Pipelines

Type of Line Pipe	Existing Utility Pipeline	Protection Required
The following types of pipe with rubber gasket joints: PVC Dielectric-coated steel line pipe Dielectric coated ductile iron line pipe	Metallic or nonmetallic gasoline, natural gasline, oil, or sanitary sewer	Encase joints that are within 100 feet on each side of the crossing with polyethylene. Extend polyethylene for 5 feet on each side of the joint.*** Install petroleum-resistant gaskets in joints within 100 feet on each side of utility.**
	Metallic or nonmetallic water or storm sewer	None
The following types of pipe with welded joints: Pretensioned concrete cylinder Reinforced concrete cylinder Cement-mortar-coated steel line pipe	Any metallic utility pipeline	Encase line pipe with polyethylene for 200 feet on each side of utility.
	Any nonmetallic utility pipeline	None
The following types of pipe with welded joints: Dielectric-coated steel line pipe	Any metallic or nonmetallic utility pipeline	None

* At sanitary sewer crossings, encase line pipe with polyethylene for 10 feet on each side of crossing.

** At natural gaslines, petroleum-resistant gaskets are not required.

*** At sanitary sewer crossings, encase pipe joints that are within 10 feet on each side of the crossing.

3.02 PREPARATION AND INSTALLATION

A. Provide polyethylene encasement to prevent contact between pipe and surrounding backfill and bedding material.

1. Polyethylene encasement is not intended to be a completely airtight and watertight enclosure.

2. Secure overlaps by using adhesive tape, plastic string, or any other material capable of holding the polyethylene encasement in place until backfilling operations are completed.

B. Prior to encasing with polyethylene, remove foreign substances, such as mud, dirt, clods, and any loose aggregate, on pipe and fitting surfaces.

C. Overlap junctions of tube or sheet polyethylene at least 1 foot longitudinally.

D. Encase fittings for pipe with polyethylene in the same manner as for pipe.

E. Repair rips, punctures, or other damage to polyethylene with adhesive tape or with a suitable polyethylene film patch. Make repairs prior to wrapping with roofing felt.

F. Wrap roofing felt around entire polyethylene encasement and tape in place.

G. Do not puncture polyethylene encasement and roofing felt during backfilling operations.

END OF SECTION

SECTION 33 12 15

VALVES AND EQUIPMENT FOR LINE PIPE INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. 6-Inch Diameter Air Valve Assemblies:

1. Measurement: Number of 6-Inch Diameter Air Valve Assemblies of each pressure class installed.
2. Payment: Unit price offered in Price Schedules:
   a. Includes:
      1) All items associated with valves as shown on drawing 1695-D-60798.
      2) Guard posts.
   b. Does not include:
      1) Line Pipe.
      2) Earthwork for Line Pipe.

B. 6-Inch Diameter Air Valve with Manhole Assemblies:

1. Measurement: Number of 6-Inch Diameter Air Valves with Manhole Assemblies of each pressure class installed.
2. Payment: Unit price offered in Price Schedules:
   a. Includes: All items associated with air valve with manhole assemblies as shown on drawing 1695-D-60799.
   b. Does not include:
      1) Line Pipe.
      2) Earthwork for Line Pipe.

C. 6-Inch Diameter Blowoff Assemblies:

1. Measurement: Number of 6-Inch Diameter Blowoff Assemblies of each pressure class installed.
2. Payment: Unit price offered in Price Schedules:
   a. Includes:
      1) All items associated with valves as shown on drawing 1695-D-60812
      2) Guard posts.

b. Does not include:

1) Line Pipe.

2) Earthwork for Line Pipe.

D. 6-Inch Diameter Blowoff with Manhole Assemblies:

1. Measurement: Number of Blowoff with Manhole Assemblies of each pressure class installed.

2. Payment: Unit price offered in Price Schedules:

a. Includes: All items associated with blowoff with manhole assemblies as shown on drawing 1695-D-60800.

b. Does not include:

1) Line Pipe.

2) Earthwork for Line Pipe.

E. 42-Inch Sectionalizing Valve Assemblies:

1. Measurement: Number of 42-Inch Sectionalizing Valve Assemblies of each pressure class installed.

2. Payment: Unit price offered in Price Schedule 2:

a. Includes:

1) All items associated with valves as shown on drawing 1695-D-60801 through 60802.

2) Guard posts.

b. Does not include:

1) Line Pipe.

2) Earthwork for Line Pipe.

F. 48-Inch Sectionalizing Valve Assemblies:

1. Measurement: Number of 48-Inch Sectionalizing Valve Assemblies of each pressure class installed.

2. Payment: Unit price offered in Price Schedules:

a. Includes:

1) All items associated with valves as shown on drawing 1695-D-60801 through 60802.

2) Guard posts.

b. Does not include:

1) Line Pipe.

2) Earthwork for Line Pipe.

G. N.A.P.I. Turnout Assembly:

1. Payment: Lump sum price offered in Price Schedule 1.

a. Includes:

1) All items associated with drawing 1695-D-60804.

b. Does not include:

1) Probe magnetic flowmeter system.

2) Line Pipe.

3) Earthwork for Line Pipe.

1.02 DEFINITIONS

A. Valves and equipment for Line Pipe Installations: Assemblies for water distribution appurtenances such as sectionalizing valves, air valves, air valves with manholes, blowoffs, and blowoff with manholes.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A536-24	Ductile Iron Castings

B. American National Standards Institute/NSF (ANSI/NSF)

1.	ANSI/NSF 372-2022	Drinking Water System Components – Lead Content

C. American Society of Mechanical Engineers (ASME)

1.	ASME B16.1-2020	Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
2.	ASME B16.47-2025	Large Diameter Steel Flanges: NPS 26 through NPS 60
3.	ASME B16.5-2025	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch
4.	ASME B40.100-22	Pressure Gauges and Gauge Attachments

D. American Water Works Association

1.	AWWA C207-23	Steel Pipe Flanges for Waterworks Service, Sizes 4-In. through 144-In. (100-mm Through 3,600-mm)
2.	AWWA C504-23	Rubber Seated Butterfly Valves

3.	AWWA C507-23	Ball Valves, 6-In. through 60-In. (150-mm through 1,500-mm)
4.	AWWA C512-15	Air Release, Air/Vacuum, and Combination Air Valves for Waterwork and Wastewater Service

E. Manufacturers Standardization Society Standard Practice (MSS)

1.	MSS SP-110-10	Ball Valves: Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals:

1. Submit data that demonstrates equipment provided meets requirements.
2. Submit data giving manufacturer's name, type, model, size, and construction and performance characteristics of equipment.
3. Mark proposed catalog sheet item which allows data to be legibly reproduced.

B. RSN 33 12 10-1, Commercial Product Data:

1. Commercial product data that demonstrates the manufacturer's name and model number of each component, pressure rating, applicable standards, size, and materials for all equipment outlined in Part 2, Products, of this specification.

C. RSN 33 12 10-2, Valve Tags:

1. Proposed valve identification information.

D. RSN 33 12 10-3, Service Manuals:

1. For each valve and equipment type outlined in Part 2 Products, include:
   a. Complete parts identification lists.
   b. Lists of special tools and accessories.
   c. Detailed instructions for installing, operating, lubricating, and maintaining the equipment.
2. For each valve:
   a. Submit hydrostatic pressure testing certification, including pressures used in testing valves.
   b. Affidavit of compliance certifying the valve was fabricated and tested in accordance with applicable standards.

1.05 HANDLING AND TRANSPORTATION

A. Take every precaution during loading, transportation, unloading, storage, and laying, to prevent damage to valves and equipment.

1. Repair damage to valves and equipment as directed if, in opinion of OGR, a satisfactory repair can be made; otherwise replace damaged valves and equipment.
2. Ship, handle, and store according to manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Valves and equipment materials:

1. ANSI/NSF 372 certified lead-free.

B. Valve Body Flange Faces and Flanges:

1. Provide spiral or concentric serrated grooved flange face gasket surface finishes suitable for gasket material provided and for operating pressures.
2. Valve flange bolt patterns to match pipe flanges.
3. Contractor to verify flanges of valves provided are suitable for piping flanges.
4. Valves shall be installed in upstream/downstream orientation suggested by valve manufacturer.

C. Furnish valves and actuators of same type and size from same manufacturer.

2.02 VALVES

A. Air Valves:

1. For air valve installations shown on Drawings 1695-D-60798 and 1695-D-60799:
2. Manufactured by DeZurik/Apco, www.dezurik.com; Cla-Val, www.cla-val.com; Val-Matic Valve and Manufacturing Corporation, www.valmatic.com; or equal, having the following essential characteristics:
   a. Dual body.
   b. Clean water service.
   c. Stainless steel internal parts such as guides, bushings, and screws.
   d. Stainless steel floats.
   e. Float-pivot supports: Brass, bronze, stainless steel, or cast iron.
   f. AWWA C512.

g. Remains open for filling line until water has displaced air at point of attachment of valve assembly after which it closes.

h. Opens when pressure in pipeline drops sufficiently to create a vacuum.

i. Releases trapped air when the pipeline is under pressure.

j. Actuated by a float or floats.

k. Furnish with ball valves in accordance with paragraph 2.02 B:

1) One ball valve on top, permits checking effectiveness of air valve.

2) One ball valve on bottom, allows valve to be drained.

3) For dual body valves, provide full port isolation ball valve between main body and air release valve.

l. Air valve vent pipe shall include a 24-mesh stainless steel screen to prevent the entrance of insects and debris.

m. Air Valve steel vent pipe: In accordance with Section 33 11 30 – Steel Manifold Piping for Line Pipe Installations.

n. Cold-water pressure rating: as shown on Drawing 1695-D-60811 minimum.

o. Body material: Ductile iron or cast steel.

p. Air release orifice size: 3/8-inch orifice minimum.

q. Flanged inlets:

1) Flat faced.

2) Pressure Classes:

a) 0 to 346 ft hd - ANSI B16.1 Class 125 or ANSI B16.5 Class 150.

b) 347 to 577 ft hd - ANSI B16.1 Class 250 or ANSI B16.5 Class 300.

B. Ball Valves:

1. Less than 4-inches in diameter:

a. General:

1) Bubble tight at the rated pressure in either direction and suitable for operation after long periods of inactivity.

2) MSS SP–110.

3) Female threaded ends.

4) Cold water pressure rating of not less than 300 psig.

b. Carbon Steel or Bronze:

1) 70LF-100 series manufactured by Apollo Valves, www.apollovalves.com; or equal, having the following essential characteristics:

a) Body: Full ported carbon steel or lead-free bronze.

b) Ball: Stainless steel or lead-free brass.

c) Valve stem: Stainless steel or lead-free brass.

d) Packing gland: Steel or brass.

e) Install where shown on drawings. Bronze or carbon steel ball valves shall be installed on carbon steel pipe.

2. 4-inch and larger in diameter:

a. AWWA C507.

b. AWWA Class as indicated on drawings.

c. Bubble tight at the rated pressure in either direction and suitable for operation after long periods of inactivity.

d. Flanges:

1) AWWA Class 150: Suitable for connection to AWWA Class D flanges.

2) AWWA Class 300 valves: Flanges suitable for connection AWWA Class F flanges.

e. Suitable for exposed service.

f. Suitable for operating pressure of adjacent pipe:

1) 0 psi to 150 psi – AWWA C507 Class 150D

2) 151 psi to 300 psi – AWWA C507 Class 300D

g. Worm gear or traveling nut manual actuator in accordance with AWWA C507.

h. Rim pull and component strength meets AWWA C507.

i. Provide gears of the self-locking type, designed to hold the valve in all positions without fluttering or creeping.

j. Provide operators that will open and close the valves under maximum unbalanced pressure conditions based on the pressure rating of the valve.

k. Provide handwheel actuator.

C. Butterfly Valves:

1. Body: Ductile iron, ASTM A536 grade 65-45-12.

2. Shaft: Stainless steel.

3. On center or eccentric shaft.

4. Flat faced flanged end connections.
5. Suitable for operating pressure of adjacent pipe:
    a. 0 to 150 psi – AWWA C504, Class 150B, body flanges suitable for connection to AWWA Class D flanges.
    b. 151 to 250 psig - AWWA C504, Class 250B, body flanges suitable for connection to AWWA Class F flanges.
6. Resilient seated:
    a. Located either in the valve body mating with a stainless-steel seating surface located on the valve disc; or in the valve disc mating with a stainless steel seating surface located in the valve body.
        1) No fully rubber lined bonded seat in body type seats are acceptable.
        2) Resilient seats shall be mechanically retained and field replaceable.
7. Tested in accordance with AWWA C504 including performance, leakage, and hydrostatic testing.
8. Provide valves which are bubbletight at rated pressure in either direction and suitable for operation after long periods of inactivity.
9. Install butterfly valves complete and lubricated in accordance with the manufacturer's instructions.
10. Axis of valve leaf: Horizontal when the valve is in the installed position except where shown on the drawings.
11. Buried service:
    a. Valves and components shall be suitable for buried service.
    b. Provide with a 2-inch square-nut operator.
    c. Provide valve box.
    d. Provide extension stems to raise the operating nut to within 6-inches of the ground surface.
        1) To prevent disconnection below top of valve box, attach extension stems using roll pins or bolts with locking nuts that extend completely through stem extension connection.
        2) Provide a total of four (4) steel tee-handle wrenches, each 4-feet in length.
12. Manual operators for butterfly valves:
    a. Worm-gear or traveling nut type manual operator in accordance with AWWA C504.
    b. Rim pull and component strength meets AWWA C504.
    c. Provide handwheel actuator as shown on drawings.

d. Provide gears of the self-locking type, designed to hold the valve in all positions without fluttering or creeping.

e. Provide operators that will open and close the valves under maximum unbalanced pressure conditions based on the pressure rating of the valve.

D. Automatic Ball Drip Valve:

1. Model B-1, manufactured by Viking Corporation, 210 N. Industrial Park Drive, Hastings, MI 49058; or equal, having the following essential characteristics:

a. Stainless steel spring.

b. Brass body.

c. Female threaded end with 1/2-inch NPT inlet and 1/4-inch outlet.

d. Automatic draining, ball check.

e. Cold water pressure rating: 250 psig.

f. Provide dielectric insulating union as necessary to prevent galvanic corrosion between dissimilar metals.

2.03 APPURTENENACES

A. Valve Boxes:

1. Model 6855 series, manufactured by Tyler Union, www.tylerunion.com; or equal, having the following essential characteristics:

a. Cast iron locking lid with pentagon shaped bolt head.

b. Cast iron extension from valve nut operator to ground surface

c. Cast iron collar with lid marked "WATER".

d. 5 1/4-inch minimum inside diameter cast iron valve box.

e. 2-piece or 3-piece and slip type.

f. Base and adequate extension items to extend from valve nut operator to ground surface.

2. In accordance with Drawings 1695-D-60802.

B. Gaskets:

1. For flat faced and raised face flanges: Multi-Swell Style 3760 manufactured by Garlock, www.garlock.com; or equal with the following essential characteristics:

a. Dimensional requirements of AWWA C207, ASME B16.47, or ASME B16.5 as shown on drawings.

b. Minimum 250 psig cold water pressure rating.

c. Flat, full face, or ring type.

d. NSF 372 compliant.

e. Suitable for cold water service.

f. Minimum 1/16-inch thick.

C. Frost Vent Cover

1. Model FrostSafe two-way damper manufactured by Val-Matic Valve and Manufacturing Corporation, www.valmatic.com; or equal, having the following essential characteristics:

a. For 6-inch air vent.

b. Suitable for connection to AWWA Class D flange.

c. Allows 2-way flow.

d. Minimizes thermal exchange of cold and warm air in and out of valve vault.

2. Allows air vent to vent at full capacity.

D. Pressure Gauges:

1. Model XP2i Digital Pressure Gauges, manufactured by AMETEK, https://www.ametekcalibration.com/products/pressure/digital-pressure-gauges/xp2i-digital-pressure-gauge; or equal, having the following essential characteristics:

a. Accuracy levels of 0.1% of reading, 0.02% or 0.05% of full-scale reading.

b. Temperature resilient with accuracy unaffected by temperature variances.

1) Temperature Range: 14 to 122 degrees Farenheit.

c. Calibrated.

1) ISO 17025 calibration report–NIST-traceable, A2LA accredited, internationally recognized by ILAC–with test data at 5 temperatures.

d. Data recording capabilities and read-outs.

e. Shock resistant.

f. Provide dielectric insulating union fittings to prevent galvanic corrosion.

E. Insulation Jacket: In accordance with Section 07 21 60 - Insulation Jacket.

PART 3 EXECUTION

3.01 INSTALLATION

A. Dielectrically insulate between dissimilar metals. Provide insulation type unions at threaded valve, pipe or fitting connections between dissimilar metals.

B. Install:

1. Valves and equipment to line and grade as shown on drawings.
2. Valves complete and lubricated in accordance with the manufacturer's instructions.
3. Valves with flanged connections so that the bolt holes straddle the vertical centerline when in the installed position.
4. Protect equipment during application of spray foam insulation to prevent interference with operation.

C. Valve Tags:

1. Provide brass or stainless-steel tags for all valves identified on drawings (drawings 1695-D-60798 through 60807).
   a. For all valves, include:
      1) Valve #.
      2) Flow direction arrow.
      3) Size and type of valve.
      4) See drawings for further details.
   b. For Reach 2 valves, also include:
      1) “Do not operate during pumping”.
   c. For bypass valves, also include:
      1) “For filling and draining, see SOP”.
   d. For Reach 3 valves, also include:
      1) “Do not operate during filling”.
2. Permanently attach valve tags to valves with wire and metal crimp-type connector.

3.02 CONTRACTOR SOURCE QUALITY TESTING

A. Shop test butterfly valves in accordance with AWWA C504, ball valves in accordance with AWWA C507, and air valves in accordance with AWWA C512. Submit Affidavit of Compliance.

1. Leak test and hydrostatic test valves at manufacturer’s facility or an alternate facility approved by COR.
2. Tests will be Government witnessed. Notify OGR 30-days prior to valve testing.
3. Minimize the number of Government trips by testing all valves from the same manufacturer during same Government trip.
4. Prior to shop leakage test and in the presence of Government, Contractor shall verify that when valve is fully closed, valve position indicator indicates “CLOSED.”

5. If indicator is not in closed position (exactly at closed), remove operator from valve, fully close valve, reinstall operator so that it indicates "CLOSED."

6. Downstream position of valve shall be visible to Government inspector. Downstream shall be visible and dry prior to and during test so that the seat can be visually inspected.

7. Shop leakage test:

   a. Pressure test valve and their seats for leaks with water in the 100 percent closed position for a timed period of 5-minutes with a pressure equal to rated design pressure. Valves shall be drip tight with no leakage.

   b. Test Acceptance:

      1) Spray or high velocity leakage will not be acceptable.

      2) If valve leaks, adjustments shall be made until valve is drip tight with no leakage. Adjustments may include adjusting butterfly and buried ball valve stops, seats, actuator, etc.

      3) If valve is not drip tight (any leakage), valve is unacceptable.

   c. After any adjustments are made, valve indicator shall be inspected again and corrected if necessary.

3.03 CONTRACTOR FIELD QUALITY TESTING

A. After each valve has been completely installed, test valve in pipeline by opening and closing valve through full range of operations 3 times.

B. Make changes or adjustments until operation is approved by COR, and valves are bubble tight and do not leak water past seats.

3.04 COATINGS

A. In accordance with Section 09 96 20 – Coatings.

END OF SECTION

SECTION 33 16 00
WATER STORAGE TANKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. San Juan Lateral Water Treatment Plant Regulating Tanks:

1. Payment: Lump sum price offered in Price Schedule 2:

a. Includes:

1) Designing and installing, tank, tank foundation, ladders, railings, pipes, fittings, and accessories.

2) Waterstops.

3) PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

4) Providing tank testing and associated equipment testing.

5) Cast-in-place concrete, reinforcement, and formwork for the tank overflow aprons.

1.02 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC)

1. AISC 360-22 — Structural Steel Buildings

B. American National Standards Institute (ANSI)

1. ANSI A14.3-2018 — Ladders – Fixed – Safety
2. ANSI A1264.1-2017 — Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrail Systems
3. ANSI/NSF 372-2022 — Drinking Water System Components – Lead Content

C. ASTM International (ASTM)

1. ASTM D1785-21a — Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D. American Water Works Association (AWWA)

1. AWWA D100-21 — Welded Steel Tanks for Water Storage

2. AWWA D110-13 (R18) — Wire and Strand Wound, Circular, Prestressed Concrete Water Tanks

3. AWWA D115-24 — Tendon-Prestressed Concrete Water Tanks

E. American Welding Society

1. AWS D1.1/D1.1M:2025 — Structural Welding Code - Steel

F. Code of Federal Regulations (CFR)

1. 29 CFR Part 1910, Subpart D — Occupational Safety and Health Administration (OSHA) Standards – Walking-Working Surfaces

G. Federal Acquisition Regulations FAR)

1. FAR 52.246-21 — Warranty of Construction

H. International Code Council (ICC)

1. IBC-2021 — International Building Code

I. National Electrical Manufacturer's Association (NEMA)

1. NEMA 250-2020 — Enclosures for Electrical Equipment (1,000 Volts Maximum)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 16 00-1, Qualifications:

1. Designer, Erection Engineer, Contractor, and Specialty Sub-Contractor qualifications.

C. RSN 33 16 00-2, Commercial Products Data:

1. Manufacturer's engineering data sheets demonstrating the applicable size, standards, bill of materials, and pressure rating for components in Part 2, Products, of this specification.

2. Tank mixer:

a. Calculations and analysis modeling demonstrating complete tank mixing.

b. General arrangement drawing.

c. Mixer drawing with component weights and materials.

d. Motor data:

1) Horsepower rating (horsepower).

2) Voltage rating (volts).

3) Full load amps (amperes).

4) Schematic diagrams:

a) Show switch controls for mixer.

5) Wiring diagrams:

a) Submit actual wiring diagrams for this specific project.

3. Tank vent: Calculations demonstrating sufficient venting capacity for inlet and withdrawal rates.

4. Ladders, railing, fall arrest system, guard door, safety gate, and other safety related appurtenances. Include anchorage components, including nuts and washers.

D. RSN 33 16 00-3, Approval Drawings:

1. Checked shop and installation drawings for ladders, railing, fall arrest system, guard door, safety gate, manways, and other safety related appurtenances.

a. Provide a checked box on each drawing indicating the date the drawing was checked and by whom.

2. In Government Format in accordance with Section 01 33 00 – Submittals:

a. Include the following on shop and installation drawings:

1) Show controlling dimensions.

2) Show details of component members and connections.

3) Show type and grade of material, and type of finish.

b. Include set of plans and elevations.

c. Show details and methods of installation and anchoring.

d. Show members, sizes and thicknesses, anchorage locations, and accessory items.

e. All field connections shall be clearly marked and noted on shop drawings, indicating size of required fasteners and their locations.

E. RSN 33 16 00-4, Calculations:

1. Submit calculations detailing design of pipe supports and tank appurtenances:

a. Analysis detailing loading and corresponding stresses on all tank appurtenances.

b. Reinforce shell, floor, and roof penetrations to transfer vertical, tangential, and horizontal stresses, seismic load, and incidental differential settlement.

c. Indicate compliance with the design requirements in Article 1.04 Design Requirements.

d. Sealed by a professional engineer registered in the State of New Mexico.

2. Submit calculations detailing structural design of:
   a. Ladders, guardrails, and other safety related appurtenances.
   b. Overflow pipe supports attached to tank and foundation.
   c. Overflow weir box design and weir box supports.
   d. Stand pipe and stand pipe supports attached to tank wall including buoyancy.
   e. Indicate compliance with the design requirements in Article 1.04 Design Requirements.
   f. Sealed by a professional engineer registered in the State of New Mexico.

F. RSN 33 16 00-5, As-Built Drawings, Manuals, and Data:
1. Government Format in accordance with Section 01 33 00 – Submittals.
2. Complete set of As-built drawings:
   a. Clearly mark drawings 1695-D-62475 through 1695-D-62483, 1695-D-60782, 1695-D-60783, and 1695-D-60809 to show final installation. Include all field modifications.
   b. Include drawings for ladders, railing, fall arrest system, guard door, safety gate, and other safety related appurtenances.
   c. Submit drawing in accordance with Section 01 78 30 – Project Record Documents.
3. Service Manuals:
   a. Submersible pressure transmitter.
   b. Non-Contacting radar level transmitter.
   c. Tank mixer.
4. Calibration Data and Report:
   a. Submit calibration data and report of findings for the following equipment:
      1) Submersible pressure transmitter.
      2) Non-Contacting radar level transmitter.

1.04 DESIGN REQUIREMENTS

A. In accordance with Part 2, Products, of this specification.

B. General:
1. Water Storage Tank Gross Volume:
   a. Liquid Volume: (2) tanks of same type, 342,000 gallons each. 42-foot internal diameter, 35-foot tall.

2. Tank vent:
   a. Size vent for an inlet/withdrawal rate of 78.1 cubic feet per second (cfs).
   b. Differential pressure across vent shall be within acceptable range as determined by tank manufacturer.
   c. Locate near roof center.
   d. Minimum of 24-inches above the surface of the tank roof.
   e. Designed in accordance with applicable AWWA code for tank type selected.
   f. Include a 24-mesh stainless-steel screen to prevent the entrance of birds and other animals.
3. Design, furnish, and install overflow weir box and overflow weir box supports. Designed for maximum loading conditions during overflow operation:
   a. Overflow rate of 78.1 cfs.
   b. Overflow weir box shall pass 78.1 cfs without exceeding Elevation 5462.9.
4. Refer to drawings for dimensions, elevations, tank venting, pipe penetrations, access hatches, and piping.
5. Hatch on top of tank shall be a minimum 4-inches above the surface of the tank roof.
   a. Provide a lockable roof hatch with rubber sealing gasket.
6. Account for openings and penetrations through tank elements. Modular seals are not permitted for penetrations through tank floor.
7. Design, furnish, and install pipe supports and brackets attached to the tank.
8. Tank mixer sized for 42-foot diameter, 35-foot-tall tank with inflow of 30 cfs to 71.0 cfs, and an outflow of 5 cfs to 71.0 cfs. Design to comply with AWWA code for tank type selected.
9. Design to comply with OSHA requirements.
10. Provide dielectric isolation as necessary to prevent galvanic corrosion between dissimilar metals.
11. Design to comply NSF 372 requirements.
12. Design for seismic loading.
13. Securely fasten tank name plate. Information shall include company name and address, year the tank was constructed, design capacity, diameter, height, base elevation, and overflow elevation.

C. Foundation:
   1. Coordinate design of tank and foundations.

2. Design foundations with the centroids of superimposed loads at their actual locations.
3. Refer to Section 53 10 00 – Geological Investigations and Section 31 23 11 – Earthwork for Structures for foundation subgrade conditions.
4. Foundation shall be an on-grade structure, including pipe encasements below the foundation. Bearing on subgrade as indicated on the drawings. Minimum depth at foundation perimeter shall be 30 inches below adjacent grade for frost depth requirements.
5. Foundation designed to support tank, equipment, accessories, and overflow piping.

D. Ladders and Railings:

1. All ladders and railings designed for exterior attachment to a tank shall be galvanized steel.
2. Designed to meet the load requirements as prescribed by 29 CFR Part 1910 Subpart D, ANSI A14.3, and ANSI A1264.1.
3. Designed for dead, live, and any combination of loads thereof, in accordance with the IBC.
4. Designed and fabricated in accordance with the applicable requirements in AISC 360.
5. All ladders designed for interior attachment to a tank shall be stainless steel.
6. Fabricate all steel ladders and railings in accordance with Section 05 50 00 – Metal Fabrications.
7. Provide insulation connections from the tank as required to prevent contact with dissimilar metals and/or other tank materials.
8. Materials and welding shall conform to all applicable requirements of AISC 360.
9. Ladders:
   a. Provide an exterior ladder from bottom of tank shell to roof of tank, including side rails, as indicated on drawings.
   b. Ladder to be continuous. Split ladders not allowed.
   c. Provide a hinged, lockable, guard gate over bottom of the ladder with minimum height of 7-feet.
   d. Provide lockable hatch with rubber sealing gasket when ladder connects into platform.
      1) Hatch on top of tank shall be a minimum 4-inches above surface of tank roof.
   e. Provide ladder side rails fabricated out of steel pipe.
   f. Rungs:

1) Raised button, serrated-edge, or metal bonded encapsulated grit surface.

2) 1 1/4-inch diameter, or width, spaced 12-inches on center.

3) Concentrated design load at center of rung, minimum: 250 pounds.

4) Minimum rung length: 18-inches.

5) Deformed concrete reinforcement not permitted.

g. Provide ladder extensions and flare ladders at platform locations.

h. Provide a fall arrest system on ladder and safety rail extension.

i. Detail ladder including steps and rungs, side rails, and ladder termination in accordance with ANSI A14.3.

10. Railings:

a. Provide railings surrounding all platforms and on roofs of tanks as indicated on drawings.

1) Provide additional guardrails and/or platforms, if necessary, to access appurtenances installed on the tank roof.

b. Provide 3-rail railings with a top rail, an intermediate rail, bottom rail, and a kick plate.

c. Railing height: 42-inches minimum.

d. Detail railings in accordance with ANSI 14.3 and ANSI A1264.1.

1.05 QUALIFICATIONS

A. Tank and Foundation Designer Qualifications: Professional Engineer registered in the State of New Mexico.

B. Erection Engineer:

1. Specializes in construction of applicable tank type selected.

2. Minimum 3-years' experience in the design, fabrication, and erection of water storage and surge tanks using the applicable AWWA, ASME, AWS, NSF/ANSI, and OSHA standards.

C. Tank and Tank Foundation Designer: Designed at least 5 similar projects.

1. Designer of Tank: Professional Engineer registered in the State of New Mexico, with a minimum of 5-years' experience designing steel tanks.

2. Designer of Tank Foundation: Professional Engineer registered in the State of New Mexico, with a minimum of 5-years' experience designing reinforced concrete foundations.

D. Installer: Installed at least 5 similar tank projects.

E. Manufacturer: Manufactured at least 5 similar tank projects:

1. Certified welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for work.

F. Contractor: Installed at least 5 similar water and or wastewater tanks of similar size and design.

1.06 WARRANTY

A. Warrant tank for extended period in accordance with the clause at FAR 52.246-21, Warranty of Construction.

PART 2 PRODUCTS

2.01 TANK OPTIONS

A. In accordance with Table 33 16 00A – Tank Options.

Table 33 16 00A – Tank Options

Tank Designation	Options Allowed	Section
Welded Steel Tank	AWWA D100	33 16 50 – Steel Tanks
Concrete Wire Wrapped	AWWA D110	33 16 51 – Concrete Wire Wrapped Tank
Concrete Prestressed	AWWA D115	33 16 52 – Concrete Prestressed Tank

2.02 PIPE, FITTINGS, VALVES, EQUIPMENT, AND ACCESSORIES

A. Standard and Schedule Steel Pipe:

1. Steel piping, fittings, couplings, and accessories in accordance with 35 21 95 – Steel Manifold Piping, and as indicated on drawings.

B. Polyvinyl Chloride Pipe: ASTM D1785.

C. Standpipe Support Brackets:

1. Corrosion resistant materials.
2. Galvanized steel not permitted.

D. Valves and Equipment:

1. Valves in accordance with 35 22 14 – Valves and Equipment and as indicated on drawings.
2. ANSI/NSF 372 compliant lead-free.

3. Suitable for raw water.

E. Submersible Pressure Transmitter: Acculevel high accuracy submersible level transmitter by Keller America, www.kelleramerica.com; or equal, having the following essential characteristics:

1. Measurement range: 0 to 30 psig.
2. Silicon pressure element or piezoelectric.
3. Fully sealed stainless steel or titanium body.
4. Cable:
   a. Polyurethane cable with vent.
   b. Length: 40-feet.
5. Output: 4-20 milliamperes DC.
6. Transmitter output units: Imperial.
7. Suitable for operation on 9 to 30 volt DC external power supply.
8. Adjustable offset (zero) and span shall be provided.
9. Minimum Accuracy: Plus or minus 0.25 percent.
10. Include:
    a. Cable clamps suitable for proper support of suspended sensor.
    b. Sink weights or anchor assembly.
    c. Sensor termination enclosure.
11. Provide calibration equipment as required.
12. Transient Protector:
    a. Protects pressure transmitter from damage due to lightning and switching surges.
    b. Compatible with pressure transmitter output of 4 to 20 milliamperes.
    c. Same manufacturer as pressure transmitter.

F. Non-Contacting Radar Level Transmitter: Rosemount Model 5408 manufactured by Emerson, www.emerson.com; or Optiwave 5200 manufactured by Krohne, www.krohne.com; or equal, with the following essential characteristics:

1. Range: 68 ft, minimum.
2. Top dead zone (blind zone near transmitter): 20 inches, maximum.
3. Minimum Accuracy: Plus, or minus 0.1 percent of measured distance.
4. Output shall be 4-20 milliamperes DC.
5. Transmitter output units: Imperial.

6. Transmitter shall be suitable for operation on 12- to 24—volt DC external power supply.
7. Cone type antenna:
   a. Material: 316 or 316L stainless-steel.
8. Housing:
   a. Aluminum.
   b. NEMA type 4x for outdoor use.
9. Process connection: 6-inch ASME B16.5 flange.
10. Liquid crystal display with local operator interface.

G. Liquid Level Indicator:

1. Model 92302, as manufactured by Shand & Jurs, 5911 Butterfield Road, Hillside, IL 60162; or equal, having the following essential characteristics:
   a. Float-actuated level gauging system consisting of a target sliding vertically over an aluminum gauge board.
   b. Gauge board graduated in feet and inches with numerals at each foot with highest reading at ground level.
   c. Type 316 stainless steel for float, cable, and guide wires.
   d. At least three-gauge board support brackets to match tank material type.
   e. True reading pulley system.

H. Fall Arrest System:

1. Miller Saf-T-Climb, as manufactured by Honeywell, https://sps.honeywell.com; or equal, having the following essential characteristics:
   a. Round cross section.
   b. Allow sleeve to swing completely around when climber reaches the top platform, to allow the climber to step onto top platform without disconnecting the sleeve.
   c. Flat safety rail is not acceptable.
   d. Include mounting brackets, tensioner, termination device, sign, and hardware.
   e. Capacity: For single person use; 1400 lbs. rated.
   f. Designed and manufactured to meet ANSI A14.3.
   g. Cable not permitted.
   h. Provide Shuttle.

I. Ladders:

1. Metal safety steps for ladders:

   a. "Tread-Grip" sheet steel ladder rungs as manufactured by Metalex, 700 Liberty Drive, Libertyville, IL 60048; "Traction Tread" ladder rung as manufactured by Eaton, 509 West Monroe Street, Highland, IL 62249; or equal, having the following essential characteristics:

   b. Concentrated design load at center of rung of at least 250-pounds.

      1) Raised button, serrated edge, or metal bonded encapsulated grit surface.

      2) Deformed concrete reinforcement not permitted.

2. Guard door over the bottom of the ladder:

   a. Minimum of 96-inch tall solid panel.

   b. Steel construction.

   c. Heavy duty continuous piano hinge to allow cover to easily swing to the side for ladder access.

   d. Lockable with a pad lock shackle up to 7/16-inch diameter.

   e. Locate locking mechanism 36-inch to 42-inch above top of tank foundation.

J. Ladder Safety Gate:

1. Kee Safety Self-Closing Safety Gate manufactured by Kee Safety Limited, www.keesafety.co.uk or equal, having the following essential characteristics:

   a. OSHA compliant.

   b. Spring loaded to automatically close behind the user.

   c. Material: galvanized steel.

K. Guardrail:

1. Rails: 1 1/2-inch standard steel pipe or Schedule 80 aluminum 6061-T6 or 6005-T5 anodized aluminum pipe.

2. 3-rail with equally spaced rails and 4-inch-high toe board (kick plate).

3. Minimum height: 42 inches above walking surface.

4. Maximum post spacing: 8 feet.

5. Maximum gap between adjacent guardrail sections: 4 inches.

6. Coordinate guardrail fittings with selected rail material.

7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.

8. Provide weep holes or other means to drain entrapped water in hollow sections of handrail and guardrail members.

9. Fabricate joints exposed to weather to be watertight.

10. Insulate rail connections from the tank as required to prevent contact with dissimilar metals and/or other tank materials.

L. Secure Roof Vent:

1. Model AST-Vent manufactured by Advance Tank Construction Co., www.advancetank.com or equal, having the following essential characteristics:

   a. Applicable AWWA code for tank type selected.

   b. Lockable.

   c. Tank vent entrance minimum 24 inches above top of tank.

   d. Protective replaceable non-corrodible #24 mesh screen to keep out insects.

   e. Frost proof.

   f. Pressure vacuum or vacuum relief mechanism.

M. Lockable roof hatch with rubber sealing gasket and security hatch position sensor. Hatch to contain counterweight or pneumatic lift assist.

N. Tank Mixer:

1. PWM-400 manufactured by Pax Water Technologies Inc., www.paxwater.com; or equal, having the following essential characteristics:

   a. Completely mix reservoir. Contained water temperature must converge to 0.8 degree C variance per 24-hour period, or less.

   b. Equipment in tank can be installed and retrieved through the tank hatch opening by personnel on tank roof with the tank full and in operation.

   c. Equipment lifted by personnel from tank not to exceed 60-pounds.

   d. Designed for continuous duty.

   e. Metallic wetted components in tank constructed of 316 stainless steel.

   f. Impeller elevated a minimum of 18-inches from tank floor.

   g. Mixer shall cause no damage to tank or cathodic protection during installation, removal, or operation.

   h. Include control center with the following:

      1) Weather resistant lockable enclosure.

         a) Variable Frequency Drive for manual speed control.

b) SCADA communications:

i. Digital output readings – motor running and controller fault.

ii. Modbus communications.

c) Automatic motor shut-off if water level drops below motor height.

d) Ground-Fault Circuit Interrupter (GFCI) Protection.

i. System Voltage: 115VAC, single phase, 60 hertz.

j. Combination motor starter:

1) Thermal magnetic circuit breaker and externally operable handle in common enclosure.

2) Voltage: 120 volts

3) NEMA 250 Type 3R lockable enclosure.

4) Ground-Fault Circuit Interrupter (GFCI) Protection.

5) Selector Switch: 2 position On/Off.

6) Indicating Lights: On (Red)/Off (Green)

7) Automatic motor shut-off if tank water level drops below a specified elevation.

8) Communications package suitable for connection to site control PLC for On/Off Control, Loss of Power Alarm, Unit Fault/Failure.

O. Spare Overflow Mesh Screen Flange: Provide one spare stainless steel mesh screen as shown on drawing 1695-D-62483.

P. Steel Tank Cathodic Protection:

1. See 26 42 11 – Submerged Galvanic Anode Cathodic Protection System for Welded Tank Options.

Q. PVC Gravity Drain:

1. In accordance with Section 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

PART 3 EXECUTION

3.01 SERVICES OF ON-SITE ERECTION ENGINEER

A. Furnish the services of an on-site erection engineer to supervise and be responsible for erecting the storage tank. Have erection engineer onsite during water tank installation and testing.

3.02 INSTALLATION

A. Install inlet, outlet, and drain and overflow piping in accordance with drawings 1695-D-62479 through 1695-D-62483, Sections 35 21 95 – Steel Manifold Piping and 35 22 14 – Valves and Equipment.

B. Provide supports and bracing as required to hold the steel pipe in place and prevent distortion during erection, placing of concrete, and backfilling.

C. Provide submersible pressure transmitter and non-contacting radar tank connections per manufacturer's design guidelines.

D. Install pipe, fittings, valves, equipment, and accessories according to manufacturer's instructions.

E. Install tank in accordance with appropriate section for proposed tank option.

F. Coordinate work of erection engineer with COR.

G. Install ladders and railings in accordance with approved manufacturer's installation drawings.

H. Route output from pressure transmitter to COR's designated location.

I. Install and calibrate pressure transmitter and non-contact radar level transmitter in accordance with manufacturer's recommendations.

   1. Calibration shall be witnessed by Government.
   2. Notify COR 14 days prior to calibration.

END OF SECTION

SECTION 33 16 50
STEEL TANKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing steel tanks in price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.

   a. Includes, but not limited to the following:

      1) Designing and installing, tank, tank foundation, ladders, railings, pipes, fittings, and accessories.

      2) Waterstops.

      3) PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

      4) Providing tank testing and associated equipment testing.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 318-19 (22) — Building Code Requirements for Structural Concrete & Commentary

B. American Welding Society (AWS)

1. AWS D1.1/D1.1M-2025 — Structural Welding Code - Steel

C. American Water Works Association (AWWA)

1. AWWA C200-23 — Steel Water Pipe, 6-In. (150 mm) and Larger
2. AWWA D100-21 — Welded Steel Tanks for Water Storage

1.03 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 00 – Submittals.

B. RSN 33 16 50-1, Shop Drawings, Design Calculations and Design Data:

1. Stamped and signed by professional engineer in the State of New Mexico.
2. Design calculations for steel tank including design and details of safety features.

3. Design thrust blocks for inlet and outlet piping at the 90-degree bend where the pipes enter the bottom of the tank.
4. Design calculations for reinforced concrete foundation and tank anchorage including:
   a. List of loading criteria and values, specific code references and load combinations.
   b. Magnitude and direction of steel tank base reactions and anchor bolt loading.
   c. Maximum bearing pressures.
5. Checked, detailed shop drawings which include dimensions, tolerances, material data, joint details, and welding requirements. Provide a checked box on each drawing indicating the date the drawing was checked and by whom.
6. Detailed design drawings of reinforced concrete foundation including:
   a. Concrete foundation layout, elevations, and dimensions.
   b. Typical sections through the foundation.
   c. Steel reinforcement details and sizes including bar lengths, location of construction and movement joints and lap splices.
   d. Anchor bolt setting plan including size, location and projection of anchor bolts, base mounting details, epoxy grout and sand cushion.
7. Detailed manufacturer's instructions for erection of tank, including:
   a. Details on bolting.
   b. Placement of gaskets and/or sealants.
   c. Coating repair procedures.
   d. Assembly procedures.

C. RSN 33 16 50-2, Inspection Reports:
   1. Mill test reports.
   2. Inspection reports.
      a. Welder performance qualifications.
      b. Non-destructive weld test reports.

1.04 DESIGN REQUIREMENTS

A. In accordance with Part 2, Products, of this specification.

B. Design, fabricate, erect, inspect and test a flat-bottom steel tanks, including appurtenances, braces, and structural members in accordance with AWWA D100, this section, as shown on drawings, and in accordance with Section 33 16 00 – Water Storage Tanks:

1. Wind and earthquake loads: See drawing 1695-D-62472.
2. Provide roof in accordance with this section and drawings:
   a. Structurally supported aluminum dome roof not permitted.
3. For welded steel tanks, provide galvanized steel ladders, platforms, and railings designed for exterior attachment in accordance with Section 05 50 00 – Metal Fabrications.
   a. Provide guardrails and/or platforms, as required, to access appurtenances installed on the tank roof.
4. For welded steel tanks, provide crushed stone required for supporting the welded steel tank bottom in accordance with AWWA D100 and as recommended by the tank manufacturer.
5. Design and provide the diameter and number of anchor bolts required for the tank. Minimum anchor bolt diameter shall be not less than 1 1/4-inches. Provide anchor bolt chairs for the anchor bolts.
6. Fabricate steel pipe in accordance with this section, Section 35 21 95 – Steel Manifold Piping, as indicated on drawings, and in accordance with AWWA C200.
7. Design and furnish overflow weir in accordance with AWWA D100 for welded steel tanks and as shown on the drawings. Overflow pipe diameter shall be as shown on drawings. Overflow pipe and supports shall accommodate differential settlement.

C. Design and construct a reinforced concrete foundation for a flat-bottom steel tank in accordance with AWWA D100, this section, and as shown on drawings:
   1. Thick cane fiber joint filler not permitted.
   2. Welded Steel Tank shall have Foundation Type 1 in accordance with AWWA D100 for welded steel tanks.
   3. AWWA D100 welded steel tank:
      a. Foundation Type 1:
         1) Design reinforced concrete ringwall foundation to support the steel tank and collateral loads. Loads imposed by equipment, accessories, and overflow piping to be supported by the steel tank in accordance with ACI 318.
         2) Provide grouted base ring and clean crushed stone cushion for supporting the steel tank bottom in accordance with AWWA D100 and as recommended by tank manufacturer. Thick cane-fiber joint filler not permitted.
         3) Crushed stone cushion resistivity shall be greater than 3,000 ohm-cm when saturated with distilled or deionized water, a chloride content less than 100-ppm, and sulfate content less than 200 ppm.

Hydrated lime may be added to the crushed stone to increase the PH in accordance with AWWA D100.

4) Tank foundation drain to be installed under tank floor. See Drawing 1695-D-62472 through 1695-D-62473.

b. Welded Steel Tank Cathodic Protection:

1) See Section 26 42 15 – Galvanic Anode Cathodic Protection for Welded Steel Tanks.

2) Incorporate required fittings or appurtenances for cathodic protection system into tank design.

4. Concrete design and placement in accordance with Section 03 30 00 – Cast-in-Place Concrete.

5. Grout design and placement in accordance with Section 03 63 00 – Epoxy Grout.

D. Design and construct proper reinforcements for pipe penetrations as shown on drawings.

PART 2 PRODUCTS

2.01 FITTINGS AND ACCESSORIES

A. Standard and Schedule Steel Pipe: Steel piping, fittings, No. 24 stainless steel mesh screen, and accessories in accordance with Section 35 21 95 – Steel Manifold Piping and as indicated on drawings.

B. Cathodic Protection: In accordance with Section 26 42 15 – Galvanic Anode Cathodic Protection for Welded Steel Tanks.

2.02 SOURCE QUALITY ASSURANCE

A. Government retains the right to witness factory inspections.

PART 3 EXECUTION

3.01 INSTALLATION

A. Follow tank manufacturer's erection procedures and approved submittals.

B. Welding procedures shall be in accordance with AWS D1.1 and AWWA D100:

1. Make available, upon request to the COR, certification that welds were made by AWS qualified welders and inspected according to AWS standards.

2. Surfaces to be welded shall be free from loose scale, slag, heavy rust, grease, paint, and other foreign material. Make surfaces smooth, uniform, and free from defects that adversely affect proper welding.

3. Clean surfaces and remove weld scale or slag prior to coating.

C. Provide steel pipe supports and bracing to hold steel pipe in place and prevent distortion during erection, placing of concrete, and backfilling.

D. Use template for anchor bolt spacing to verify correct location of anchors. Subject to government approval.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Hydrostatically test tanks in accordance with AWWA D100.

1. Repair leaks in the tank in accordance with manufacturer's recommendations.
2. Notify COR 5-days prior to test.
3. Furnish water and dispose of test water after testing and repairs are complete.
4. Observe water level drop for a period of 24 hours.

B. Testing of welds:

1. In accordance with AWS D1.1 and AWWA D100.

3.03 SERVICES OF ON-SITE ERECTION ENGINEER

A. Erection engineer shall supervise and be responsible for erecting the steel tank. Erection engineer shall be onsite during installation and testing phases of steel tank.

B. Do not place concrete floor and foundation until subgrade is approved by Erection Engineer.

C. Coordinate work of Erection Engineer with COR.

3.04 COATINGS

A. In accordance with Section 09 96 20 – Coatings.

END OF SECTION

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SECTION 33 16 51
CONCRETE WIRE WRAPPED TANK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing concrete wire wrapped tank in price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.

   a. Includes, but not limited to the following:

      1) Designing and installing, tank, tank foundation, ladders, railings, pipes, fittings, and accessories.

      2) Waterstops.

      3) PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

      4) Providing tank testing and associated equipment testing.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 350-20	Building Code Requirements for Environmental Engineering Concrete Structures
2.	ACI 350.1-22	Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary
3.	ACI 350.3-20	Seismic Design of Liquid-Containing Concrete Structures and Commentary
4.	ACI 372R-13	Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures
5.	ACI 506R-16	Guide to Shotcrete
6.	ACI 506.2-13(18)	Shotcrete

B. ASTM International (ASTM)

1.	ASTM A185/A185M-07	Steel Welded Wire Reinforcement, Plain, for Concrete
2.	ASTM A227/A227M-17	Steel Wire, Cold-Drawn for Mechanical Springs

3.	ASTM A416/A416M-18	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
4.	ASTM A421/A421M-21	Uncoated Stress-Relieved Steel Wire for Prestressed Concrete
5.	ASTM A475-03(2020)	Zinc-Coated Steel Wire Strand
6.	ASTM A497/A497M-07	Steel Welded Wire Reinforcement, Deformed, for Concrete
7.	ASTM A586-18	Zinc-Coated Parallel and Helical Steel Wire Structural Strand
8.	ASTM A603-19	Zinc-Coated Steel Structural Wire Rope
9.	ASTM A615/A615M-15a	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
10.	ASTM A648-18	Steel Wire, Hard-Drawn for Prestressed Concrete Pipe
11.	ASTM A653/A653M-20	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
12.	ASTM A722/A722M-18	Uncoated High-Strength Steel Bars for Prestressing Concrete
13.	ASTM A821/A821M-21	Steel Wire, Hard-Drawn for Prestressed Concrete Tanks
14.	ASTM A882/A882M-20	Filled Epoxy-Coated Seven-Wire Prestressing Steel Strand
15.	ASTM A1008/A1008M-21a	Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
16.	ASTM A1064/A1064M-18a	Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
17.	ASTM C881/C881M-20a	Epoxy-Resin-Base Bonding Systems for Concrete
18.	ASTM D1056-20	Flexible Cellular Materials-Sponge or Expanded Rubber
19.	ASTM D1752-18	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
20.	ASTM D2000-18	Standard Classification System for Rubber Products in Automotive Applications

21.	ASTM D2240-15(2021)	Standard Test Method for Rubber Property: Durometer Hardness

C. American Water Works Association (AWWA)

1.	AWWA D110-13(R18)	Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks

D. Code of Federal Regulations

1.	29 CFR 1910.27	Fixed Ladders

E. International Building Code (IBC)

IBC-121	International Building Code

F. Post Tensioning Institute (PTI)

1.	PTI DC10.7-83	Post-Tensioned Commercial and Industrial Floors
2.	PTI TAB.1-06	Post-Tensioning Manual, Sixth Edition
3.	PTI DC20.8-04	Design of Post-Tensioned Slabs Using Unbonded Tendons
4.	PTI M10.2-00	Specification for Unbonded Single Strand Tendons
5.	PTI M10.3-00	Field Procedures Manual for Unbonded Single Strand Tendons
6.	PTI M50.3-12	Specification for Grouting of Post-Tensioned Structures
7.	PTI CRT20	Manual for Certification of Plants Producing Unbonded Single Strand Tendons, Sixth Edition.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 16 51-1, Approval Drawings and Data:

1. Shop drawings, show details:
   a. Used in fabrication of tank components and tank construction.
   b. Show details that shall be used in the preparation of the tank foundation.
   c. Show details that shall be used in the layout of the tank foundation drain.
2. Manufacturer's installation instructions.
3. Tank surface finishes and coating materials.
4. Concrete design mixes, including shotcrete.

5. Structural design calculations or analyses sealed by registered professional engineer in the State of New Mexico.

6. Provide 2- by 2-foot area of shotcrete finishes to be used as the standard for acceptance of installed construction.

C. RSN 33 16 51-2, Test Reports:

1. Submit certified mill test reports indicating ultimate and yield strength of all reinforcing bars, prestressing and post tensioning steel, and any other steel components.

D. RSN 33 16 51-3, Documentation:

1. Furnish applicable "Affidavits of Compliance" to building codes.

E. RSN 33 16 51-4, Final Drawings and Data:

1. Submit final drawings and data consisting of approved detailed shop drawings.

2. Submit Operation and Maintenance Manuals.

F. RSN 33 16 51-5, Qualifications:

1. ACI Nozzleman certification.

1.04 DESIGN REQUIREMENTS

A. Tank:

1. Refer to Section 33 16 00 – Water Storage Tanks.

2. Design one of the following in accordance with ACI 350, and AWWA D110:

a. Type I: Cast-In-Place Concrete with Vertical Prestressed Reinforcement.

b. Type II: Shotcrete with a Steel Diaphragm.

c. Type III: Precast Concrete with Steel Diaphragm.

3. Design foundation/floor slab for single concrete placements, no joints are allowed.

4. Foundation/floor slab design shall take into account concentrated loads from the roof column supports.

5. Perimeter wall shall be wire-wound and vertically prestressed as applicable. If cast in place, full-height placements not to exceed 75-feet in length.

6. Design core wall for initial compressive forces applied by prestressing and other applicable loadings.

7. Tank foundation drain to be installed under tank foundation/floor slab. See Drawing 1695-D-62473.

B. Foundation/Floor Slab:

1. Refer to Section 33 16 00 – Water Storage Tanks.
2. Refer to Section 31 23 11 – Earthwork for Structures for subgrade conditions.

C. Design for earthquake resistance based on ACI 350.3 and requirements of AWWA D110.

D. Base design on AWWA D110 and ACI 350 load combinations, with basis for loadings as defined herein:

1. Load combinations for prestressed or post-tensioned items: In accordance with AWWA D110 and ACI 350.
2. Load combinations for non-prestressed/post-tensioned items: In accordance with ACI 350.
3. Snow load: See drawings for definitions of snow loads.
4. Wind Loads (during construction and prior to backfilling):
   a. See drawings for definition of wind loads.
5. Uniform live load over roof area: 20 psf. (non-reducible).

E. Design and detail wall, foundation and roof per ACI 350 and AWWA D110 and the requirements noted herein.

F. Design for lowest mean ambient temperature and for temperature differential required for project location.

1. Foundation/Floor Slab:
   a. Refer to Section 33 16 00 – Water Storage Tanks.
   b. Refer to Section 31 23 11 - Earthwork for Structures for subgrade conditions.
   c. Minimum concrete thickness:
      1) Footing: 12-inches.
      2) Other Cast-in-Place Concrete elements: 8-inches or as required by ACI 350 if greater than 8-inches.
   d. Minimum Concrete Cover: In accordance with ACI 350:
      1) Top cover for membrane floors: 1 1/2-inch.
      2) Bottom cover for membrane floors: 2-inch.
      3) Pre-stressed or post-tensioned concrete exposed to earth, water, or liquid: 1 1/2-inch for floor and roof, 1-inch for walls.
   e. Provide foundation drainage system to collect leakage from tank foundation and discharge freely to daylight away from tank as shown on drawings.

G. Roof Design Criteria:

1. Conventionally reinforced construction: In accordance with ACI 350 relative to spacing between joints, minimum reinforcement ratios, and cracking serviceability (including serviceability load factors).

2. Prestressed/post-tensioned construction: In accordance with AWWA D110 and ACI 350.

H. Waterstops:

1. Adhesive waterstops are not permitted.

2. For sliding joints, deflection data shall be submitted and summarized from tank analysis for these locations.

3. Shear, load and deflection capabilities for the proposed waterstop shall be certified in writing by waterstop manufacturer and shall be adequate for movement indicated in tank analysis.

4. Continuous waterstops shall be used at all wall/footing and roof/wall joints. These joints shall be specifically detailed to remain watertight.

1.05 QUALIFICATIONS

A. Prestressing, Post-tensioning Supplier/Installer:

1. In addition to qualifications listed in Section 33 16 00 – Water Storage Tanks:

a. Provide post-tensioning systems from a Post-Tensioning Institute (PTI) Certified Plant.

b. Erection engineer shall be a full-time employee of the pre-stressing and post-tensioning and wire-winding supplier/installer.

B. Shotcrete Nozzlemen Certification.

PART 2 PRODUCTS

2.01 TANK

A. AWWA D110 Tank as manufactured by DN Tanks, Incorporated, 351 Cypress Lane, El Cajon, CA, 92020; The Crom Corporation, 250 SW 36th Terrace, Gainsville, FL 32607, Preload, Incorporated, 49 Wireless Blvd #200, Hauppauge, NY 11788, Precon Tanks, 115 SW 140th Terrace, Newberry, FL 32669; or equivalent with the following essential characteristics:

1. Materials:

a. General requirements:

1) Comply with AWWA D110, PTI TAB.1 and ACI 350.

b. Concrete:

1) Materials: Conform to Section 03 30 00 – Cast-In-Place Concrete.

2) Wall, interior columns, and roof: 28-day compressive strength not less than 4,500 pounds per square inch and air entrained.

3) Floor: 28-day compressive strength not less than 4,500 psi and no air entrainment.

4) Cement: In accordance with Section 03 30 00 – Cast-In-Place Concrete Article 2.01 Cementous Materials.

5) Superplasticizer and water reducing admixture shall be incorporated into floor concrete.

c. Shotcrete:

1) 28-day compressive strength not less than 4,500-psi.

2) Cement: Conform to Section 03 30 00 – Cast-In-Place Concrete.

3) Conform to ACI 506.2.

2. Prestress wire or strand for circumferential wrapping:

a. Cold drawn, high-carbon wire shall conform to ASTM A821, ASTM A227, ASTM A421, and ASTM A648 Class II, as applicable.

b. Strand: Conform to ASTM A416 or A475, as applicable.

3. Reinforcing bars, wire mesh:

a. Reinforcing Bars: ASTM A615, Grade 60.

b. Wire Mesh: ASTM A185 or ASTM A497.

c. Conform to Section 03 20 00 – Concrete Reinforcing.

4. Wedges:

a. Conform to PTI TAB.1. Wedge shall not break into separate pieces upon stressing.

b. Designed to securely anchor strand without significantly reducing ductility of strand or tendon.

c. Strand slip after anchoring is not permitted.

d. Prevent breaking of individual strand wires in wedges during stressing.

e. Achieve dynamic fatigue and impact loading resistance without strand slippage or wire breakage.

5. Steel diaphragm:

a. Provide vertically ribbed steel sheets with adjacent and opposing channels that provide mechanical bond to concrete.

b. Conform to ASTM A653 or A1008.

c. Minimum thickness: 26 gauge.

d. Uncoated sheet steel shall comply with ASTM A1008.

e. Galvanized sheet steel shall comply with ASTM A653 and have a minimum G90 coating per table 1 of ASTM A653.

6. Elastomeric materials:

a. Bearing pads conforming to ASTM D2240 or ASTM D2000.

b. Sponge filler conforming to ASTM D1056 or ASTM D1752.

c. Epoxy-ASTM C881 Type III, Grade I.

7. Strand for earthquake cables:

a. Galvanized or epoxy coated with a fusion-bonded, grit-impregnated coating according to ASTM A882.

b. ASTM A416, grade 250 or 270 before galvanizing, ASTM A586, ASTM A603, or ASTM A475 after galvanizing. Only hot-dipped galvanizing shall be permitted for zinc coating.

8. Vertical/Roof/Floor prestressed reinforcement (as required):

a. Strand: ASTM A416, grade 250 or 270.

b. Threadbar: ASTM A722, grade 150 or 160.

c. Post-tensioning systems: Produced by PTI certified plant and tested to meet requirements of ACI 350 for corrosion protection.

d. Post-tensioning systems: Fully encapsulated.

9. Prestressed reinforcing left in ducts for more than 10-days prior to grouting shall be corrosion-protected in accordance with AWWA D110Ducts for bonded tendons:

a. Manufactured ducts for bonded tendons from corrosion-resistant materials and comply with PTI Guide Specification, “Acceptance Standards for Post-tensioning Systems.”

10. Grout fitting:

a. Grout fittings: Conform to PTI M50.3.

b. Tendons shall have grout openings at stressing anchorages.

c. Provide grout vents or drain holes at low and high points.

d. Prevent grout leakage at grout openings or vents.

11. Grout materials: PTI M50.3 and AWWA D110.

12. Couplings:

a. Couplings for bonded tendons shall not reduce elongation of rupture below requirements of tendon itself.

b. Use where approved by Erection Engineer.

2.02 FOUNDATION DRAIN

A. Materials:

1. Gravel Drain Material: Conform to Section 31 24 18 – Gravel Drain for Water Storage Tanks.
2. HDPE Geomembrane, HDPE Embedment Strip, Rubber Gaskets, Stainless Steel Clamps, and Sealant: Conform to Section 31 32 36 – HDPE Geomembrane for Water Storage Tanks.
3. PVC Pipe: Conform to Section 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

2.03 ACCESSORIES

A. Refer to Section 33 16 00 – Water Storage Tanks.

B. Interior Ladder:

1. Type 304 stainless steel.
2. Requirements for interior ladder: Comply with 29 CFR 1910.27 and IBC.
3. Supports on tank interior: Stainless steel.

C. Silt Stops:

1. Provide removable silt stop(s) at discharge pipes and other locations shown.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Comply with AWWA D110, ACI 372 and ACI 350.

B. Do not place concrete foundation/floor slab until subgrade is approved by Erection Engineer.

C. Core Wall:

1. Provide continuous and full-length steel diaphragm between tank contents and prestressing wires:
   a. With no horizontal joints.
   b. Mechanically seam vertical diaphragm joints except where located between wall panels, where either mechanical seaming or sealing with epoxy may be employed.
   c. Seal vertical diaphragm joints to be full watertight.
   d. Piercing of diaphragm is not permitted except by design.

e. Do not allow form ties to pierce diaphragm.

2. Fabricate precast panels to curvature of tank radius:

a. Tolerance in panel wall thickness: 0- to plus 1/4-inch.

b. Place concrete for each panel in one continuous operation.

3. Locate bearing pads and hold them in position prior to erection of wall panels. Do not nail pads.

4. Properly secure sponge filler pads. Caulk voids around bearing pads and sponge with non-toxic sealant to prevent mortar seepage.

5. Field-placed concrete or shotcrete shall be form and/or water cured until prestressing begins.

D. Horizontal Prestressing:

1. Term "wire" signifies either wire or strand.

2. Place prestressing wire on wall with wire winding machine capable of consistently producing stress in wire within range of 0 percent to ±2 percent of stress required by design:

a. No circumferential movement of wire along tank wall will be permitted during or after stressing wire.

3. Stressing may be accomplished by drawing wire through die or other means that result in uninterrupted elongation, thus assuring uniform stress throughout length and over periphery of tank.

4. Temporarily anchor each coil of prestressing wire at enough intervals to minimize loss of prestress in case wire breaks during wrapping.

5. Minimum spacing (center to center) of prestressing wires is 3/8-inch and minimum clear space between wires of 5/16-inch or 1.5 wire diameters, whichever is greater:

a. Respace wires not meeting spacing requirements.

b. Do not place prestressing closer than 3-inch from base of walls or floors where radial movement may occur.

6. Displace band of prestressing normally required over height of opening into circumferential bands immediately above and below opening to maintain required prestressing force. Bundling of wires is prohibited.

7. Splicing of wire: Only permitted when completing application of a full coil of wire, or when removing defective section of wire:

a. Join ends of individual coils by suitable steel splicing devices capable of developing full strength of wire.

8. Use calibrated stress recording device, which can be recalibrated, in determining wire stress levels on wall during and after prestressing process.

E. Take at least one stress reading per foot or one stress reading for every roll of wire, whichever is greater, immediately after wire has been applied on wall:

1. Record readings referring to applicable height and layer of wire for which stress is being taken.
2. Contractor to keep written record of stress readings and deliver record to Owner.
3. Make stress readings on straight lengths of wire.
4. If applied stresses fall below design stress in steel, provide additional wire to bring stress up to required design stress.
5. If stress in steel is more than 7 percent over required design stress, wrapping operation should be discontinued and adjusted.

F. Foundation Drain:

1. Install to limits as shown on drawings and in accordance with approved installation plan.
2. Install foundation drain components in accordance with Sections 31 24 18 – Gravel Drain for Water Storage Tanks, 31 32 36 – HDPE Geomembrane for Water Storage Tanks, and 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

G. Foundation/Floor Slab:

1. No construction joints are permitted.
2. Minimum thickness of 8-inches of concrete required over pipe encasements in concrete floor (if applicable).
3. Reference Section 31 23 11 – Earthwork for Structures, for subgrade conditions
4. Consolidate foundation/floor slab so no air pockets or voids are present.

H. Shotcrete:

1. Weather limitations: Comply with AWWA D110.
2. Placement: Comply with ACI 506.2 and AWWA D110.
3. Shotcrete: Applied by ACI certified nozzle men.
4. Use vertical screed wires to ensure uniform and correct thickness of shotcrete.
5. Test wall for hollow spots and repair defective areas.
6. Each shotcrete layer: Broomed prior to final set to effect satisfactory bonding for subsequent layer.
7. Do not apply shotcrete to reinforcing steel or diaphragm which is encrusted with overspray.
8. Coating of steel diaphragm:
    a. Cover steel diaphragm with layer of shotcrete at least 1-inch thick prior to prestressing.

b. Total minimum coating over steel diaphragm: 3-inches including diaphragm cover, wire cover and finish covercoat.

9. Coating over prestressing wire:

a. Individually encase each prestress wire in shotcrete of thickness enough to provide clear cover over wire of at least 1/2-inch.

b. Apply finish coat of shotcrete as soon as practicable after last application of wire coat:

1) Total thickness of shotcrete covercoat: Not less than 2-inches over wire or strand.

c. Provide natural gun finish.

I. Tolerances:

1. Out-of-plumb in total wall height: ±1/2-inch.

2. Out-of-round in diameter: ±1-inch.

J. Roof:

1. Cast-in-place or precast concrete free spanning dome roof:

a. Dome roof shall have rise to span ratio within range of 1:8 to 1:14.

b. Minimum concrete thickness: 5-inches for both precast dome and cast-in-place dome with minimum 1 1/2-inches cover to any reinforcement.

c. For cast-in-place dome:

1) Do not remove formwork for roof until concrete is of enough strength. Refer to ACI 350.

2) Give roof soffit form finish. Give exterior roof surface floated finish.

d. Dome: Fixed to tank wall.

e. Columns or interior supports will not be permitted.

f. Base dome designs on elastic spherical shell analysis.

2. Cast-in-place prestressed/post-tensioned concrete roof:

a. No construction joints are permitted.

b. Construct roof to be supported by perimeter walls and interior columns:

1) Locate and design interior columns and roof system to result in adequate strength and limit deflections in accordance with ACI 350 and IBC as applicable.

2) Minimum slope at top surface: 1.5 percent center to edge.

c. Do not remove any portion of formwork for roof until concrete is of enough strength and tendons have been fully tensioned (as applicable). Refer to ACI 350.

d. Give roof soffit form finish. Give exterior roof surface floated finish.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test concrete in accordance with ACI 350.

B. Shotcrete:

1. Test in accordance with ACI 506.2.
2. Make tests from shotcrete while being placed.
3. Sounding of shotcrete cover-coat: As recommended in AWWA D110.

C. Watertightness Testing:

1. Tank supplier shall perform watertightness testing.
2. Upon completion of tank, Supplier shall perform watertightness testing of tank:
   a. Watertightness testing shall be performed prior to application of water proofing, if applicable, to tank walls.
   b. Water for watertightness testing shall be supplied by Contractor.
   c. Level for watertightness testing shall be high water level as shown on drawings.
   d. Procedures and criteria for watertightness testing and acceptance shall be as defined in ACI 350.1. Maximum allowable loss shall be 0.0125 percent of tank volume per day.
   e. The wall and wall-floor joint shall have no measurable seepage and shall be watertight.

   Damp spots on the exterior wall surface or measurable leakage of flowing water at the wall base where the source is from inside of the tank shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand.

END OF SECTION

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SECTION 33 16 52
CONCRETE PRESTRESSED TANK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing concrete prestressed tank in price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.
   a. Includes, but not limited to the following:
      1) Designing and installing, tank, tank foundation, ladders, railings, pipes, fittings, and accessories.
      2) Waterstops.
      3) PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.
      4) Providing tank testing and associated equipment testing.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 350-20	Building Code Requirements for Environmental Engineering Concrete Structures
2.	ACI 350.1-22	Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary
3.	ACI 350.3-20	Seismic Design of Liquid-Containing Concrete Structures and Commentary

B. ASTM International (ASTM)

1.	ASTM A185/A185M-07	Steel Welded Wire Reinforcement, Plain, for Concrete
2.	ASTM A416/A416M-18	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
3.	ASTM A497/A497M-07	Steel Welded Wire Reinforcement, Deformed, for Concrete
4.	ASTM A615/A615M-20	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

5.	ASTM A722/A722M-18	Uncoated High-Strength Steel Bars for Prestressing Concrete
6.	ASTM C881/C881M-20a	Epoxy-Resin-Base Bonding Systems for Concrete
7.	ASTM D1056-20	Flexible Cellular Materials - Sponge or Expanded Rubber
8.	ASTM D1752-18	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
9.	ASTM D2000-18	Standard Classification System for Rubber Products in Automotive Applications
10.	ASTM D2240-15(2021)	Standard Test Method for Rubber Property - Durometer Hardness

C. American Water Works Association (AWWA)

1.	AWWA D115-24	Tendon-Prestressed Concrete Water Tanks

D. American Welding Society (AWS)

1.	AWS D1.1/D1.1M-20	Structural Welding Code, Steel
2.	AWS D1.3/D1.3M-18	Structural Welding Code, Sheet Metal

E. Code of Federal Regulations

1.	29 CFR 1910.27	Fixed Ladders

F. International Building Code (IBC)

1.	IBC-2021	International Building Code (IBC)

G. Post Tensioning Institute (PTI)

1.	PTI DC10.7-20	Post-Tensioned Commercial and Industrial Floors
2.	PTI TAB.1-06	Post-Tensioning Manual, Sixth Edition
3.	PTI DC20.8-04	Design of Post-Tensioned Slabs Using Unbonded Tendons
4.	PTI M10.2-17	Specification for Unbonded Single Strand Tendons
5.	PTI M10.3-16	Field Procedures Manual for Unbonded Single Strand Tendons
6.	PTI M50.3-12	Specification for Grouting of Post-Tensioned Structures

7. PTI CRT-G1120-21 Manual for Certification of Plants Producing Unbonded Single Strand Tendons, Sixth Edition

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 16 52-1, Approval Drawings and Data:

1. Shop drawings:
   a. Show all details used in fabrication of tank components and tank construction.
   b. Show details used in preparation of tank foundation.
   c. Show details used in layout of tank foundation drain.
2. Manufacturer's installation instructions.
3. Tank surface finishes and coating materials.
4. Waterstop product information, samples, and certifications as requested by Contract Documents.
5. Concrete design mixes.
6. Structural design calculations or analyses sealed by a professional engineer registered in the State of New Mexico, for record purposes only.

C. RSN 33 16 52-2, Test Reports:

1. Submit certified mill test reports indicating ultimate and yield strength of reinforcing bars, prestressing and post tensioning steel, and any other steel components.

D. RSN 33 16 52-3, Documentation:

1. Furnish applicable "Affidavits of Compliance" to building codes.

E. RSN 33 16 52-4, Final Drawings and Data:

1. Submit final drawings and data consisting of approved detailed shop drawings.
2. Submit Operation and Maintenance Manuals.

1.04 DESIGN REQUIREMENTS

A. Tank:

1. Refer to Section 33 16 00 – Water Storage Tanks.
2. Design in conformance with ACI 350, and AWWA D115 and PTI TAB.1:
   a. Cast-In-Place Concrete with internal tendons.

3. Design foundation/floor slab for single concrete placements, no joints are allowed.
4. Foundation/floor slab shall consider concentrated loads from roof column supports for floor design.
5. Tank foundation drain to be installed under tank foundation/floor slab. See drawings.
6. Perimeter wall: Horizontally and vertically prestressed and cast in full-height placements:
   a. Refer to 33 16 00 – Water Storage Tanks for concrete thickness.
   b. Thickness of concrete wall: As required by AWWA D115, and applied loading, not less than 9-inches.
   c. Do not use backfill loads in design of tank to counteract hydraulic loads or provide residual compression in wall.
   d. Consider tank analysis and design on all required openings and penetrations through tank elements.
   e. Slope of floor: 1 percent center to edge.

B. Foundation/Floor Slab:
1. Refer to Section 33 16 00 – Water Storage Tanks.
2. Refer to Section 31 23 11 – Earthwork for Structures for subgrade conditions.
3. Conventionally reinforced cast-in-place concrete foundation/floor slab is not permitted.
4.
5. Post-tensioned floor membrane slab:
   a. Designed for prestressed/post-tensioned construction in accordance with AWWA D115 and ACI 350:
      1) Minimum concrete thickness in accordance with ACI 350.
      2) Minimum concrete cover in accordance with ACI 350.
6. Post-tensioned structural slab:
   a. Designed for prestressed/post-tensioned construction in accordance with AWWA D115 and ACI 350.
      1) Minimum concrete thickness: 8-inches.
      2) Minimum concrete cover in accordance with ACI 350.
   b. Provide foundation drainage system to collect leakage from tank foundation and discharge freely to daylight away from tank as shown on drawings.

C. Design for earthquake resistance based on ACI 350.3 and requirements of AWWA D115.

D. Base design on AWWA D115 and ACI 350 load combinations, with basis for loadings as defined herein:

1. Load combinations for prestressed or post-tensioned items: In accordance with AWWA D115 and ACI 350.
2. Load combinations for non-prestressed/post-tensioned items: In accordance with ACI 350.
3. Snow load: See drawings for definitions of snow loads.
4. Uniform live load over roof area: 20-psf. (non-reducible).

E. Wind Loads (during construction and prior to backfilling):

1. See drawings for definition of wind loads.

F. Design for lowest mean ambient temperature and for temperature differential required for project location.

G. Roof Design Criteria:

1.
2. Roof design for prestressed/post-tensioned construction: In accordance with AWWA D115 and ACI 350.

H. Waterstops:

1. Adhesive waterstops are not permitted.
2. For sliding joints, deflection data shall be submitted and summarized from tank analysis for these locations.
3. Shear, load, and deflection capabilities for the proposed waterstop shall be certified in writing by waterstop manufacturer and shall be adequate for movement indicated in tank analysis.
4. Continuous waterstops shall be used at all wall/footing and roof/wall joints. Joints shall be specifically detailed to remain watertight.

1.05 QUALIFICATIONS

A. In addition to qualifications listed in Section 33 16 00 – Water Storage Tanks:

1. Post-tensioning components and systems shall be provided by PTI CRT-G11120 Certified Plant.
2. Superintendent:
   a. Full-time employee of post tensioning supplier
   b. Be present during construction of tank:
   c. Holder of current Certified Grouting Technician certificate from American Segmental Bridge Institute.

PART 2 PRODUCTS

2.01 TANK

1. Materials
   a. General Requirements:
      1) Comply with AWWA D115, ACI 350, PTI TAB.1.
      2) Materials used shall conform to Section 03 30 00 – Cast-In-Place Concrete, Part 2.
   b. Concrete:
      1) Wall, interior columns, and roof: 28-day compressive strength not less than 4,500 pounds per square inch (psi) and shall be air entrained.
      2) Floor: 28-day compressive strength not less than 4,500 psi and no air entrainment.
      3) Incorporate superplasticizer and water reducing admixture into floor concrete.
2. Prestress Strand for Circumferential Tendons:
   a. Comply with ACI 350.
   b. Strand: Conform to ASTM A416, ASTM A722, or ASTM A582.
3. Reinforcing Bars, Wire Mesh:
   a. Reinforcing Bars: ASTM A615, Grade 60.
   b. Wire Mesh: ASTM A185 or ASTM A497.
4. Wedges:
   a. Conform to PTI TAB.1.
   b. Not break into separate pieces upon stressing.
   c. Designed to securely anchor strand without significantly reducing ductility of strand or tendon.
   d. Strand slip after anchoring not permitted.
   e. Prevent breaking of individual strand wires in wedges during stressing.
   f. Achieve dynamic fatigue and impact loading resistance without strand slippage or wire breakage.
5. Elastomeric Materials:
   a. Bearing pads: ASTM D2240 or ASTM D2000.
   b. Sponge filler: ASTM D1056 or ASTM D1752.
   c. Epoxy: ASTM C881 Type III, Grade I.

6. Vertical/Roof Prestressed Reinforcement (as required):
   a. Strand: ASTM A416, grade 250 or 270.
   b. Threadbar: ASTM A722, grade 150 or 160.
   c. Corrosion protect vertical prestressed reinforcing left in ducts for more than 21-days prior to grouting in accordance with AWWA D115.
7. Ducts for Bonded Tendons:
   a. Ducts for bonded tendons:
      1) Manufactured from corrosion-resistant materials
      2) Comply with PTI Guide Specification, "Acceptance Standards for Post-tensioning Systems."
8. Grout Fitting:
   a. Grout fittings: Conform to PTI M50.3.
   b. Tendons shall have grout openings at stressing anchorages.
   c. Provide grout vents or drain holes at low and high points.
   d. Prevent grout leakage at grout openings or vents.
9. Grout Materials: PTI M50.3 and AWWA D115.
10. Couplings:
    a. Couplings for bonded tendons shall not reduce elongation of rupture below requirements of tendon.
    b. Used where approved by Erection Engineer.

2.02 FOUNDATION DRAIN

A. Materials:

1. Gravel Drain Material: Conform to Section 31 24 18 – Gravel Drain for Water Storage Tanks.
2. HDPE Geomembrane, HDPE Embedment Strip, Rubber Gaskets, Stainless Steel Clamps, and Sealant: Conform to Section 31 32 36 – HDPE Geomembrane for Water Storage Tanks.
3. PVC Pipe: Conform to Section 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

2.03 ACCESSORIES

A. Refer to Section 33 16 00 – Water Storage Tanks.

B. Access Doors:

1. Materials:
   a. Aluminum.
   b. Stainless steel or aluminum bolts.

C. Interior Ladder:
1. Type 304 stainless steel.
2. Requirements for interior ladder: Comply with 29 CFR 1910.27 and IBC.
3. Supports on tank interior: Stainless steel.

D. Silt Stops:
1. Provide removable silt stop(s) at discharge pipes and other locations as shown om drawings.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. General:
1. Comply with AWWA D115.
2. Do not place concrete foundation/floor slab until subgrade approved by Erection Engineer.
3. For wall base joints with bearing pads, locate bearing pads and hold in proper position prior to erection of wall panels. Do not nail pads. Properly secure sponge filler pads. Caulk voids around bearing pads and sponge with non-toxic sealant to prevent mortar seepage.
4. Form and/or water cure field-placed concrete floors and roofs until prestressing begins.
5. Do not place concrete floor and foundation until subgrade is approved by Erection Engineer.

B. Foundation Drain:
1. Install to limits as shown on drawings and in accordance with approved installation plan.
2. Install foundation drain components in accordance with Sections 31 24 18 – Gravel Drain for Water Storage Tanks, 31 32 36 – HDPE Geomembrane for Water Storage Tanks, and 33 11 17 –PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

C. Foundation/Floor Slab:
1. No construction joints are permitted.

2. Minimum thickness of 8-inches concrete required over all pipe encasements in concrete floor (if applicable).
3. Reference Section 31 23 11 – Earthwork for Structures.
4. Consolidate foundation/floor slab so no air pockets or voids are present.

D. Refer to ACI 350 for curing, hot and cold weather concreting, forming and troweled finish.

E. Tolerances:
1. Out-of-plumb in total wall height: ±1/2-inch.
2. Out-of-round in diameter: ±1-inch.

F. Roof:
1. Support roof by perimeter walls and interior columns.
   a. No construction joints are permitted.
   b. Locate and design interior columns and roof system to result in adequate strength and to limit deflections in accordance with ACI 350 and IBC as applicable.
   c. Minimum slope at top surface: 1 percent center to edge.
   d. Design forms to resist forces acting, including forces with respect to sloped surfaces.
2. Do not remove portions of formwork for roof until concrete is of enough strength and tendons have been fully tensioned (as applicable).
3. Form finish roof soffit. Exterior roof surface floated finish.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test concrete in accordance with ACI 350.

B. Watertightness Testing:
1. Tank supplier shall perform watertightness testing.
2. Upon completion of tank, tank supplier shall perform leak testing of tank:
   a. Watertightness testing shall be performed prior to application of water proofing, if applicable, to tank walls.
   b. Water for watertightness testing shall be supplied by Contractor.
   c. Level for watertightness testing shall be high water level as shown on drawings.
   d. Procedures and criteria for watertightness testing and acceptance shall be as defined in ACI 350.1. Maximum allowable loss shall be 0.0125 percent of tank volume per day.

e. The wall and wall-floor joint shall have no measurable seepage and shall be watertight.

f. Damp spots on the exterior wall surface or measurable leakage of flowing water at the wall base where the source is from inside of the tank shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand

END OF SECTION

SECTION 33 21 95
METAL PIPING FOR LINE PIPE INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedule 1 for applicable items of work:

   a. Includes:

      1) 6-Inch Diameter Air Valve Assemblies.
      2) 6-Inch Diameter Air Valve with Manhole Assemblies.
      3) 6-Inch Diameter Blowoff Assemblies.
      4) 6-Inch Diameter Blowoff with Manhole Assemblies.
      5) 48-Inch Sectionalizing Valve Assemblies.
      6) Metal Pipe Air Vents

B. Cost:

1. Include in prices offered in Price Schedule 2 for applicable items of work:

   a. Includes:

      1) 6-Inch Diameter Air Valve Assemblies.
      2) 6-Inch Diameter Air Valve with Manhole Assemblies.
      3) 6-Inch Diameter Blowoff Assemblies
      4) 6-Inch Diameter Blowoff with Manhole Assemblies.
      5) 42-Inch Sectionalizing Valve Assemblies.
      6) 48-inch Sectionalizing Valve Assemblies.
      7) Metal Pipe Air Vents.

1.02 DEFINITIONS

A. Metal Piping for Line Pipe Installations: Piping for water distribution appurtenances such as sectionalizing valves, blowoffs, air vents and air valves:

1. Details of steel manifold piping for line pipe installations are shown on drawings 1695-D-60798 through 1695-D-60802, 1695-D-60804 through 1695-D-60805, and 1695-D-60811 through 1695-D-60812.

1.03 REFERENCE STANDARDS

A. American National Standards Institute/NSF (ANSI/NSF)

1.	ANSI/NSF 372-22	Drinking Water System Components – Lead Content

B. American Society of Mechanical Engineers (ASME)

1.	ASME B16.47-2025	Large Diameter Steel Flanges: NPS 26 through NPS 60
2.	ASME B16.5-2025	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
3.	ASME B16.9-2024	Factory-Made Wrought Steel Buttwelding Fittings
4.	ASME B16.11-2021	Forged Steel Fittings, Socket-welding and Threaded
5.	ASME PCC-1-2022	Guidelines for Pressure Boundary Bolted Flange Joint Assembly

C. ASTM International (ASTM)

1.	ASTM A36/A36M-19	Carbon Structural Steel
2.	ASTM A53/A53M-24	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3.	ASTM A105/A105M-24	Carbon Steel Forgings for Piping Applications
4.	ASTM A139/A139M-22	Electric-Fusion (Arc) - Welded Steel Pipe (NPS 4 and over)
5.	ASTM A234/A234M-24	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
6.	ASTM A240/A240M-25a	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
7.	ASTM A420/A420M-24a	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service
8.	ASTM A1011/A1011M-23	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
9.	ASTM A1018/A1018M-23a	Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-

		Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability
10.	ASTM E165/E165M-23	Liquid Penetrant Examination for General Industry
11.	ASTM E709-21	Magnetic Particle Testing

D. American Welding Society (AWS)

1.	AWS D1.1/D1.1M:2025	Structural Welding Code

E. American Water Works Association (AWWA)

1.	AWWA C200-23	Steel Water Pipe 6-In (150-mm) and Larger
2.	AWWA C206-23	Field Welding of Steel Water Pipe
3.	AWWA C207-23	Steel Pipe Flanges for Waterworks Service Sizes 4-In. Through 144-In
4.	AWWA C227-22	Bolted, Split-Sleeve Couplings
5.	AWWA C604-24	Installation of Buried Steel Water Pipe 4-In (100-mm) and Larger

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 21 95-1, -2, -3, -4, Shop Drawings:

1. RSN 33 21 95-1, Reach 2, Start of Reach 2 to Start of San Juan River HDD.
2. RSN 33 21 95-2, Reach 2, End of San Juan River HDD to end of Reach 2.
3. RSN 33 21 95-3, Reach 3, Start of Reach 3 to Start of Chaco River HDD.
4. RSN 33 21 95-4, Reach 3, End of Chaco River HDD to end of Reach 3.
5. Submit concurrently with applicable corresponding Reach section of pipelaying diagrams submitted until Section 33 11 10 – Pipeline General Requirements.
6. As soon as practicable after date of award and before proceeding with fabrication of material, submit, for approval, the required copies of checked drawings and data.
7. Include checked, detailed shop drawings which include dimensions and tolerances, material data, joint details, welding requirements, and all painting, lining, and coating requirements.
    a. Provide checked box on each drawing indicating date drawing was checked and by whom.
    b. When revised drawings and data are resubmitted, clearly identify changes from previous submittals.

C. RSN 33 21 95-5, Commercial Product Data:

1. Manufacturer's engineering data sheets demonstrating the applicable size, standards, material, and pressure rating for components in Part 2, Products, of this specification.

D. RSN 33 21 95-6, Final Drawings and Data:

1. Complete set of As-built drawings.

a. Clearly mark drawings 1695-D-60798 through 1695-D-60802, 1695-D-60804 through 1695-D-60805, and 1695-D-60811 through 1695-D-60812 to show all field modifications of the final installation.

b. Submit drawings in accordance with Section 01 78 30 – Project Record Documents.

2. Contractor source and field quality testing:

a. Weld Nondestructive testing (NDT) reports including retests after weld repair.

b. Affidavit of compliance to AWWA C200 and C206 as applicable.

c. Hydrostatic test reports:

1) Time-pressure record.

1.05 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 60 00 – Product Requirements.

B. During loading, transporting, unloading, storing, and laying, prevent damage to steel manifold piping for line pipe installation linings and coating. Transport and handle in accordance with fabricator's instructions:

1. Provide padded bolsters curved to fit under the outside of the pipe.

2. Provide heavy padding under ties during transportation and storage.

C. Maintain circularity of pipe sections during coating, lining, transporting, and installation operations:

1. Provide stulls or adjustable spiders.

2. Measured deviation between maximum and minimum diameters at stulls or spiders shall not exceed 0.5 percent of nominal pipe diameter.

D. Do not store directly on the ground.

E. Store so that lifting straps can be passed beneath pipe sections.

F. Provide space to allow personnel to move between pipe sections.

G. Cover with tarps and tie down securely.

H. Repair damage to lining and coating as directed if, in the opinion of COR a satisfactory repair can be made; otherwise replace damaged section at expense of Contractor in accordance with Section 09 96 20 – Coatings.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Steel plate:

1. ASTM A36, ASTM A1011, SS grade 36, 40, or 45; or ASTM A1018, SS Grade 36 or 40.

B. Standard and Schedule Steel Plate:

1. ASTM A53, Type E or S, grade B.

C. Electric-Fusion (Arc-) Welded, Spiral-seam Steel Pipe:

1. ASTM A139, Grade C, D or E.

D. Stainless Steel Plate:

1. ASTM A240, Type 304 or 316.

E. Flanges:

1. Slip-on ring type flat faced: AWWA C207, ASME B16.47, or ASME B16.5.
2. Flat face with finish suitable for gasket:
   a. Provide spiral or concentric serrated grooved flange face gasket surface finishes that are suitable for flat gasket material provided and for operating pressures.
3. Provide flanges suitable for line pipe pressure locations.
4. Suitable for connection to adjacent flanges or valve flanges.

F. Gasket:

1. Multi-Swell Style 3760 as manufactured by Garlock, www.garlock.com or equal with the following essential characteristics:
   a. Dimensional requirements of AWWA C207, ASME B16.47, or ASME B16.5 as shown on drawings.
   b. Flat, full face or ring type.
   c. Suitable for cold water service.
   d. Provide gaskets suitable for line pipe pressure locations.
   e. Minimum 1/16-inch thick.

G. Flange Bolts, Studs, Nuts, and Washers:

1. AWWA C207 for AWWA flanges.
2. ASME B16.47 or ASME B16.5 for ASME flanges.
3. Bolts: ASTM A193/A193M, Grade B7.
4. Nuts:
   a. Greater than 1-inch diameter: ASTM A194/A194M, Grade 2H
   b. 1-inch diameter or less: ASTM A563
5. Washers: ASTM F436.

H. Threaded Steel Fittings:

1. ASME B16.11 and ASTM A105.
2. Provide where shown on drawings.
3. Threaded NPT: ASME B.20.1.

I. Butt-welded Steel Fittings:

1. ASME B16.9 and ASTM A234 or ASTM A420 – WPL6.
2. Provide where shown on drawings.

J. Pipe Couplings:

1. Grooved-end: Style 77 manufactured by Victaulic, www.victaulic.com; or equal, having the following essential characteristics:
   a. Minimum allowable pipe end separation:
      1) Couplings less than 4-inch in diameter: 0.0625-inch.
      2) Couplings 4-inches in diameter and greater: 0.125-inch.
   b. Pressure ratings suitable for line pipe pressure.
   c. NSF 372 compliant.
   d. Flexible joint type with rolled or cut grooves.
2. Non-restrained flexible split sleeve type couplings: Style 230, manufactured by Victaulic, www.victaulic.com; or equal, having the following essential characteristics:
   a. Coupling type as shown on drawings.
   b. Pressure ratings suitable for line pipe pressure.
   c. Conforms to AWWA C227.
   d. Steel material.

e. Coupling housing: Arched, 2 or more segmented, split sleeve-type which when closed compresses elastomeric O-ring gaskets beneath arches of sleeve to create radial seal around pipe ends joined inside of coupling.

f. Gaskets: Suitable for cold-water service.

g. NSF 372 compliant.

h. Minimum misalignment tolerance (lateral offset between pipe ends: 0.125-inch.

3. Restrained flexible split sleeve type couplings: Style 233 manufactured by Victaulic, www.victaulic.com,; or equal, having the following essential characteristics:

a. Conforms to AWWA C227.

b. Coupling housing: Arched, 2 or more segmented, split sleeve-type which when closed compresses elastomeric O-ring gaskets beneath arches of sleeve to create radial seal around pipe ends joined inside of coupling.

c. Minimum misalignment tolerance (lateral offset between pipe ends): 0.125-inch.

d. Minimum allowable angular deflection:

1) 42-inch: 1°15’.

K. Anchor bolts:

1. Expansion anchors or epoxy type anchor bolts with studs and epoxy as shown on drawings:

a. Expansion anchors:

1) CID A-A-1923A, Type 4.

b. Adhesive Anchors: Drilled type, installed with a chemical adhesive system:

1) Adhesive: HIT-HY 200 epoxy adhesive manufactured by Hilti Corporation, www.hilti.com; or equal, having the following essential characteristics:

a) Injectable two-component epoxy adhesive.

b) Stud and epoxy combination by same manufacturer.

c) End of stud: Double cut chisel point.

d) Studs (threaded rods): ASTM A193, Grade B7.

e) Nuts: ASTM A194, Grade 2H.

f) Washers: ASTM F436 Type 1 and ANSI B18.22.1 Type A Plain

2.02 FABRICATION

A. Fabricate steel manifold piping for line pipe installations in accordance with these specifications, as indicated on drawings, and in accordance with AWWA C200.

B. Longitudinal, girth, and spiral joints, other than field welds:

1. Double-welded butt joints with complete penetration.
2. Stagger longitudinal joints.
3. Longitudinal, girth, and spiral joints shall not intersect at outlet connections.

C. Cut plates accurately to size and shape.

D. Bend or roll plates to true circular with curvature continuous from edges of plates.

E. Properly form edges to be joined by welding to suit type of welding and to allow complete penetration.

F. Perform welding with a process that protects molten metal from atmosphere:

1. Where practicable, use automatic machines.
2. Where weld metal is deposited in successive layers, clean each layer thoroughly before subsequent layer is deposited.
3. Take particular care in aligning and separating edges of plates to be joined by butt welding so that complete penetration and fusion of welds will be ensured.
4. After welding is complete, remove weld spatter.

G. Protect work and operator from wind, rain, and snow during welding operations:

1. Welding is not permitted on wet surfaces or when temperature of steel is lower than 0 degrees F.
2. Apply heat to welding areas as needed during field installation. At pipe surface temperatures between 0- and 32-degrees F, heat surface of areas within 3-inches of the point where a weld is to be started to at least 60 degrees F.

H. Ends to be joined by a pipe coupling: Exterior surface of pipe end to be connected with sleeve-type coupling shall be free from weld reinforcement (bead), seams, scars, dents, flats, or other defects likely to interfere with joint-sealing process in accordance with coupling manufacturer instructions.

I. Flanges and flanged connections:

1. During attachment of flanges to associated steel manifold pipe, take adequate steps to ensure that face of flanges remains flat and perpendicular to centerline of attached piping.
2. Remove by machining, initial, residual, or latent irregularities or warping that remains in face of flange after its attachment to steel manifold piping.

3. After machining, flange thickness shall not be reduced below minimum thickness specified in AWWA C207, ASME B16.47, ASME B16.5, or as shown on drawings.
4. Weld pipe flanges to piping so bolt holes straddle vertical centerline when in installed position.
5. Provide pipe flanges that connect to valve body flanges with same number of bolt holes, bolt pattern, and bolt circle diameter as valves with which connected.

J. Continuously weld joints of flange supports and pipe supports.

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. Flange Weld Testing:

1. Test flange welds by magnetic particle or liquid penetrant method in accordance with AWS D1.1.
2. Repair defects and retest weld.

B. Hydrostatic Pressure Testing:

1. Straight sections of steel manifold piping for line pipe installations manufactured and hydrostatically tested in accordance with ASTM A53 or ASTM A139 need not be retested.
2. Notify Government a minimum of 30-days before test.
3. Government will witness hydrostatic test and calibration of pressure gauges.
4. Use 2 or more pressure gauges with one being a recording type:
   a. Upper limit of pressure gauges shall be between 1.5 and 3 times required test pressure. Calibrate pressure gauges with a deadweight tester.
   b. Calibrate at least 1 gauge, which is used for acceptance of test, within 30-days prior to use.
   c. Make a time-pressure record of hydrostatic pressure test.
5. Furnish temporary supports, bulkheads, air vents, dead weight tester, and other equipment necessary to perform hydrostatic tests.
6. If flange is attached to piping section after piping section has been hydrostatically tested, piping section will not require retesting.
7. Water temperature for tests: Greater than 45 degrees F.
8. Vent air from test sections.
9. Fill each section with water and uniformly increase pressure until required test pressure is reached:
   a. Hold test pressure for a minimum of 15-minutes.
   b. Apply and release test pressure 3 successive times.

c. After each application, hold pressure to 2/3 of required pressure until welded joints and seams can be examined.

d. Repair defects. After defects are repaired repeat complete test procedure.

10. After hydrostatic testing is completed, cut sections for handling purposes on planes normal to pipe axis.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install steel manifold piping for line pipe installation to line and grade as shown on drawings and in accordance with AWWA C604.

B. Prevent steel pipe from being displaced or overstressed during concrete and backfill placement.

C. Furnish and install supports and bracing as may be required to hold steel manifold piping in place, prevent distortion, and prevent flotation during erection, placing of concrete. Supports and bracing shall bear against the exterior pipe surface a minimum of 120-degrees of the pipe circumference and not create a point load on the pipe:

1. Embedment of timber supports will not be permitted.

2. If used for the support system, cables or chains may not bear directly against the steel pipe or concrete reinforcement.

D. Contact between pipe and rebar will not be allowed.

E. Install pipe spools with flanged connections so that bolt holes straddle vertical centerline when in installed position.

F. Dielectrically insulate between dissimilar metals:

1. Provide insulating type unions at threaded valve, pipe or fitting connections between dissimilar metals.

2. Provide insulating flange kits for flanges of dissimilar metals.

3. Provide insulating hardware kits, including sleeves and washers, for bolts of dissimilar metals to the adjacent metal (e.g., flange, coupling body, etc.).

G. Install pipe couplings, gaskets, and other appurtenances in accordance with manufacturer instructions:

1. Maximum allowable misalignment (lateral offset) between pipe ends at split sleeve type couplings: 0.125-inch:

a. Government may witness installation of pipe couplings. Contractor shall notify COR prior to coupling installations.

b. If misalignment exceeds 0.125-inch, piping shall be repaired at the expense of the Contractor to correct misalignment. Piping repair method subject to COR approval.

c. Do not deflect pipe between coupling pairs at couplings for dynamic joint deflection to correct misalignment.

H. Field joints:

1. Field joints shown on drawings are required to facilitate lining or installation of steel manifold piping.

2. Allowable field joints for steel manifold piping:

a. AWWA C207, ASME B16.47, and ASME B16.5 flanged joints per ASME PCC-1 respectively:

1) Flanges shall be suitable for working pressure of adjacent pipe.

2) Flanges shall not be permitted underneath buildings, water storage tanks, or in concrete encasements.

b. Full-penetration butt welds.

c. Threaded couplings for pipe less than 4-inches in diameter.

3. Welded field joints shall be in accordance with AWWA C206.

4. Prepare field welded surfaces and recoat in accordance with Section 09 96 20 – Coatings.

3.02 CONTRACTOR FIELD QUALITY TESTING

1. Nondestructive Testing of Field Welds:

a. Test all welds in accordance with AWWA C206 and this specification.

b. Complete inspections and tests as work progresses in presence of COR and in accordance with AWS D1.1.

c. When welds are found to be defective by the standards of AWS, repair welds in accordance with AWS D1.1 and reexamine welds to ensure the adequacy of repairs.

d. Visual Inspection: Visually inspect all welds following procedures, techniques, and standards of AWS D1.1.

e. Testing of full penetration field welds: Ultrasonic or radiograph methods in accordance with AWS D1.1.

f. Prepare field welded surfaces and recoat in accordance with Section 09 96 20 – Coatings.

3.03 LINING AND COATING

A. Refer to Section 09 96 20 – Coatings.

END OF SECTION

SECTION 33 42 30
CORRUGATED METAL PIPE CULVERTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Corrugated Metal Culverts:

1. Measurement: Linear foot of installed culvert.
2. Payment: Liner foot prices offered in Price Schedule 2:
   a. Includes:
      1) Excavation.
      2) Backfill.
      3) CLSM.
      4) Compaction.
      5) Corrugated Metal Culverts.
      6) Culvert Flared end for Entry and Exit.
      7) Culvert Coupling Bands.
      8) Culvert Installation.
      9) Geotextile Installation.
      10) Riprap Installation.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A760/A760M-15	Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
2.	ASTM C33/C33M-13	Concrete Aggregates

1.03 DELIVERY, STORAGE, AND HANDLING

A. Haul and handle pipe to avoid damage to galvanized coating.

B. Do not use rope, cable, or chain slings for handling pipe.

PART 2 PRODUCTS

2.01 CORRUGATED METAL PIPE

A. Corrugations:

1. 2 2/3-inch by 1/2-inch:

   a. Annular or helical.

B. Diameter: 12-inches.

C. Sheet thickness: 0.064-inches.

D. Corrugated Steel Pipe and Coupling Bands:

1. ASTM A760, Type I.
2. Galvanized.

E. Flared end sections:

1. Prefabricated sections of standard manufacture.
2. Same metal as pipe to which they are attached.

2.02 FILTER

A. ASTM C33 fine aggregate.

2.03 RIPRAP

A. In accordance with Section 31 37 00 – Riprap.

PART 3 EXECUTION

3.01 GENERAL

A. Furnish and lay corrugated metal pipe of sizes and gauges shown on drawings complete with coupling bands and joint materials.

B. Install flared end section on inlet and outlet end of each pipe.

3.02 EXCAVATION

A. Excavation for pipe trench: In accordance with Section 31 23 22 – Pipe Trench Earthwork.

3.03 LAYING CORRUGATED METAL PIPE

A. Lay corrugated metal pipe to lines and grades shown on drawings or established by COR:

1. Laying Tolerances:
   a. Departure from and return to established alignment and grade, maximum: 1/8-inch per foot of pipe.
   b. Total departure, maximum: 1-inch.

B. Lay pipe in accordance with Section 33 11 10 – Pipeline General Requirements.

C. Place pipe on soil pads as shown on Drawings 1695-D-60795:
   1. Material: Suitable for backfill.
   2. Compact soil pads in accordance with Section 31 23 02 – Compacting Earth Materials.

D. Lay pipe with outside laps of circumferential joints pointing upstream and with longitudinal joints at sides.

E. Coupling Bands:
   1. Use where necessary to join sections of pipe.
   2. Draw fastenings up tight.
   3. Install to ensure tight joints.
   4. Joints between sections approximately at center of coupling band.

F. Install flared end sections in accordance with manufacturer's instructions.

3.04 BACKFILL

A. As each unit of pipe is laid, tamp backfill material about pipe to hold it rigidly in place until joints are completed.

B. After joints have been completed, place and compact backfill in accordance with Section 31 23 22 – Pipe Trench Earthwork.

C. CLSM in accordance with Section 31 23 70 – Controlled Low Strength Material (CLSM).

D. Compact to 95 percent compaction.

E. Place filter material at culvert outlets.

3.05 PROTECTION

A. Equipment travel over pipe not permitted until backfill has been placed and compacted to depth recommended by pipe manufacturer, but not less than 1-foot above top of pipe. Provide adequate earth cover over pipe to prevent damage from construction equipment loads.

3.06 SURFACING

A. In accordance with Section 32 15 10 – Gravel Surfacing..

3.07 REPAIR

A. Repair damage to galvanized coatings including factory or field cut edges and welding in accordance with ASTM A760.

END OF SECTION

SECTION 35 21 95
STEEL MANIFOLD PIPING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Steel Manifold Piping:

1. Payment: Lump sum prices offered in Price Schedule 2.

1.02 DEFINITIONS

A. Steel Manifold Piping:

1. Details of steel manifolds are shown on drawings 1695-D-62475 through 1695-D-62483, and 1695-D-60804.

1.03 REFERENCE STANDARDS

1.	ANSI/NSF 372-2022	Drinking Water System Components – Lead Content

B. American Society of Mechanical Engineers (ASME)

1.	ASME B1.20.1-2013(R2018)	Pipe Threads, General Purpose (Inch)
2.	ASME B16.47-2020	Large Diameter Steel Flanges: NPS 26 through NPS 60
3.	ASME B16.5-2020	Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24
4.	ASME B16.9-2018	Factory Made Wrought Buttwelding Fittings
5.	ASME B16.11-2021	Forged Fittings, Socket-Welding and Threaded
6.	ASME B18.22.1-1965(R2017)	Plain Washers
7.	ASME PCC-1-2022	Guidelines for Pressure Boundary Bolted Flange Joint Assembly

C. ASTM International (ASTM)

1.	ASTM A36/A36M-19	Carbon Structural Steel
2.	ASTM A53/A53M-22	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
3.	ASTM A105/A105M-23	Carbon Steel Forgings for Piping Applications

4.	ASTM A139/A139M-22	Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
5.	ASTM A193/A193M-23	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
6.	ASTM A194/A194M-22a	Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
7.	ASTM A234/A234M-23a	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
8.	ASTM A240/A240M-23	Chromium and Chromium-Nickel Stainless-Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
9.	ASTM A420/A420M-22	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service
10.	ASTM F436/F436M-19	Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
11.	ASTM A1011/A1011M-23	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
12.	ASTM A1018/A1018M-23	Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
13.	ASTM E165/E165M-18	Liquid Penetrant Examination for General Industry
14.	ASTM E709-21	Magnetic Particle Testing

D. American Welding Society (AWS)

1.	AWS D1.1/D1.1M:2020	Structural Welding Code - Steel

E. American Water Works Association (AWWA)

1.	AWWA C200-17	Steel Water Pipe - 6 In (150 mm) and Larger
2.	AWWA C206-17	Field Welding of Steel Water Pipe
3.	AWWA C207-18	Steel Pipe Flanges for Waterworks Service, Sizes 4 In. through 144 In. (100 mm Through 3,600 mm)

4.	AWWA C208-22	Dimensions for Fabricated Steel Water Pipe Fittings
5.	AWWA C227-22	Bolted, Split-Sleeve Couplings
6.	AWWA C604-17	Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger

F. Commercial Item Descriptions (CID)

1.	CID A-A-1923A-01	Shield Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 35 21 95-1, Shop Drawings:

1. Checked, detailed shop drawings including dimensions and tolerances, material data, joint details, and welding requirements:
   a. Provide checked box on each drawing indicating date drawing was checked and by whom.
   b. When revised drawings and data are resubmitted, clearly identify changes from previous submittals.

C. RSN 35 21 95-2, Field Welder Qualifications

1. Welder certifications

D. RSN 35 21 95-3, Commercial Products Data:

1. Manufacturer's engineering data sheets demonstrating the applicable size, standards, material, and pressure rating for components in Part 2, Products, of this specification.

E. RSN 35 21 95-4, Pipe Installation Procedure and Calculations:

1. Structural calculations and details of supports and tiedowns for the steel manifold piping stamped and signed by a registered professional engineer in State of New Mexico:
   a. Calculations must demonstrate that the tiedown system is adequate to resist uplift forces resulting from floatation of the steel manifold piping in freshly placed concrete and that the tiedown system will not cause stresses in excess of the allowable in the steel manifold piping.
2. Methods for maintaining circularity and preventing damage to steel pipe, fittings, lining and coating during loading, transporting, unloading, storing, and laying.
3. Type and location of pipe supports and tie downs to be used.
4. Methods for ensuring pipe alignment.

5. Type, locations, and details of field welds.
6. Installation procedure.

F. RSN 35 21 95-5, Source Quality Test Reports:

1. Provide hydrostatic test procedure, including time-pressure record.
2. Report detailing results of hydrostatic testing including time pressure record of each hydrostatic test.

G. RSN 35 21 95-6, Final Drawings and Data:

1. Field Weld Test Results: Results of air and soap tests on field welded double lap and butt strap joints.
2. Complete set of As-Built drawings
   a. Clearly mark drawings 1695-D-60913 through 1695-D-60952 to show all field modifications of the final installation.
   b. Submit drawings in accordance with Section 01 33 00 – Submittals article 1.04 paragraph C.6 and Section 01 78 30 – Project Record Documents.

1.05 QUALIFICATIONS

A. Steel Pipe Welders: Welders and Welding Operators to be qualified in accordance with AWS D1.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 60 00 – Product Requirements.

B. During loading, transporting, unloading, storing, and laying, prevent damage to steel manifold piping linings and coating. Transport and handle in accordance with fabricator's instructions:

1. Provide padded bolsters curved to fit under outside of pipe.
2. Provide heavy padding under ties during transportation and storage.

C. Maintain circularity of pipe sections during coating, lining, transporting, and installing operations:

1. Provide stulls or adjustable spiders.
2. Measured deviation between maximum and minimum diameters at stulls or spiders shall not exceed 0.5 percent of nominal pipe diameter.

D. Do not store directly on the ground.

E. Store so that lifting straps can be passed beneath pipe sections.

F. Provide space to allow personnel to move between pipe sections.

G. Cover with tarps and tie down securely.

H. Repair damage to lining and coating as directed if, in the opinion of COR, a satisfactory repair can be made; otherwise, replace damaged section at expense of Contractor and in accordance with Section 09 96 20 – Coatings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Piping and equipment materials:

1. ANSI/NSF 372 compliant lead-free.

B. Steel plate:

1. ASTM A36, ASTM A1011, SS, Grade 36, 40, or 45; or ASTM A1018, SS, Grade 36 or 40.

C. Stainless Steel Orifice Plate: ASTM A240, Type 304/304L or 316/316L

2.02 PIPE

A. Standard and Schedule Steel Pipe:

1. ASTM A53, Type E or S, Grade B.

B. Electric–Fusion– (arc–) Welded, Spiral–Seam Steel Pipe:

1. ASTM A139, Grade C, D, or E.

C. Threaded Steel Fittings:

1. ASME B16.11 and ASTM A105.
2. Threaded NPT: ASME B1.20.1.

D. Butt-Welding Steel Fittings:

1. ASME B16.9 and ASTM A234 or ASTM A420 - WPL6.

E. Steel Pipe Miter Bend Elbows: Designed, fabricated, and dimensioned in accordance with AWWA C208.

2.03 FITTINGS

A. Flanges:

1. Slip-on: AWWA C207, ASME B16.47, or ASME B16.5.
2. Flat face with finish suitable for gasket:

a. Provide spiral or concentric serrated grooved flange face gasket surface finishes that are suitable for flat gasket material provided and for operating pressures.

b. Contractor shall confirm flange facing matches mating flange at all attachments.

B. Flange Bolts, Studs, Nuts, and Washers:

1. AWWA C207 for AWWA flanges.

2. ASME B16.47 or ASME B16.5 for ASME flanges.

3. Bolts: ASTM A193/A193M, Grade B7.

4. Nuts:

a. Greater than 1-inch diameter: ASTM A194/A194M, Grade 2H

b. 1-inch diameter or less: ASTM A563

5. Washers: ASTM F436.

C. Pipe couplings:

1. Minimum cold water working pressure ratings: 150 psig.

2. Gaskets: Suitable for cold-water service.

3. Grooved-end: Style 77 or Style W77/W77B manufactured by Victaulic, www.victaulic.com; or equal, having the following essential characteristics:

a. Ductile iron conforming to ASTM A536, Grade 65-45-12.

b. Flexible joint type with rolled or cut grooves.

c. Minimum allowable pipe end separation:

1) Couplings 4-inches in diameter and greater: 0.125-inch.

4. Restrained flexible split sleeve type couplings: Style 232 manufactured by Victaulic, www.victaulic.com,; or equal, having the following essential characteristics:

a. Conforms to AWWA C227.

b. Coupling housing: Arched, 2 or more segmented, split sleeve-type which when closed compresses elastomeric O-ring gaskets beneath arches of sleeve to create radial seal around pipe ends joined inside of coupling.

c. Minimum misalignment tolerance (lateral offset between pipe ends): 0.125-inch.

d. Minimum allowable angular deflection:

1) 42-inch: 1°0’.

5. Restrained couplings for dynamic joint deflection:

a. Suitable for buried service.

b. Spaced to accommodate 2-inches of differential settlement.

1) Contractor to submit data or calculations under RSN 35 21 95-1 that demonstrate differential settlement is accommodated within allowable space.

c. Conforms to the following options:

1) Restrained flexible type for dynamic joint deflection Style 233, manufactured by Victaulic, www.victaulic.com; or equal, having the following essential characteristics:

a) Conforms to AWWA C227.

b) Coupling housing: Arched, 2 or more segmented, split sleeve-type which when closed compresses elastomeric O-ring gaskets beneath arches of sleeve to create radial seal around pipe ends joined inside of coupling.

c) Minimum misalignment tolerance (lateral offset between pipe ends): 0.125-inch.

d) Minimum allowable angular deflection:

i. 42-inch: 1°15'.

2) Grooved-end with welding ring: Style W77 with Vic-Ring manufactured by Victaulic, www.victaulic.com; Style 7022 manufactured by ASC Engineered Solutions, www.asc-es.com; or equal, having the following essential characteristics:

a) Uses welding rings to form flexible grooved end on plain end pipe.

b) Ring material: carbon steel that meets or exceeds the requirements of ASTM A105.

c) Housing: ASTM A536 Gr. 65-45-12

d) Minimum allowable pipe end separation:

i. Couplings 4-inches in diameter and greater: 0.19-inch.

e) Minimum allowable angular deflection per coupling:

i. 42-inch: 0°29'.

ii. Installed in multiples to accommodate required differential settlement amount.

3) Dynamic movement joint Style W257B, manufactured by Victaulic, www.victaulic.com; or equal, having the following essential characteristics:

a) Pipe spools meet requirements of ASTM A53, Type E or S, Grade B.

b) Assembly accommodates a minimum of X" of differential settlement.

2.04 APPURTENANCES

A. Anchor bolts:

1. Expansion anchors or epoxy type anchor bolts with studs and epoxy as shown on drawings:

   a. Expansion anchors:

      1) CID A-A-1923A, Type 4.

   b. Adhesive Anchors: Drilled type, installed with a chemical adhesive system:

      1) Adhesive: HIT-HY 200 epoxy adhesive manufactured by Hilti Corporation, www.hilti.com; or equal, having the following essential characteristics:

         a) Injectable two-component epoxy adhesive.

         b) Stud and epoxy combination by same manufacturer.

         c) End of stud: Double cut chisel point.

         d) Studs (threaded rods): ASTM A193, Grade B7.

         e) Nuts: ASTM A194, Grade 2H.

         f) Washers: ASTM F436 Type 1 and ANSI B18.22.1 Type A Plain

B. Gaskets:

1. Multi-Swell Style 3760 manufactured by Garlock, www.garlock.com; or equal, having the following essential characteristics:

   a. Dimensional requirements of AWWA C207, ASME B16.47, or ASME B16.5 as shown on drawings.

   b. Flat, full face or ring type.

   c. Minimum 150 psig cold water pressure rating.

   d. Minimum 1/16-inch thick.

   e. Suitable for cold water service.

C. Flange insulation:

1. Flange isolating gasket kit complete with the "Trojan" type of gasket manufactured by Advanced Products and Systems, Inc., www.apsonline.com, or equal with the following essential characteristics:

   a. Provide full-faced gaskets as shown on drawings. Outside diameter of gasket is same as outside diameter of flange.

b. Provide retainer with integral Nitrile sealing element ("Trojan" type).

c. Retainer material to be suitable for cold water service as recommended by gasket manufacturer.

d. One insulating sleeve and 2 insulating washers for each bolt. Material suitable for cold water service as recommended by gasket manufacturer.

e. Asbestos gaskets are not acceptable.

f. Prevent damage to gasket, gasket supplier to provide required bolt torques, recommended bolt tightening sequence, and flange face finish for insulating flanged joints.

g. Suitable for 150 psig cold water service.

2.05 FABRICATION

A. Fabricate steel manifold piping in accordance with these specifications, as indicated on drawings, and in accordance with AWWA C200.

B. Longitudinal, girth, and spiral joints, other than field welds:

1. Double-welded butt joints with complete penetration.
2. Stagger longitudinal joints.
3. Longitudinal, girth, and spiral joints shall not intersect at outlet connections.

C. Cut plates accurately to size and shape.

D. Bend or roll plates to true circular with curvature continuous from edges of plates.

E. Properly form edges to be joined by welding to suit type of welding and to allow complete penetration.

F. Perform welding with a process that protects molten metal from atmosphere:

1. Where practicable, use automatic machines.
2. Where weld metal is deposited in successive layers, clean each layer thoroughly before subsequent layer is deposited.
3. Take particular care in aligning and separating edges of plates to be joined by butt welding so that complete penetration and fusion of welds will be ensured.
4. After welding is complete, remove weld spatter.

G. Protect work and operator from wind, rain, and snow during welding operations:

1. Welding is not permitted on wet surfaces or when temperature of steel is lower than 0 degrees F.

2. Apply heat to welding areas as needed during field installation. At pipe surface temperatures between 0 and 32 degrees F, heat surface of areas within 3-inches of the point where a weld is to be started to at least 60 degrees F.

H. Ends to be joined by a pipe coupling:

1. Exterior surface of pipe end to be connected with sleeve-type coupling shall be free from weld reinforcement (bead), seams, scars, dents, flats, or other defects likely to interfere with joint-sealing process in accordance with coupling manufacturer instructions.

I. Flanges and flanged connections:

1. During attachment of flanges to associated steel manifold pipe, take adequate steps to ensure that face of flanges remains flat and perpendicular to centerline of attached piping.
2. Remove by machining, initial, residual, or latent irregularities or warping that remains in face of flange after its attachment to steel manifold piping.
3. After machining, flange thickness shall not be reduced below minimum thickness specified in AWWA C207, ASME B16.47, ASME B16.5, or as shown on drawings.
4. Weld pipe flanges to the piping so that bolt holes straddle vertical centerline when in the installed position.
5. Provide pipe flanges that connect to valve body flanges with same number of bolt holes, bolt pattern, bolt circle diameter, and face type, flat or raised, as valves to which they are connected.

J. Continuously weld joints of flange supports and pipe supports.

2.06 CONTRACTOR SOURCE QUALITY TESTING

A. Flange Weld Testing:

1. Test flange welds by magnetic particle or liquid penetrant method in accordance with AWS D1.1.
2. Repair defects and retest weld.

B. Coupling Restraint Ring Weld Testing:

1. Test welds of restraint rings welded to pipe for split-sleeve restrained couplings by magnetic particle or liquid penetrant method in accordance with AWS D1.1.
2. Repair defects and retest weld.

C. Hydrostatic Pressure Testing:

1. Straight sections of steel piping manufactured and hydrostatically tested in accordance with ASTM A53 or ASTM A139 need not be retested.

2. Notify Government a minimum of 30-days before test.
3. Government may witness hydrostatic test and calibration of pressure gauges.
4. Use 2 or more pressure gauges with one being a recording type:
   a. Upper limit of pressure gauges shall be between 1.5 and 3 times required test pressure. Calibrate pressure gauges with a deadweight tester.
   b. Calibrate at least 1 gauge, which is used for acceptance of test, within 30-days prior to use.
   c. Make a time-pressure record of hydrostatic pressure test.
5. Furnish temporary supports, bulkheads, air vents, dead weight tester, and other equipment necessary to perform hydrostatic tests.
6. If flange is attached to piping section after piping section has been hydrostatically tested, piping section will not require retesting.
7. Water temperature for tests: Greater than 45 degrees F.
8. Vent air from test sections.
9. Fill each section with water and uniformly increase pressure until required test pressure is reached:
   a. Hold test pressure for a minimum of 15-minutes.
   b. Apply and release test pressure 3 successive times.
   c. After each application, hold pressure to 2/3 of required pressure until welded joints and seams can be examined.
   d. Repair defects. After defects are repaired repeat complete test procedure.
10. After hydrostatic testing is completed, cut sections for handling purposes on planes normal to pipe axis.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install steel manifold piping to line and grade as shown on drawings and in accordance with AWWA C604:
   1. Install steel manifold pipe in accordance with the approved Pipe Installation Procedure.

B. Prevent steel pipe from being displaced or overstressed during concrete and backfill placement.

C. Furnish and install supports and bracing as may be required to hold steel manifold piping in place, prevent distortion, and prevent flotation during erection and placing of concrete. Supports and bracing shall bear against the exterior pipe surface a minimum of 120-degrees of the pipe circumference and not create a point load on the pipe:
   1. Embedment of timber supports will not be permitted.

2. If used for the support system, cables or chains may not bear directly against the steel pipe or concrete reinforcement.

D. Contact between pipe and rebar will not be allowed.

E. Install pipe spools with flanged connections so that bolt holes straddle vertical centerline when in installed position.

F. Dielectrically insulate between dissimilar metals:

1. Provide insulating type unions at threaded valve, pipe or fitting connections between dissimilar metals.

2. Provide insulating flange kits for flanges of dissimilar metals.

3. Provide insulating hardware kits, including sleeves and washers, for bolts of dissimilar metals to the adjacent metal (e.g., flange, coupling body, etc.).

G. Install pipe couplings, gaskets, and other appurtenances in accordance with manufacturer instructions:

1. Maximum allowable misalignment (lateral offset) between pipe ends at split sleeve type couplings: 0.125-inch:

a. Government may witness installation of pipe couplings.

b. If misalignment exceeds 0.125-inch, piping shall be repaired at the expense of the Contractor to correct misalignment. Piping repair method subject to COR approval.

c. Do not deflect pipe between coupling pairs at couplings for dynamic joint deflection to correct misalignment.

H. Install flange isolation kits in accordance with manufacturer instructions:

1. Use dielectric anti seize sparingly for installation of bolts.

I. Install anchor bolts in accordance with manufacturer instructions.

J. Field joints:

1. Field joints shown on drawings are required to facilitate lining or installation of steel manifold piping.

2. Allowable field joints for steel manifold piping:

a. AWWA C207, ASME B16.47, and ASME B16.5 flanged joints per ASME PCC-1 respectively:

1) Flanges shall be suitable for working pressure of adjacent pipe.

2) Flanges shall not be permitted underneath buildings, water storage tanks, or in concrete encasements.

b. Full-penetration butt welds.

c. Double welded lap joints, or double welded butt strap joints.

d. Threaded couplings for pipe less than 4-inches in diameter.

3. Welded field joints shall be in accordance with AWWA C206.

4. Prepare field welded surfaces and recoat in accordance with Section 09 96 20 – Coatings.

K. Steel manifold piping earthwork:

1. In accordance with Section 31 23 22 – Pipe Trench Earthwork.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Nondestructive Testing of Field Welds of Steel Pipe:

1. Test all welds in accordance with AWWA C206 and this specification.

2. Complete inspections and tests as work progresses in presence of COR and in accordance with AWS D1.1.

3. When welds are found to be defective by the standards of AWS, repair welds in accordance with AWS D1.1 and reexamine welds to ensure the adequacy of repairs.

4. Visual Inspection: Visually inspect all welds following procedures, techniques, and standards of AWS D1.1.

5. Testing of full penetration joints:

a. Ultrasonic methods in accordance with AWS D1.1.

6. Testing of partial penetration joint field welds and fillet field welds:

a. Magnetic particle testing: ASTM E709.

b. Dye penetrant: ASTM E165.

c. Standards of acceptance for both types: AWS D1.1.

d. Caulking or peening of defective welds is not permitted.

e. Repair and retest unsatisfactory welds.

7. Inspect all double lap welded and butt strap joints by air test:

a. AWWA C206.

b. Test the joints by shop drilling and tapping for a 1/8-inch or 1/4-inch national pipe thread in the lap end of the pipe.

c. Apply 40 psig of air into the connection between the two fillet welds and maintain for a period of 5-minutes.

d. Paint the welds with a soap solution.

e. Mark any leaks indicated by the escaping air bubbles.

f. Repair welds at leak locations in accordance with AWS D1.1 and AWWA C206 and retest.

g. Close the threaded openings with pipe plugs.

h. Seal weld the pipe plugs and grind the weld smooth.

i. Submit test results to COR within one week after testing.

j. Prepare field welded surfaces and recoat in accordance with Section 09 96 20 – Coatings.

3.03 LINING AND COATING

A. Refer to Section 09 96 20 – Coatings.

END OF SECTION

SECTION 35 22 14
VALVES AND EQUIPMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Valves and Equipment:

1. Payment: Lump sum prices offered in Price Schedule 2 for various types and sizes of valves and equipment provided as shown on drawings.

1.02 SYSTEM DESCRIPTION

A. Furnish and install valves and equipment associated with water tanks in accordance with the requirements of the drawings and these specifications.

B. Details of valves and equipment are shown on drawings: 1695-D-62475 through 1695-D-62483, and 1695-D-60804.

1.03 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

1.	ANSI/NSF 372-2022	Drinking Water System Components – Lead Content

B. American Society of Mechanical Engineers (ASME)

1.	ASME B16.47-2025	Large Diameter Steel Flanges: NPS 26 through NPS 60
2.	ASME B16.5-2025	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch
3.	ASME B40.100-22	Pressure Gauges and Gauge Attachments

C. American Water Works Association (AWWA)

1.	AWWA C207-23	Steel Pipe Flanges for Waterworks Service, Sizes 4 In. through 144 In.
2.	AWWA C504-23	Rubber-Seated Butterfly Valves
3.	AWWA C512-15	Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service

D. Manufacturers Standardization Society of the Valves and Fittings Industry (MSS)

1.	MSS SP-110-2010	Ball Valves Threaded, Socket–Welding, Solder Joint, Grooved, and Flared Ends

E. International Society of Automation (ISA)

1. ISA 62381-2011 — Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT

F. National Electrical Manufacturing Association Standards (NEMA)

1. NEMA 250-2020 — Enclosures for Electrical Equipment (1,000 Volts Maximum)

1.04 SUBMITTALS

A. Submit the following in accordance with the requirements of Sections 01 33 00 – Submittals.

B. RSN 35 22 14–1, Commercial Products Data:

1. Manufacturer's engineering data sheets demonstrating the applicable size, standards, bill of materials, and pressure rating for components in Part 2, Products, of this specification.

2. Flowmeter systems:

a. Dedicated microprocessor-based processing unit (console).

b. Submit detailed installation instructions and drawings showing installation details, detail dimensions, and locations of conduit connections. Include manufacturer's instructions for attaching flowmeter to the pipe and cabling to flowmeter display indicator/transmitter console.

c. Schematic and wiring diagrams including those showing connections to external equipment in accordance with Division 26 – Electrical.

C. RSN 35 22 14–2, Shop Testing Certifications and Reports:

1. Hydrostatic pressure testing certifications and pressures used in testing valves:

a. AWWA Class 150B butterfly valves tested in accordance AWWA C504.

D. RSN 35 22 14-3, Valve Tags:

1. Proposed valve identification information.

E. RSN 35 22 14–4, Service Manuals:

1. Complete parts identification lists including clearly identified recommended spare parts, lists of special tools and accessories, detailed instructions for installing, adjusting, operating, lubricating, and maintaining the equipment for components in Part 2, Products, of this specification.

a. Include schematic and wiring diagrams for flowmeter.

F. RSN 35 22 14-5, Test Reports:

1. Flowmeter simulated test reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 60 00 – Product Requirements.

B. Take precaution during loading, transportation, unloading, storage, and laying, to prevent damage to the valves and equipment:

1. Repair damage to the valves and equipment as directed if, in the opinion of Contract Office Representative (COR), a satisfactory repair can be made; otherwise replace damaged valves and equipment.

2. Ship, handle, and store according to manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Valves and equipment materials:

1. NSF/ANSI 372 compliant lead-free.

B. Valve Body Flange Faces and Flanges:

1. Flat faced.

2. Provide spiral or concentric serrated grooved flange face gasket surface finishes that are suitable for the gasket material provided and for the operating pressures.

3. Valve flange bolt patterns to match pipe flanges.

C. Valves to operate and seal with flow in either direction (bi-directional). Provide double seated valves or other modifications as needed for sealing in either direction.

D. Furnish valves and actuators of same type and size from same manufacturer.

E. Provide one extra set of seats for each size and type of butterfly valve.

2.02 VALVES

A. Ball Valves:

1. Less than 4-inches in diameter:

a. Carbon Steel or Bronze:

1) 70LF-100 series manufactured by Apollo Valves, www.apollovalves.com; or equal, having the following essential characteristics:

a) Body: Full ported carbon steel or lead-free bronze.

b) Ball: Stainless steel or lead-free brass.

c) Valve stem: Stainless steel or lead-free brass.

d) Packing gland: Steel or brass.

e) Install where shown on drawings. Bronze or carbon steel ball valves shall be installed on carbon steel pipe.

f) Bubble tight at the rated pressure in either direction and suitable for operation after long periods of inactivity.

g) MSS SP–110.

h) Female threaded ends.

i) NSF 372 compliant.

j) Cold water pressure rating of not less than 300 psig.

B. Combination Air Valves:

1. Manufactured by DeZurik/Apco, www.dezurik.com; Cla-Val, www.cla-val.com; Val-Matic Valve and Manufacturing Corporation, www.valmatic.com; or equal, having the following essential characteristics:

a. Single or dual body.

b. Clean water service.

c. Stainless steel internal parts such as guides, bushings, and screws.

d. Stainless steel floats.

e. Float-pivot supports: Brass, bronze, stainless steel, or cast iron.

f. AWWA C512.

g. Remains open for filling line until water has displaced air at point of attachment of valve assembly after which it closes.

h. Opens when pressure in pipeline drops sufficiently to create a vacuum.

i. Releases trapped air when the pipeline is under pressure.

j. Actuated by a float or floats.

k. Spare parts:

1) One (1) complete set of air valve spare parts for each size and type including:

a) Seats, lever, and gasket.

b) Additional parts recommended by manufacturer.

c) Box and clearly label box:

i. Include detailed list of spare parts inside box.

d) Store in location as directed by COR.

l. Furnish with ball valves in accordance with paragraph 2.01 A:

1) One ball valve on top, permits checking effectiveness of air valve.

2) One ball valve on bottom, allows valve to be drained.

3) For dual body valves, provide full port isolation ball valve between main body and air release valve.

m. Air valve vent pipe shall include a 24-mesh stainless steel screen to prevent the entrance of insects and debris.

n. Air Valve vent pipe: In accordance with Section 35 21 95 – Steel Manifold Piping.

o. 6-inch combination air valves.

1) Cold-water pressure rating: 150 psig.

2) Body material: Ductile iron or cast steel.

3) Air release orifice size: 3/8-inch minimum.

4) Operating pressure for seat materials: 0 to 150 psig.

5) Flanged inlet:

a) Flat faced.

b) Suitable for connection to AWWA or ASME B16.5 flanges as shown on the drawings.

C. Butterfly Valves:

1. Series AWWA Seated Butterfly Valve manufactured by Val-Matic Valve and Manufacturing Corp, www.valmatic.com; or equal, having the following essential characteristics:

a. AWWA C504.

b. Pressure classes: 150B as shown on drawings.

c. Body flanges suitable for connection to AWWA Class D, ASME B16.47, or ASME B16.5 Class 150 flanges.

d. Shaft material: Stainless steel.

e. Seats: Buna-N.

f. Seat mating surface and hardware: Stainless steel.

g. Provide valves which are bubbletight at rated pressure in either direction and suitable for operation after long periods of inactivity.

h. Install butterfly valves complete and lubricated in accordance with the manufacturer's instructions.

i. Axis of valve leaf: Horizontal when the valve is in the installed position, except where shown on the drawings.

j. Resilient seated:

1) Located either in the valve body mating with a stainless steel seating surface located on valve disc; or in valve disc mating with a stainless steel seating surface located in valve body:

a) No fully rubber lined bonded seat in body type seats are acceptable.

b) Resilient seats shall be mechanically retained and field replaceable.

2. Manual operators for butterfly valves:

a. Equip all manually operated butterfly valves with a worm-gear or a traveling nut type manual operator in accordance with AWWA C504.

b. Rim pull and component strength meets AWWA C504.

c. Provide gears of the self-locking type, designed to hold the valve in all positions without fluttering or creeping.

d. Provide handwheel unless otherwise shown on the drawings.

e. Provide operators that will open and close the valves under maximum unbalanced pressure conditions based on the pressure rating of the valve.

3. Buried butterfly valves:

a. Suitable for buried and submerged service.

b. Provide valve boxes.

c. Provide 2-inch square-nut operator.

d. Provide extension stems where required to raise the operating nut to within 6-inches of the ground surface where shown on the drawings:

1) To prevent disconnection below top of valve box, attach extension stems using roll pins or bolts with locking nuts that extend completely through stem extension connection.

e. Provide one tee-handle wrench with a length of 4-feet.

D. Flap Valves:

1. Model A2540 series as manufactured by Troy Valve, www.penntroy.com; or Model 50C Round as manufactured by Hydro Gate, www.hydrogate.com; or equal, having the following essential characteristics:

a. Cast or ductile iron body and cover.

b. Bronze seat and disc ring.

c. Stainless steel hinge pin and cotter pins.

d. Constructed with offset from vertical for positive closure.

1) 6-inch flap valve: minimum 8-degree offset

2) 42-inch flap valve: minimum 5-degree offset

e. Flange to match pipe flange shown on drawings.

2.03 EQUIPMENT

A. Frost Vent Cover

1. Model FrostSafe two-way damper manufactured by Val-Matic Valve and Manufacturing Corporation, www.valmatic.com; or equal, having the following essential characteristics:

   a. For 6-inch air vent.

   b. Suitable for connection to AWWA Class D flange.

   c. Allows 2-way flow.

   d. Minimizes thermal exchange of cold and warm air in and out of valve vault.

2. Allows air vent to vent at full capacity.

B. Probe magnetic flowmeter system:

1. Indicator/transmitter and flowmeter system to be by same manufacturer.

2. System parameters:

   a. Steel pipe size: 6-inch OD, Std. thickness.

   b. Flow rate range: 0-250 gallons per minute.

   c. Operating Pressures:

      1) Cold-water pressure rating: 75 psig.

3. Dedicated indicator/transmitter microprocessor-based processing unit shall be from same manufacturer as probe magnetic flowmeter.

   a. Capable of operating up to 100-feet between flowmeter sensor and remote indicator/transmitter

4. Probe Magnetic Flowmeter System – Model 282L SPI MAG, as manufactured by McCrometer, https://www.mccrometer.com/; or equal, having the following essential characteristics.

   a. Body sensor: 2-inch.

   b. Accuracy: Plus or minus 2 percent of flowrate. Accuracy based on the following assumptions:

      1) At least 5 straight pipe diameters upstream of the flowmeter.

      2) At least 10 straight pipe diameters downstream of the flowmeter.

   c. Sensor housing: Stainless steel, Type 316.

   d. Insertion tube:

      1) Material: Stainless steel.

2) Depth: Manufacturer recommendation.

3) Suitable for hot tap.

e. Ball valve:

1) Suitable for hot tap.

2) MSS SP-110.

3) Stainless steel, type 304 or 316.

4) Fully ported.

5) Lever operated.

f. Cable between flowmeter sensor and indicator/transmitter: Type specified by flowmeter manufacturer suitable for pulling through conduit. Remote cable length minimum of 25 feet.

g. Electrical service for device operation: powered by converter.

5. Indicator/Transmitter Console – Procomm Electromagnetic Flowmeter Converter, as manufactured by McCrometer, https://www.mccrometer.com/; or equal, having the following essential characteristics:

a. Input power: 115-volts, single phase, 60 hertz.

b. Galvanically isolate input power between analog, alarms, and earth/ground.

c. Display: Backlit alphanumeric, digital LCD readout. All menu commands are visible to display.

d. Input/Output Module:

1) Modbus or 4-20 mA Converter Output Module.

e. Remote wall mounted enclosure: NEMA 250, Type 4X.

f. Micro-processor based.

g. Display readout to simultaneously display flowrate and totalized flow.

h. Readout: User selectable flow in units of cubic feet per second and gallons per minute with at least 1 significant digit in tenths. Eight-digit (minimum) display of totalized volume in acre feet at least one significant digit in tenths.

i. Self-test routine that checks for proper operation.

2.04 APPURTENANCES

A. Valve Boxes:

1. Model 6855 series, manufactured by Tyler Union, www.tylerunion.com; or equal, having the following essential characteristics:

a. Cast iron locking lid with pentagon shaped bolt head.

b. Cast iron extension from valve nut operator to ground surface

c. Cast iron collar with lid marked "WATER".

d. 5 1/4-inch minimum inside diameter cast iron valve box.

e. 2-piece or 3-piece and slip type.

f. Base and adequate extension items to extend from valve nut operator to ground surface.

2. In accordance with Drawing 1695-D-62477.

B. Pressure Gauges:

1. Model 213.40 manufactured by Wika Instrument, LP, www.wika.us; Type 1279 manufactured by Ashcroft Inc., www.ashcroft.com; or equal, having the following essential characteristics:

a. Case material: Brass, aluminum alloy, stainless steel, or phenolic.

b. Dust-proof and moisture-proof case.

c. Glycerin liquid filled.

d. 3-inch to 4 1/2-inch.

e. Dial: White with black markings.

f. Black indicating pointer.

g. Red maximum reading pointer indicating highest pressure attained.

h. Shatter resistant window.

i. ASME B40.100, Grade A accuracy or better.

j. Bottom connects to air-valve.

k. Range displayed: 0 psi to 300 psi.

l. Provide dielectric insulating unions fittings to prevent galvanic corrosion between dissimilar metals.

C. Insulation Jacket: In accordance with Section 07 21 60 - Insulation Jacket.

2.05 CONTRACTOR SOURCE QUALITY TESTING

A. Shop test AWWA butterfly valves in accordance with AWWA C504.

1. Leak test valves in both directions and hydrostatically test valves at manufacturer's facility or an alternate facility approved by COR.

2. Tests will be Government witnessed. Notify COR 30-days prior to valve testing.

3. Minimize number of Government trips by testing all valves from same manufacturer during same Government trip.

4. Prior to shop leakage test and in presence of Government, Contractor shall verify that when valve is fully closed, valve position indicator indicates, "CLOSED".
5. If indicator is not in closed position (exactly at closed), remove operator from valve, fully close valve, reinstall operator so that it indicates, "CLOSED".
6. Shop leakage test:
   a. Spray or high velocity leakage will not be acceptable.
   b. If valve leaks, adjustments shall be made until valve is drip tight with no leakage. Adjustments may include adjusting valve stops, seats, actuators, or other components.
   c. If valve is not drip tight, valve is unacceptable.
   d. After any adjustments are made, valve position indicator shall be inspected again and corrected if necessary.
7. Manually operated AWWA butterfly valves:
   a. Leakage test in both directions in accordance with AWWA C504. Record results.
   b. Hydrostatic test in accordance with AWWA C504. Record pressures used.
   c. Pressure test valves and their seats for leaks with water in 100 percent closed position for a timed period of 5-minutes with pressure equal to rated design pressure. Valves shall be drip tight with no leakage.
   d. Downstream position of valve shall be visible to Government inspector.

B. Shop test AWWA Combination Air Valves in accordance with AWWA C512.

PART 3 EXECUTION

3.01 INSTALLATION

A. Dielectrically insulate between dissimilar metals:
   1. Provide insulating type unions at threaded valve, pipe or fitting connections between dissimilar metals.
   2. Provide insulating flange kits for flanges of dissimilar metals:
      a. See Section 35 21 95 – Steel Manifold Piping for insulating flange kits.

B. Provide a sufficient quantity of unions for removal, replacement and maintenance of valves and equipment.

C. Install the valves and equipment to line and grade as shown on drawings.

D. Install valves with flanged connections so that the bolt holes straddle the vertical centerline when in the installed position.

E. Install valves and gaskets in accordance with the manufacturer's instructions.

F. Valve Tags:

1. Provide brass or stainless steel tags for all valves identified on drawings (drawings 1695-D-62475 through 1695-D-62483, and 1695-D-62498 through 1695-D-62501).

   a. For all valves, include:

      1) Valve #.

      2) Flow direction arrow.

      3) Size and type of valve.

      4) See drawings for further details.

2. Stamp or engrave tag with the valve identification code designated in the Piping and Instrumentation Diagram drawings.

3. Permanently attach tag to valve with wire and metal crimp-type connector.

G. Flowmeter:

1. Install new flow measuring device in accordance with these specifications and the manufacturer's recommendations.

   a. Indicator/Transmitter Location:

      1) Transmitter display shall be visible from outside the enclosure.

2. Signal cable from each transducer/sensor to run in new conduit as follows:

   a. Provide rigid and flexible conduit as required.

3. Install the flowmeter remote consoles within the vault. Mount the flowmeter console to the vault wall at the location approved by the COR.

4. Furnish bolts, brackets, supports, and mounting hardware required to install equipment.

5. Make connections between flowmeter indicators/transmitters and flowmeter sensors:

   a. Cable splicing not allowed.

   b. Cable to run in grounded conduit (flexible and rigid) between flowmeter sensors and respective indicator/transmitter.

6. Make connections between flowmeter indicator/transmitter and incoming power.

7. Electrical:

   a. Install in accordance with Division 26 – Electrical.

   b. Install electrical wiring, shielded telemetry cable, conduit, power supplies, electrical boxes, terminal blocks, and necessary accessories required to complete installation.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Tests shall be witnessed by COR. Notify COR at least 5-days in advance of when tests are to be performed.

B. Field testing:

1. After each valve has been completely installed, test valve in steel manifold by opening and closing valve through full range of operation 3 times.
2. Make changes or adjustments until operation is approved by COR.
3. Valves have zero allowable leakage.

C. Flowmeter testing:

1. Furnish testing equipment and additional hardware necessary for complete testing.
2. Perform tests after installing flowmeter.
3. Flowmeter simulated test: Demonstrate equipment operates in accordance with this Section, including:
   a. Check displays for correct readouts and check each I/O (input/output) point for correct I/O signal.
   b. Test each output connection for correct output conformance.
   c. Verify all instrumentation and indication devices function properly. Test all functions of flowmeter transmitter for correct operation.
   d. Make corrections and adjustments to provide complete installation satisfactory to COR.
   e. Flowmeter Site Acceptance Test (SAT): ISA 62381
      a) See Section 25 08 10 - Automation System Testing and Acceptance, for full requirements.
4. Demonstrate that flowmeter sensor can be installed and retracted from the pipe without draining or depressurizing the system.

3.03 COATINGS

A. Coat valves and equipment in accordance with Section 09 96 20 – Coatings.

END OF SECTION

SECTION 35 42 35
WASH CROSSING BANK PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Wash Crossings:

1. Payment: Lump sum prices offered in Price Schedules for appropriate Wash Crossing Station.

   a. Includes:

      1) Compacting backfill to 85 percent, or match in situ density, whichever is the higher density.

      2) Vertical steel member (erosion indicator post).

      3) Toe rock (riprap) and geotextile fabric, if required.

      4) Costs associated with stormwater discharge permit in accordance with Section 01 57 30 – Water Pollution Control.

   b. Does not include:

      1) Line Pipe, joint restraints, or anchor blocks.

      2) Erosion control blankets and coir wattles.

1.02 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1.	AASHTO M288-15	Geotextile Specification for Highway Applications
2.	AASHTO T104-99	Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
3.	AASHTO T310-13	In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
4.	AASHTO T85-14	Specific Gravity and Absorption of Coarse Aggregate
5.	AASHTO T99	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. American Society for Testing and Materials (ASTM)

1.	ASTM C535-16	Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
2.	ASTM D698-12e2	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 KN-m/m^3)
3.	ASTM D5080-17	Standard Test Method for Rapid Determination of Percent Compaction

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 35 42 35-1, Certifications:

1. Certified test reports made by an independent testing laboratory indicating that all products meet or exceed requirements.

C. RSN 35 42 35-2, Field Verification of Wash Crossing Elevations:

1. As listed under this "Project Conditions" of this Section, submit written verification of existing ground surface elevation and depth of cover at wash crossings prepared by a licensed surveyor.

1.04 PROJECT CONDITIONS

A. Drawings included in these specifications show existing wash crossing locations, however, topography shown may not represent current ground surfaces.

1. Survey ground surface and verify depth of cover over line pipe before submitting pipe laying diagrams.

PART 2 PRODUCTS

2.01 RIPRAP

A. In accordance with Section 31 37 00 – Riprap.

2.02 GEOTEXTILE

A. Geotextile material in accordance with Section 32 15 10 – Gravel Surfacing.

B. Place geotextile as shown on drawings.

2.03 EROSION CONTROL BLANKET

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

2.04 EROSION CONTROL BLANKET ANCHORS

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

2.05 COIR WATTLES

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

2.06 VERTICAL STEEL MEMBERS

A. Use angle iron, steel pipe, or steel railroad rails.

B. Use steel angles at least 4- by 4- by 0.25-inch.

C. Use standard weight steel pipe with minimum outside diameter of 4-inches and minimum of 3/16-inch thick.

D. Use railroad rails with unit weight at least 30 pounds per yard:

1. Color: Neon orange.
2. Attach non-destructible label with the following:

NGWSP PIPELINE INDICATOR POST
If exposed, please contact Navajo Tribal Utility Authority with location

PART 3 EXECUTION

3.01 RIPRAP INSTALLATION

A. Site Preparation:

1. Compact channel bed and bank line excavated for pipe trench backfill:
   a. Compact to 85 percent of maximum density obtained in accordance with Section 31 23 02 – Compacting Earth Materials.
2. Remove large, sharp objects including but not limited to rocks, cut trees, roots, shrubs, and glass that may damage geotextile fabric.
3. Grade wash bank slope as shown on drawings.

B. Geotextile Placement:

1. Place geotextile between riprap and supporting soil.
2. Place fabric as smoothly as possible on prepared surface.
3. Fabric may be folded or cut to conform to surface.

4. Folds and Overlaps:
   a. Fold or overlap in direction of construction.
   b. Overlap fabric a minimum of 30-inches.
5. Hold fabric in place with pins or staples.

C. Riprap Placement:
1. In accordance with Section 31 37 00 – Riprap.
2. Place riprap stones to form continuous blanket of minimum thickness indicated on drawings.

D. Backfill and Compaction:
1. In accordance with Section 31 23 02 – Compacting Earth Materials.

3.02 EROSION CONTROL BLANKET INSTALLATION

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

3.03 COIR WATTLE INSTALLATION

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

3.04 VERTICAL STEEL MEMBER INSTALLATION

A. Drive or place vertical steel members in bed of wash crossings as shown on drawings to serve as advanced warning of channel bed lowering.

B. Top of vertical steel member shall be located 3-feet above top of pipe elevation.

3.05 SURFACE FLOW DIVERSION BERM INSTALLATION

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

3.06 REPAIR

A. Repair or replace products damaged during installation at Contractor's expense.

END OF SECTION

SECTION 51 00 00
INFORMATION AVAILABLE TO OFFERORS

PART 1 GENERAL

1.01 ORDER OF PRECEDENCE

A. In case of differences between sections in Division 51 – Information Available to Offerors and sections in other divisions of the specifications, the requirements in the other divisions will govern.

B. Government assumes no responsibility for deductions, interpretations, or conclusions made by Contractor based on information made available by the Government, in accordance with the clause at FAR 52.236-3, Site Investigations and Conditions Affecting the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 51 00 35

SITE SPECIFIC REVEGETATION PLAN

PART 1 GENERAL

1.01 PROJECT CONDITIONS

A. Where there are differences as determined by CO between details shown on diagrams and details of existing features at jobsite, use details of existing features at jobsite.

1.02 SITE SPECIFIC REVEGETATION PLAN FOR NAVAJO - GALLUP WATER SUPPLY PROJECT

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BUREAU OF RECLAMATION

Site-Specific Revegetation Plan for Reaches 1, 2, 3, 4A & 4B and Pumping Plants 1, 2 & 3 and the San Juan Lateral Water Treatment Plant of the Navajo-Gallup Water Supply Project

Navajo-Gallup Water Supply Project, New Mexico
Interior Region 7, Upper Colorado Basin

prepared by

Eric Creeden, General Biologist, Western Colorado Area Office

Cover Photo: Example landscape on Reach 4A (Ecosystem Management, Inc.)

U.S. Department of the Interior **January 2022**

Mission Statements

The Department of the Interior conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

The mission of the Bureau of Indian Affairs is to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives.

The mission of the Navajo Nation Division of Natural Resources is to manage, protect, conserve and preserve the Navajo Nation's natural and cultural resources for the benefit of the Navajo people.

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1. Introduction

This site-specific revegetation plan for Reaches 1, 2, 3, 4A & 4B and Pumping Plants 1, 2 & 3 and the San Juan Lateral Water Treatment Plant of the Navajo-Gallup Water Supply Project (NGWSP) has been prepared by the Bureau of Reclamation (Reclamation). This revegetation plan will be used in conjunction with input from cooperating agencies and the project's contractor(s) to develop strategies for the successful revegetation and reclamation of the project.

2. Goals

The short-term goal of project reclamation is to achieve the short-term stability, visual, hydrological, and productivity objectives of the surface management agency. The long-term goal of project reclamation is to restore the character and productivity of the land and set the course for eventual ecosystem restoration, including the restoration of a natural and diverse vegetation community, hydrologic stability, and functional habitat.

The goal of revegetation is to meet 70% of the pre-construction vegetative cover or better with 3 years of reseeding. If pre-disturbance vegetative cover is below 25%, the goal of revegetation is to meet pre-disturbance levels.

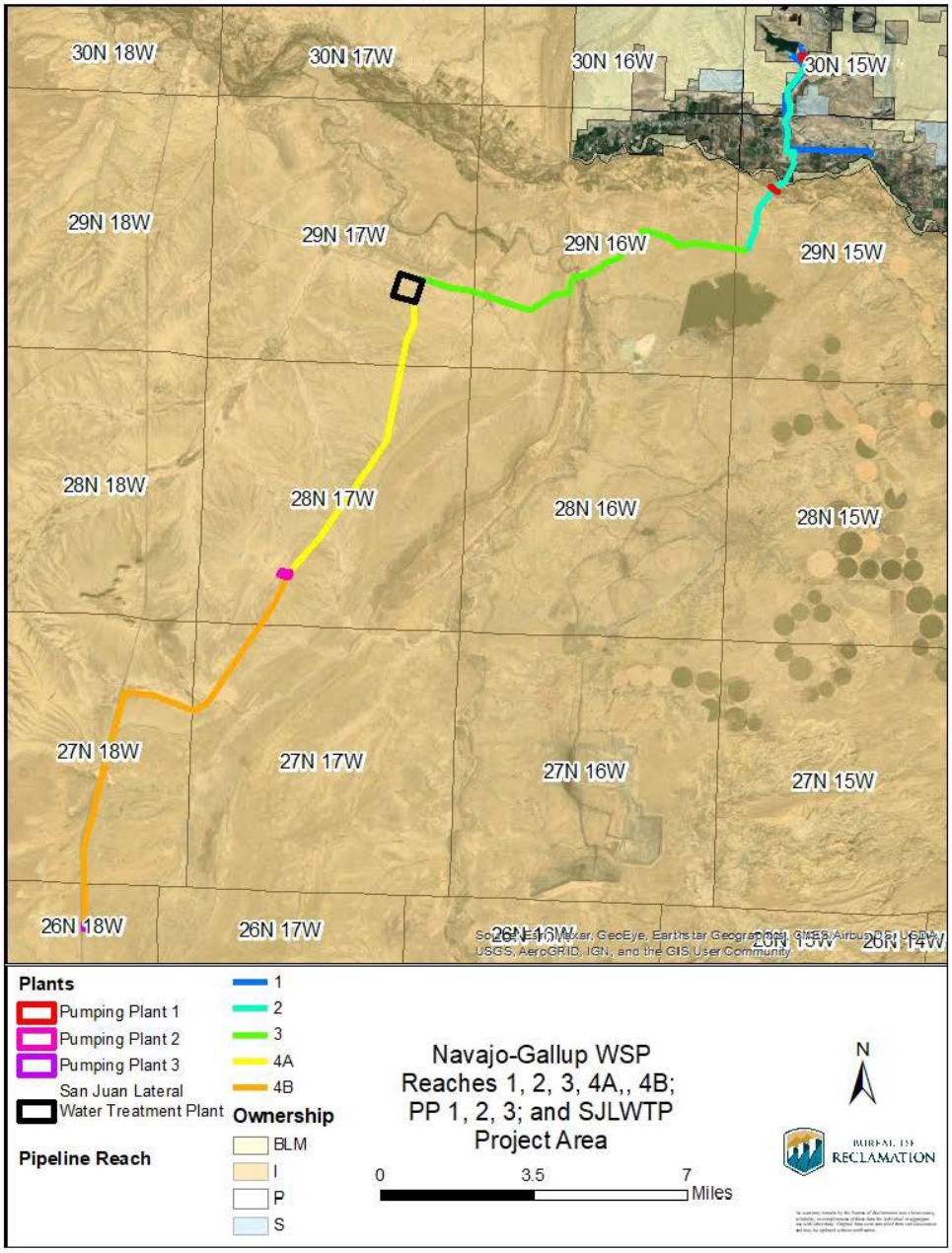
3. Project Description

Reaches 1, 2, 3, 4A & 4B of the NGWSP are located in the southwest corner of San Juan County, New Mexico generally from the community of Sanostee and roughly parallel to Highway 491 northward towards Kirtland, New Mexico and the San Juan Generating Station. Pumping plant 1 is located at the junction of Reaches 1 and 2, Pumping Plant 2 is located at the junction of Reaches 4A and 4B, and Pumping Plant 3 is located at the southern terminus of Reach 4B. The San Juan Lateral Water Treatment Plant is located at the junction of Reaches 3 and 4A. Table 1, below, describes the size of these project areas.

Table 1. Project Area Breakdown

Project Area	Acres	Notes
Reach 1 Pipeline Right-of-Way (ROW)	2.8	Approximately 0.2 mile of pipeline in 100- to 150-foot-wide ROW. Construction anticipated 2024-2026.
Reach 2 Pipeline ROW	89.2	Approximately 5.1 miles of pipeline in 100- to 150-foot-wide ROW. Construction anticipated 2024-2026.
Reach 3 Pipeline ROW	163.3	Approximately 8.6 miles of pipeline in 100- to 150-foot-wide ROW. Construction anticipated 2024-2026.
Reach 4A Pipeline ROW	127.3	Approximately 7.0 miles of pipeline in 100- to 150-foot-wide ROW. Construction anticipated 2022-2024.
Reach 4B Pipeline ROW	195.0	Approximately 10.9 miles of pipeline in 100- to 150-foot-wide ROW. Construction anticipated 2022-2024.
Reach 4B Staging Areas	18.8	Two staging areas Construction anticipated 2022-2024.
Pumping Plant 1	4.0	Construction anticipated 2025-2027
Pumping Plant 2	4.0	Construction anticipated 2022-2025
Pumping Plant 3	4.6	Construction anticipated 2022-2025
San Juan Lateral Water Treatment Plant	Up to 50	Construction anticipated 2025-2028

Map 1, below, shows the general location of the project area.



Map 1. Overview Map of Project Area

3

3.1 Reaches 1, 2, 3, 4A & 4B Pipeline ROW

Reaches 1, 2, 3, 4A & 4B consist of approximately 31.8 miles of water pipeline ROW generally between 100 and 150 feet in width. Various areas of the ROW have been constricted for avoidance of cultural resources, and multiple areas of horizontal direction drilling and jack and boring are proposed avoid disturbances to rivers, washes, roadways, pipelines and other infrastructure, and cultural areas. The entirety of the project south of the San Juan River is on Navajo Nation Tribal Trust lands. The San Juan River valley is comprised of multiple private landowners as well as NMDOT and San Juan County road ROWs. North of the San Juan River valley includes private landowners, Bureau of Land Management lands, and lands managed by the New Mexico State Lands Office.

Project construction of pipelines is scheduled for 2022 through 2026. Approximately 578 acres of pipeline ROW will be cleared and grubbed of vegetation for construction. The pipeline will be constructed and the ROW will be recontoured with topsoil respread and prepared for revegetation.

3.2 Pumping Plants 1, 2 and 3

Pumping Plant 1 is located at the junction of Reaches 1 and 2, Pumping Plant 2 is located at the junction of Reaches 4A & 4B, and Pumping Plant 3 is located at the southern terminus of Reach 4B. Construction of Pumping Plant 1 is planned for 2025-2027, and Pumping Plants 2 & 3 are planned for construction from 2022 through 2025. Approximately 12.6 acres will be cleared during initial construction of the pumping plants with approximately 3-4 acres reclaimed after construction.

3.3 Reach 4B Staging Areas

Two staging areas approximating 18.8 acres would be used during construction of Reaches 4A and 4B. One staging area is located directly west of Pumping Plant 2 and the other staging area is located to the south and where the pipeline alignment takes a 90-degree bend to the east and leaves the U.S. Highway 491 corridor.

3.4 San Juan Lateral Water Treatment Plant

A 180-acre site just south of Navajo Route N36 was identified for the location of the water treatment plant, and construction of the plant is anticipated to disturb no more than 100 acres of the site. Phase 1 project work would occur in an approximately 1,800-foot-long by 1,000-foot-wide area (41.3 acres). The footprint of Phase 2 at full buildout is anticipated to be slightly larger than at Phase 1 (1,975-foot-long by 1,150 area [52.1 acres]). Depending on the treatment process, facilities would include 5 to 6 buildings, 2 to 6 lined and unlined ponds, septic system, and 3 to 6 tanks/vaults. The plant would be constructed in two phases; Phase 1 would operate at approximately 22 MGD capacity and Phase 2 would operate at full capacity of 37.6 MGD.

4. Site Conditions

Site conditions are summarized from the project's biological surveys and Biological Evaluation, and pre-construction vegetation surveys by Reclamation. The southern portion of the project is located within the Navajo Nation and is adjacent to widely scattered residential areas that include homes, residential yards, paved roads, two-track roads, power lines, and commercial facilities. Terrain drops into the San Juan River valley then steadily increase northward towards the San Juan Generating Station. Terrain includes gently undulating topography interspersed with steep badland and rock features and bluffs with elevations ranging from approximately 5,500 feet above mean sea level (AMSL) at the southern end of the project down to approximately 5,100 feet AMSL at the San Juan River and back to 5,300 feet AMSL near the San Juan Generating Station. Numerous surface geology formations are mapped in the project area and include badland formations, river wash, loams.

Pre-construction activities have included project surveying and staking as well as geotechnical testing by Reclamation. Construction of the pipeline is planned for 2022-2027 and will include clearing and grubbing of vegetation; topsoil removal and storage; pipeline construction and installing; grading, compaction, and restoration of the surface to original contours; topsoil replacement, and erosion control and stormwater management, and reseeding and reclamation.

4.1 Vegetation Communities

Reach 1, the northern half of Reach 2, central portion of Reach 3 near the Hogback, and the southern half of Reach 4B are characterized as a desert scrub grassland. Sparsely vegetated barren lands occur on Reaches 3, 4A, and 4B generally surrounding the Hogback. Areas of Reach 3 north of Route N36 and the southern portion of Reach 2 are vegetated by grasslands. Some agricultural and fallowed areas are in the San Juan River valley and riparian corridors exist along the Chaco and San Juan Rivers, Shumway Arroyo, along ditches, and under the San Juan Generating Station Dam.

4.1.1 Desert Scrub Grasslands

Vegetation percent cover in desert scrub grasslands of the project area averaged 33% (11% invasive species). Dominant vegetation included fourwing saltbush (*Atriplex canescens*), sand dropseed (*Sporobolus cryptandrus*), broom snakeweed (*Gutierrezia sarothrae*), Indian ricegrass (*Oryzopsis hymenoides*), Russian thistle (*Salsola* sp.), and halogeton (*Halogeton glomeratus*); while subdominant vegetation included greasewood (*Sarcobatus vermiculatus*), alkali sacaton (*Sporobolus airoides*), mat saltbush (*Atriplex corrugata*), winterfat (*Krascheninnikovia lanata),* scarlet globemallow (*Sphaeralcea coccinea*), beeplant (*Cleome* spp.), rubber rabbitbrush (*Ericameria nauseosa*), and James' galleta (*Pleuraphis jamesii*) among others.

4.1.2 Grasslands

Vegetation percent cover in grasslands of the project area averaged 42% (8% invasive species). Dominant vegetation includes James' galleta, Indian ricegrass, and sand dropseed; while subdominant vegetation included broom snakeweed, Russian thistle, halogeton, and rubber rabbitbrush among others.

4.1.3 Desert Flats

Vegetation percent cover in the barren desert flats of the project area averaged 16% (3% invasive species). Dominant vegetation includes alkali sacaton, halogeton, sixweeks grama, annual wheatgrass, and Russian thistle; while subdominant vegetation includes fourwing saltbush, winterfat, and unidentified forbs among others.

4.1.4 Riparian

The only riparian area that is planned to be disturbed is located on Reach 1 south of the San Juan Generating Station Dam. Vegetation is dominated by tamarisk and grasses with areas of rushes and sedges in zones of shallow groundwater or surface water.

4.2 Noxious Weeds

Russian thistle and halogeton are pervasive throughout the project area. Cocklebur (*Xanthium* sp.), cheatgrass (*Bromus tectorum*), and saltcedar (*Tamarix* sp.) are also found within and adjacent to the project area, with the latter primarily near water sources and washes. Halogeton is listed as a Class B species, and cheatgrass and saltcedar are listed at Class C species in New Mexico. These species are also listed noxious weeds on the Navajo Nation.

4.3 Pre-Disturbance Photographs

Pre-disturbance photographs of the project area are provided below from the project's pre-construction vegetation surveys by Reclamation.

Photo 1. Southern boundary of BLM of Reach 2 facing south; desert scrub grassland. (Eric Creeden/Reclamation)

Photo 2. Reach 3 grassland. (Eric Creeden/Reclamation)

Photo 3. Barren desert flat area in Reach 3 facing southwest towards the Hogback. (Eric Creeden/Reclamation)

Photo 4. Barren desert flat area near the San Juan Lateral Water Treatment Plant facing south. (Eric Creeden/Reclamation)

Photo 5. Desert flat area of Reach 4A. (Eric Creeden/Reclamation)

Photo 6. Desert scrub grassland of Reach 4B with Russian thistle in foreground. (Eric Creeden/Reclamation)

5. Revegetation Workflow

The details and methods for reclamation and revegetation as described further in this chapter are generally derived from the BLM Farmington Field Office's (FFO) 2013 Bare Soil Reclamation Procedures, regional reclamation and revegetation guides for arid zones, and consultation and coordination with the Navajo Nation and Bureau of Indian Affairs (BIA) Navajo Region.

5.1 Site Evaluation (Contractor)

The revegetation contractor shall evaluate the site conditions in the field and determine the applicability of actions described in this site-specific revegetation plan. The contractor shall evaluate these methods and submit any changes or recommendations to Reclamation that are thought to increase the successful implementation for the project prior to conducting work.

5.2 Soil Testing and Amendment

Soil conditions in the project area may preclude the successful attainment of vegetation standards for the vegetation communities in the project area. Reclamation conducted soil testing within the Block 4C-8 and Block 9-11 project areas in both native and NGWSP disturbed areas. Disturbed areas were found to have lower percentages of organic matter but otherwise were similar to native soils. Additional soil testing may be done in the project area of this site-specific revegetation plan; however, soil conditions are believed to be like those previously tested and no additional testing is planned at this time. Any future testing and analysis, if needed, shall document the physical and chemical properties of the soil as well as details on the macronutrients and micronutrients in the soil.

Based on analysis of the soil testing results (if conducted), organic and inorganic soil amendments may be requested to be added to the topsoil to improve its physical and chemical characteristics. The revegetation contractor shall consider the use of organic and permaculture soil management practices which involve minimizing or eliminating the use of synthetic fertilizers and pesticides, and nurture rich, long-term balanced soil fertility and nutrient cycling. Example organic soil amendments include humate, manure, and compost. Fertilizers, especially those containing Nitrogen, are not recommended based on the potential for promoting annual noxious weeds over native reseeded species. Degraded soil conditions may not preclude attempts to revegetate the site, but soil condition documentation may be used as a basis for future exception consideration for revegetation.

In areas where soil amendments are used, soil testing shall be repeated three years following project revegetation efforts to determine the success or lack of success of the soil amendments in improving soil health in the project areas.

5.3 Site Preparation

Site preparation will include ripping compacted soils to a sufficient depth (minimum 18 inches) with a maximum furrow spacing of 2 feet. If large clumps of soil clods are present, the site will be disked to break up the soil. Disking will be performed on the contour running perpendicular to slopes to minimize erosion.

Topsoil will be respread evenly across the disturbed area by the construction contractor to the approximate depth of topsoil that was initially cleared with a minimum depth of 6 inches. Replaced

topsoil will be free of trash, weeds, tree root balls and trunks. Final seedbed preparation shall include raking or harrowing the topsoil to promote a firm seedbed.

5.4 Erosion Control and Stormwater Management

Erosion control and stormwater management measures (primarily erosion control matting, wattles, and riprap) will be placed by the construction contractor along restored water features in the project area following guidance from the project's design specifications.

Erosion control matting shall be non-palatable for livestock (e.g. coconut based) and shall be installed in accordance with the manufacturer's recommended installation procedures. Erosion control measures shall be firmly secured to the ground. Newly installed erosion control features shall be long-lasting and robust to impacts from wind and water erosion.

5.5 Reseeding

Reseeding would be performed as soon as possible following construction and testing and immediately after topsoil has been replaced and the site prepared. The general time frame for reseeding would be July 15 to November 15 and would coincide with conditions when ambient temperatures are above 38 F, when the ground is not snow covered or frozen, and when there is a greater potential for moisture. Reseeding in the spring may also show success depending on moisture levels prior to the arrival of the summer monsoon.

A disk-type seed drill would primarily be used for reseeding with drill rows spaced one foot or less apart. Seed drilling would be performed on the contour running perpendicular to slopes to minimize runoff, rilling, and erosion. In areas where the slope is too steep to drill seed; hand broadcasting, mechanical broadcasting, hydroseeding, or other seeding methods may be utilized. Broadcast reseeding rates would be double that of drill seeding rates. Smaller seeds would be planted at a depth 0.25 to 0.5 inches whereas larger seeds would be planted at a depth of 1 to 2 inches. Improper planting depth can be especially problematic for successful reseeding and planting too shallow is generally better than planting too deep. Broadcast seeds would be covered in the appropriate depth of topsoil immediately after broadcasting using a hand rake or float.

Target revegetation percent cover goals are listed in Table 3, below, per guidance in the overall NGWSP Revegetation Plan. The general revegetation goal for project reaches is 70% of pre-disturbance levels. If pre-disturbance vegetation cover was below 25%, however, the goal of revegetation is to meet pre-disturbance levels.

Table 3. Target Revegetation Percent Cover Goals

Project Area	Native Vegetation % Cover	Invasive Vegetation % Cover	Total Vegetation % Cover	Target Revegetation % Cover
Desert Scrub Grasslands	22	11	33	23
Grasslands	34	8	42	29
Desert Flats	13	3	16	16

5.5.1 Seed Mixes

Disturbed areas will be reseeded with weed-free seed mixes that are described below. Deviations from the below seed mixes (due to outside forces such as seed availability) will be consulted upon with Reclamation. The seed mix in Table 4 will be used for the general project area. This seed mix has been derived based on vegetation surveys of the project area, information and seed pick lists from the BLM FFO's 2013 Bare Soil Reclamation Procedures (Appendix A & B), and Navajo Nation/BIA Navajo Region's 2018 NGWSP Recommended Seed Species for Bare Soils/Invasive Weed Infested Sites (Appendix C). The seed mix in Table 5 will be used in potential and occupied Mesa Verde cactus habitat. Revegetating private lands would include any additional landowner specific requests.

Prior to seeding, the revegetation contractor shall provide to Reclamation certification of the origin of seed, seed percent purity and germination, as well as information on prohibited and restricted weed seed content. Prohibited weed seeds in New Mexico are not allowed and the seed mix shall be 100% certified weed free. Seed purity shall meet a minimum of 85% and germination shall also meet a minimum of 85% with germination test of less than one year old at the time of seeding. Seed containers shall be sealed and labeled with seed origin and other seed specifications. Intrastate shipping of seeds shall be in accordance with New Mexico state seed laws and regulations; Interstate shipping of seeds shall be in accordance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act.

Table 4. Upland Seed Mix for Project Area

Common Name	Scientific Name	Variety	Season	Form	Pure Live Seed (PLS) lbs/acre*
Sterile triticale	*Triticum aestivum X Secale cereale 'Quickguard'*	VNS	-		2.0
Fourwing saltbush	*Atriplex confertifolia*	VNS	Cool	Shrub	3.0
Shadscale	*Krascheninnikovia lanata*	VNS	Cool	Subshrub	2.0
Indian ricegrass	*Achnatherum hymenoides*	Paloma or Rimrock	Cool	Bunch	3.0
Western wheatgrass	*Pascopyrum smithii*	Arriba	Cool	Sod	2.0
Galleta	*Pleuraphis jamesii*	Viva florets	Warm	Bunch/Sod	2.0
Purple threeawn	*Aristida purpurea*	VNS	Warm	Bunch	2.0
Sand dropseed	*Sporobolus cryptandrus*	VNS	Warm	Bunch	0.25
Alkali sacaton	*Sporobolus airoides*	VNS	Warm	Bunch	0.25
Scarlet globemallow	*Sphaeralcea coccinea*	VNS	Warm	Forb	0.25

Common Name	Scientific Name	Variety	Season	Form	Pure Live Seed (PLS) lbs/acre*
Narrowleaf penstemon	*Penstemon angustifolius*	VNS	Cool	Forb	0.25
Rocky mountain beeplant	*Cleome serrulate*	VNS	Warm	Forb	0.25
Hairy false goldenaster	*Heterotheca villosa*	VNS	Warm	Forb	0.25
***Based on 60 pure live seeds (PLS) per square foot, drill seeded. Double this rate (120 PLS per square foot) if broadcast or hydroseeded.**					

Table 5. Seed Mix for Potential and Occupied Mesa Verde Cactus Habitat in Project Area

Common Name	Scientific Name	Variety	Season	Form	Pure Live Seed (PLS) lbs/acre*
Mat saltbush	*Atriplex corrugata*	VNS	-	Shrub	2.0
Winterfat	*Krascheninnikovia lanata*	VNS	Cool	Subshrub	2.0
Indian ricegrass	*Achnatherum hymenoides*	Paloma or Rimrock	Cool	Bunch	3.0
Galleta	*Pleuraphis jamesii*	Viva florets	Warm	Bunch/Sod	2.0
Purple threeawn	*Aristida purpurea*	VNS	Warm	Bunch	2.0
Sand dropseed	*Sporobolus cryptandrus*	VNS	Warm	Bunch	0.25
Scarlet globemallow	*Sphaeralcea coccinea*	VNS	Warm	Forb	0.25
Narrowleaf penstemon	*Penstemon angustifolius*	VNS	Cool	Forb	0.25
Rocky mountain beeplant	*Cleome serrulate*	VNS	Warm	Forb	0.25
Sand verbena	*Abronia villosa*	VNS	Warm	Forb	0.5
***Based on 60 pure live seeds (PLS) per square foot, drill seeded. Double this rate (120 PLS per square foot) if broadcast or hydroseeded.**					

5.5.2 Mulching

Mulching generally protects against erosion and can increase the chance of successful revegetation. Mulch shall be certified weed-free straw or native grass hay and shall be mechanically crimped into the soil within 24 hours of seeding at a rate of approximately 2 tons/acre. If hydroseeding is used, a mulch component shall be incorporated into the slurry mix.

5.6 Fencing

The NGWSP Revegetation Plan interprets the use of fencing as something that may be necessary to achieve ground cover criteria if acceptable ground cover conditions are not achieved within three years. No construction of fencing for enhanced revegetation success is anticipated for the project at this time. Other fences may exist within the project ROW, particularly near Navajo residences and land boundaries. No fences shall be cut during the revegetation process without the consent of adjacent landowners and by Reclamation.

5.7 Noxious and Invasive Weed Monitoring and Management

Halogeton and Russian thistle are both found in the project area and their presence is anticipated to increase due to the project's ground disturbance in the project area. Any noxious and invasive weeds found in the wetland areas of below the San Juan Generating Station Dam will be removed prior to construction. If herbicide use is anticipated to help with the successful establishment of revegetation, the revegetation contractor or Reclamation shall create an herbicide use plan with applicator certifications. Applicators shall be certified by the appropriate State, Tribal, or local agencies and application shall comply with label directions and applicable laws and regulations.

6. Monitoring and Reporting

Site monitoring and reporting of the disturbed project area will be completed by Reclamation and project contractors after construction and revegetation is complete and will continue until the revegetation percent goals and standards are attained and approved by Reclamation and the appropriate land manager. Monitoring will not be allowed when the ground surface is covered with snow or impacted by heavy precipitation. A monitoring plan will be developed to measure the success of reclamation efforts. Monitoring results will be reported and analyzed annually to see if changes are needed to meet the reclamation goals of the project.

Mitigation, monitoring, and reporting for the San Juan Generating Station Dam area will follow the wash specific plans developed in coordination with the USACE. Monitoring will include wash cross sections, vegetation transects, and photo points, and results will be analyzed to see if changes are needed to meet the reclamation goals of the project.

6.1 Noxious and Invasive Weeds

Reclamation and/or a contractor shall conduct annual noxious weed surveys in the summer. Surveys will be completed for three years following project revegetation efforts. Noxious weed results shall be reported to Reclamation with recommendations for treatment included in the report.

6.2 Revegetation

Reclamation and/or a project contractor will monitor the progress of revegetation in the project areas through both quantitative (vegetation transects) and qualitative (photo points) means.

6.2.1 Vegetation Transects

The line-point intercept method will be used to estimate vegetative percent cover for revegetated areas. Transect locations will be determined randomly within the project area and will be recorded using a GPS unit and associated geospatial information system (GIS). If needed, transects may be placed near project access points to facilitate project monitoring and reduce driving in the project area. Transects will be 100 meters in length with a recording taken every meter. All rooted vegetation (alive, dormant, dead) will be recorded by species, with areas of bare ground marked and unrooted loose vegetation or woody debris marked as litter. Species will be marked as either desirable or undesirable. Generally, three transects will be located per mile of project pipeline unless determined otherwise by project participants. The project area will be stratified by vegetation community and percent cover estimates averaged across the project area by vegetation community. Transects shall be directed along a diagonal across the drill seeding rows to not follow a seeding row. Additional details may be found within the overall NGWSP revegetation plan as well as the BLM FFO's 2013 Bare Soil Reclamation Procedures.

6.2.2 Photo Points

Photos points shall be established at all vegetation transects as well as any pertinent landscape monitoring locations. For vegetation transects, one photo shall be taken of the length of the transect and an additional photo shall be taken downwards of an approximate 1 square meter area at the start of the transect.

7. Adaptive Management

When monitoring reports indicate revegetation has not been successful, or Reclamation and/or the land manager identify negative impacts within the revegetation area, Reclamation will consult with the project participants to analyze issues that may have contributed to the failure, or lack of meaningful progress. All parties affected by the federal undertaking may be invited to participate in the discussion (e.g., grazing/farm/residential permit holder, grantee, land manager, surface staff, range staff, realty staff, recreation staff, or other authorized users that may be operating in the vicinity). The participants will discuss the potential causes that may have contributed to the nonattainment of the standards. The discussions may result in the development of a remedy plan (adaptive management methods) to address the lack of revegetation success, or to repair and reseed damage to reclaimed areas. In cases where Reclamation can demonstrate that the site does not have the biological potential to attain the standards, the discussions may result in the initiation of the NGWSP exception process described in the overall Revegetation Plan.

8. Appendices

8.1 Appendix A. BLM FFO 2013 Bare Soil Reclamation Procedures: Recommendations for Effective Reclamation

Recommendations: Provided below are some procedures and methods that may to help achieve more effective reclamation success.

Soil Testing: Development of a soil testing plan for evaluation of the results of topsoil handling and reclamation procedures related to revegetation may prove beneficial. Suggested soil testing may include some or all of the following: pH, electrical conductivity (EC), texture, topsoil depth and overall soil depth, carbonates (reactivity), organic matter (OM), Sodium Absorption Ratio (SAR).

Topsoil Stripping, Storage, and Replacement: At a minimum, the upper six (6) inches of topsoil should be stripped, following the removal of vegetation during construction of well pads, pipelines, roads, or other surface facilities. The stripped topsoil should be stored separately from subsoil or other excavated material and replaced prior to final seedbed preparation. Topsoil should not be used for blow pits or flaring areas.

Seedbed Preparation: For cut-and-fill slopes, initial seedbed preparation should consist of backfilling and recontouring to achieve the configuration specified in the reclamation plan. Seedbed preparation for compacted areas should be ripped to a minimum depth of eighteen (18) inches, with a maximum furrow spacing of two (2) feet. Where practicable, ripping should be conducted in two passes at perpendicular directions. Avoid leaving large clumps or clods. If this exists, disking should be conducted. Disking and seed drills should run perpendicular to slopes to provide terracing and prevent rapid runoff and erosion.

Seedbed preparation is one of the most important steps for reclamation success. Following final contouring, the backfilled or ripped surfaces should be covered evenly with topsoil. Final seedbed preparation should consist of raking or harrowing the spread topsoil prior to seeding to promote a firm seedbed. **A loose seedbed makes it impossible to control the depth of seeding because the tires and the planter sink into the soil.** Seedbed preparation may not be necessary for topsoil storage piles or other areas of temporary seeding.

Planting Depth: **Improper planting depth, particularly the planting of some species too deeply, in "fluffy" soils, is one of the major impediments to reseeding success.** The Truax seed drill or modified rangeland drills that allows for seeding species from different seed boxes at different planting depths has been used by other BLM offices to address this issue. Efforts should be taken to ensure that perennial grasses and shrubs are planted at the appropriate depth. Intermediate size seeds such as wheatgrasses and shrubs should be planted at a depth of 0.5 inches, larger seeds such as Indian ricegrass at 1 to 2 inches, and small seeds such as alkali sacaton, and sand dropseed should be planted at a depth of 0.25 inches. In situations where differing planting depths are not practicable with the equipment being used, the entire mix should be planted no deeper than 0.25 inch. Planting too shallow is generally better than planting too deep. **A review of current research methods is recommended (e.g., USDA**

PLANTS, USDA Plant Materials Centers, Native Seed Companies).

Soil Amendments: Amending a soil is not the same thing as mulching, although many types of mulch also are used as amendments. A "soil amendment" is any material added to a soil to improve its physical properties, such as water retention, permeability, water infiltration, drainage, aeration, nutrition and structure. Organic amendments include sphagnum peat, humate, wood chips, grass clippings, straw, compost, manure, biosolids, sawdust and wood ash. Inorganic amendments include vermiculite, perlite, lime, gypsum, tire chunks, pea gravel and sand.

Mulching: Mulch may increase the success of seed germination and provide protection against erosion. Mulch should be applied within 24 hours following completion of seeding. In areas of interim reclamation that used drill-seeding or broadcast-seeding/raking, mulch shall consist of crimping certified weed-free straw or certified weed-free native grass hay into the soil. Hydromulching may be used in areas of interim reclamation where crimping is impracticable, in areas of interim reclamation that were hydroseeded, and in areas of temporary seeding regardless of seeding method. Mulch applications in extremely clayey soils should be evaluated carefully to avoid developing an adobe mixture. In these cases, a soil amendment may prove more beneficial.

Timing of Seeding: Precipitation is the principal input controlling biological processes in arid and semiarid regions. The pattern of soil moisture will have a great impact on the fate of seeding. Many grasses species will germinate following significant moisture events that allow for deeper infiltration of soil moisture (4-12 inches deep). This moisture generally persists for several weeks and is available for seedling root growth and establishment.

Grass species belong to one of two basic physiological types; cool season or warm season. Cool season grasses have optimum growth temperatures of 70-75°F with growth halting at around 40°F. Warm season optimum temperatures occur at 85-95°F and growth ceasing at about 55°F. The best time for seeding grass is at the beginning of the growing season. For cool season grasses, there are two growing cycles: FALL and SPRING. The best time to plant cool season grasses is in late summer or early fall. For warm season grasses, there is 1 growing season: SUMMER. The best time plant warm season grass species is early spring or summer, with the onset of the monsoons, typically beginning in early to mid-July.

The paragraph above provides the optimal timings of seeding for cool and warm season species which make up the seed mixes for of the eight desired plant communities for reclaiming disturbed areas. Experience in Farmington Field Office has shown with adequate winter moisture seeds planted in the late fall or early winter (before the ground is frozen), that cool season species will germinate the following spring, setting the stage for germination of warm season species in the mix later in the season.

Additional Seeding Rates or Species: While minimum seed requirements have been provided by the BLM, it does not exclude proposals for increased seeding rates or additional species/varieties of plants to BLM for approval to achieve reclamation standards. Industry attaining an understanding of soil types, precipitation patterns, the climate, and vegetation/environment relationships could be very valuable.

Sterile Cover Crop Option: Sterile cover crops can be useful in temporary site stabilization in the case where bare soil is exposed. It also can be used with the perennial mix in reclamation for a non-persistent "nurse" crop. A nurse crop is an annual crop used to assist in establishment of a perennial crop. Nurse crops reduce the incidence of weeds, prevent erosion, and shelter tender seedlings from sun and wind.

Other advantages are:

- Sterile annual plant; rapid germination (sprout rapidly, establish quickly)
- Plant will not persist past one growing season
- Cold tolerant, able to grow under cool conditions
- Larger root mass and more efficient use of soil nutrients than wheat; holds soil and builds soil organic matter
- Superior tolerance to disease, salt, and drought compared to wheat
- Able to adapt to a wide range of soil and moisture conditions
- Adapts either fall or spring plantings; has fair to excellent winter survival

Common Name	Scientific Names	Variety	Season	Form	PLS lbs/acre*
Sterile cover crop	*Triticum aestivum X Secale cereale*	Quickguard or similar sterile hybrid var.	Cool	Grass	7-10
***Based on 60 pure live seeds (PLS) per square foot, drill seeded. Double this rate (120 PLS per square foot) if broadcast or hydroseeded. Can be mixed with the perennial mix and seeded at the same time.**					

BLM Consultation: BLM is available provide consultations concerning fencing options to help minimize industry costs, should fencing be necessary to achieve reclamation success.

8.2 Appendix B. BLM FFO 2013 Bare Soil Reclamation Procedures: Applicable Menu Based Seed Mixes

Table 5. Saltbush/Shadscale/Winterfat Community menu based reclamation seed mix

Common Name	Scientific Names	Variety	Season	Form	PLS lbs/acre*
Plant two of the following:					
Fourwing saltbush	*Atriplex canescens*	VNS	Cool	Shrub	4.0
Shadscale saltbush	*Atriplex confertifolia*	VNS	Cool	Subshrub	2.0
Winterfat	*Krascheninnikovia lanata*	VNS	Cool	Shrub	2.0
Plant one of the following:					
Indian ricegrass	*Achnatherum hymenoides*	Paloma or Rimrock	Cool	Bunch	4.0
Bottlebrush squirreltail	*Elymus elymoides*	Tusas germplasm or VNS	Cool	Bunch	3.0
Plant two of the following:					
Alkali sacaton	*Sporobolus airoides*	VNS	Warm	Bunch	0.25
Galleta	*Pleuraphis jamesii*	Viva florets	Warm	Bunch/Sod	3.0
Sand dropseed	*Sporobolus cryptandrus*	VNS	Warm	Bunch	0.5
Plant one of the following:					
Western wheatgrass	*Pascopyrum smithii*	Arriba	Cool	Sod	3.0
Siberian wheatgrass	*Agropyron fragile*	Vavilov	Cool	Bunch	3.0
Plant one of the following:					
Blue grama	*Bouteloua gracilis*	Alma or Hachita	Warm	Sod	2.5
Needleandthread	*Hesperostipa comata*	VNS	Cool	Bunch	2.5
Plant one of the following:					
Scarlet globemallow	*Sphaeralcea coccinea*	VNS	Warm	Forb	0.25
Narrowleaf penstemon	*Penstemon angustifolius*	VNS	Cool	Forb	0.25

***Based on 60 pure live seeds (PLS) per square foot, drill seeded. Double this rate (120 PLS per square foot) if broadcast or hydroseeded.**

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Table 6. Reduced Palatability menu based reclamation seed mix

Common Name	Scientific Names	Variety	Season	Form	PLS lbs/acre*
Plant three of the following:					
Rubber rabbitbrush	*Ericameria nauseosa*	VNS	Cool	Shrub	2.0
Antelope bitterbrush	*Purshia tridentata*	VNS	Cool	Shrub	2.0
Wyoming sagebrush	*Artemsia tridentata* spp. *Wyomingensis*	VNS	Cool	Shrub	2.0
Fourwing saltbush	*Atriplex canescens*	VNS	Cool	Shrub	3.0
Shadscale saltbush	*Atriplex confertifolia*	VNS	Cool	Shrub	2.0
Fringed sage	*Artemisia frigida*	VNS	Cool	Subshrub	2.0
Plant one of the following:					
Purple threeawn	*Aristida purpurea*	VNS	Warm	Bunch	3.0
Bottlebrush squirreltail	*Elymus elymoides*	Tusas germplasm or VNS	Cool	Bunch	4.0
Plant two of the following:					
Indian ricegrass	*Achnatherum hymenoides*	Paloma or Rimrock	Cool	Bunch	3.5
Blue grama	*Bouteloua gracilis*	Alma or Hachita	Warm	Sod	2.0
Sand dropseed	*Sporobolus cryptandrus*	VNS	Warm	Bunch	0.5
Plant one of the following:					
Alkali sacaton	*Sporobolus airoides*	VNS	Warm	Bunch	0.25
Needleandthread	*Hesperostipa comata*	VNS	Cool	Bunch	2.5
Plant three of the following:					
Scarlet globemallow	*Sphaeralcea coccinea*	VNS	Warm	Forb	0.25
Smallflower or Nelson's globemallow	*Sphaeralcea parvifolia*	VNS	Warm	Forb	0.25
Annual sunflower	*Helianthus annuus*	VNS	Warm	Forb	0.25

Prairie aster	*Machaeranthera tanacetifolia*	VNS	Warm	Forb	0.25
Rocky Mountain beeplant	*Cleome serrulata*	VNS	Warm	Forb	0.25
Blanket flower	*Gaillardia pulchella* or *G. aristata*	VNS	Warm	Forb	0.25
Lewis flax	*Linum lewisii*	VNS	Warm	Forb	0.25
Hairy false goldenaster	*Heterotheca villosa*	VNS	Warm	Forb	0.25
Golden crownbeard	*Verbesina encelioides*	VNS	Warm	Forb	0.25
Tailcup lupine	*Lupinus caudatus*	VNS	Warm	Forb	0.25
***Based on 60 pure live seeds (PLS) per square foot, drill seeded. Double this rate (120 PLS per square foot) if broadcast or hydroseeded.**					

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8.3 Appendix C. Navajo Nation/BIA NGWSP Recommended Seed Species for Bare Soils/Invasive Weed Infested Sites

Navajo Nation/BIA----NGWSP RECOMMENDED SEED SPECIES FOR BARE SOILS/INVASIVE WEED INFESTED SITES

September 28, 2018

Preferred Species:

Shrubs:

Four-wing saltbrush	*Atriplex canescens*
Shadscale saltbush	*Atriplex confertifolia*
Fringed sage	*Artemisia frigida*
Winterfat	*Krascheninnikovia lanata*

Grasses:

Bottlebrush squirreltail	*Elymus elymoides*
Indian ricegrass	*Achnatherum hymenoides*
Alkali sacaton	*Sporobolus airoides*
Galleta	*Pleuraphis jamesii*
Sand dropseed	*Sporobolus cryptandrus*

Forbs:

Scarlet globemallow	*Sphaeralcea coccinea*
Rocky Mt. Beeplant	*Cleome serrulata*
Annual sunflower	*Helianthus annuus*
Beardlip penstemon	*Penstemon barbatus*
Prairie aster	*Machaeranthera tanacetifolia*

Acceptable Alternatives:

Shrubs:

Mat saltbush	*Atriplex corrugata*
Bitterbrush	*Purshia tridentata*
Greasewood	*Sacrobatus vermiculatus*

Grasses:

Needle and thread	*Hesperostipa comata*
Blue grama	*Bouteloua gracilis*
Purple three awn	*Aristida purpurea*

Forbs:

Gooseberry-leaf globemallow	*Sphaeralcea grossulariifolia*
Hairy false goldenaster	*Heterotheca villosa*
Golden crownbeard	*Verbesina encelioides*

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 51 00 40

NTUA - MARKERS

PART 1 GENERAL

1.01 MARKERS

A. Above Ground Markers as referenced in 10 14 16 – Utility Markers.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 51 00 42

NTUA WATERLINE RELOCATION REQUIREMENTS

PART 1 GENERAL

1.01 TO BE DETERMINED AND PROVIDED IN FUTURE

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 51 00 45

WEATHERS PROPERTY WATER SAMPLE RESULTS

PART 1 GENERAL

1.01 FOR INFORMATION ONLY

A. The water sampling detailed in these results were found during the NGWSP Reach 1 Pipeline Repair project. Information is provided for contractor knowledge.

B. Report:

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75 Suttle Street
Durango, CO 81303
970.247.4220 Phone
jeremy.allen@greenanalytical.com

16 February 2026

Paul Bergstrom
Bureau of Reclamation - NM
1235 LaPlata Hwy
Farmington, NM 87401
RE: [none]

Enclosed are the results of analyses for samples received by the laboratory on 02/05/26 14:31. The data to follow was performed, in whole or in part, by Green Analytical Laboratories. Any data that was performed by a subcontract laboratory is included within the GAL report, or with an additional report attached.

If you need any further assistance, please feel free to contact me.

Sincerely,

Jeremy D Allen
Laboratory Director

All accredited analytes contained in this report are denoted by an asterisk (*). For a complete list of accredited analytes please do not hesitate to contact us via any of the contact information contained in this report. All of our certifications can be viewed at http://greenanalytical.com/certifications/

Green Analytical Laboratories is NELAP accredited through the Texas Commission on Environmental Quality. Accreditation applies to drinking water and non-potable water matrices for trace metals and a variety of inorganic parameters. Green Analytical Laboratories is also accredited through the Colorado Department of Public Health and Environment and EPA region 8 for trace metals, Cyanide, Fluoride, Nitrate, and Nitrite in drinking water. TNI Certificate Number: TX-C26-00037

Our affiliate laboratory, Cardinal Laboratories, is also NELAP accredited through the Texas Commission on Environmental Quality for a variety of organic constituents in drinking water, non-potable water and solid matrices. Cardinal is also accredited for regulated VOCs, TTHM, and HAA-5 in drinking water through the Colorado Department of Public Health and Environment and EPA region 8. TNI Certificate Number: TX-C25-00101

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Bureau of Reclamation - NM	Project:	Misc.	
1235 LaPlata Hwy	Project Name / Number:	[none]	**Reported:**
Farmington NM, 87401	Project Manager:	Paul Bergstrom	02/16/26 14:57

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
Weathers #4	2602094-01	Water	02/05/26 12:00	02/05/26 14:31	

Green Analytical Laboratories

Jeremy D Allen, Laboratory Director

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. In no event shall Green Analytical Laboratories be liable for incidental or consequential damages. GALs liability, and clients exclusive remedy for any claim arising, shall be limited to the amount paid by client for analyses. All claims, including those for negligence and any other cause whatsoever, shall be deemed waived unless made in writing and received within thirty days after completion of the applicable service.

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

Weathers #4

2602094-01 (Ground Water)
Sampled Date: 02/05/26 12:00
Sampled By:

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
Microbiology									
Total Coliform	Present			No Unit	1	02/05/26 16:24	SM9223B		CDN
E. Coli	Present			No Unit	1	02/05/26 16:24	SM9223B		CDN
General Chemistry									
Oil & Grease (HEM)	<5.00	5.00	1.70	mg/L	1	02/13/26 11:00	EPA 1664 A		JDA

Subcontracted -- **Cardinal Laboratories 101 East Marland Hobbs, NM 88240**

VOLATILES BY GC/MS									
1,1,1,2-Tetrachloroethane*	<0.0005	0.0005	0.00006	mg/L	1	02/14/26 01:47	8260B		SK
1,1,1-Trichloroethane*	<0.0005	0.0005	0.00006	mg/L	1	02/14/26 01:47	8260B		SK
1,1,2,2-Tetrachloroethane*	<0.0005	0.0005	0.00006	mg/L	1	02/14/26 01:47	8260B		SK
1,1,2-Trichloroethane*	<0.0005	0.0005	0.00006	mg/L	1	02/14/26 01:47	8260B		SK
1,1-Dichloroethane*	<0.0005	0.0005	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
1,1-Dichloroethene*	<0.0005	0.0005	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
1,1-Dichloropropene*	<0.0005	0.0005	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
1,2,3-Trichlorobenzene*	<0.001	0.001	0.0002	mg/L	1	02/14/26 01:47	8260B	R-06	SK
1,2,4-Trichlorobenzene*	<0.001	0.001	0.0001	mg/L	1	02/14/26 01:47	8260B	R-06	SK
1,2,4-Trimethylbenzene*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
1,2-Dibromo-3-chloropropane*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
1,2-Dibromoethane*	<0.0005	0.0005	0.00009	mg/L	1	02/14/26 01:47	8260B		SK
1,2-Dichlorobenzene*	<0.0005	0.0005	0.00007	mg/L	1	02/14/26 01:47	8260B		SK
1,2-Dichloroethane*	<0.0005	0.0005	0.00006	mg/L	1	02/14/26 01:47	8260B		SK
1,2-Dichloropropane*	<0.0005	0.0005	0.00008	mg/L	1	02/14/26 01:47	8260B		SK
1,3,5-Trimethylbenzene*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
1,3-Dichlorobenzene*	<0.0005	0.0005	0.00005	mg/L	1	02/14/26 01:47	8260B		SK
1,3-Dichloropropane*	<0.0005	0.0005	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
1,4-Dichlorobenzene	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
1,4-Dioxane	<0.020	0.020	0.020	mg/L	1	02/14/26 01:47	8260B		SK
1.2.3-trichloropropane*	<0.0005	0.0005	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
2,2-Dichloropropane*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK

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Jeremy D. Allen

Jeremy D Allen, Laboratory Director

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

Weathers #4

2602094-01 (Ground Water)
Sampled Date: 02/05/26 12:00
Sampled By:

Subcontracted -- **Cardinal Laboratories 101 East Marland Hobbs, NM 88240**

VOLATILES BY GC/MS

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
2-Butanone*	<0.002	0.002	0.002	mg/L	1	02/14/26 01:47	8260B		SK
2-Chlorotoluene*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
2-Hexanone*	<0.001	0.001	0.0003	mg/L	1	02/14/26 01:47	8260B		SK
4-Chlorotoluene*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
4-Methyl-2-pentanone*	<0.001	0.001	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
Acetone*	<0.010	0.010	0.0009	mg/L	1	02/14/26 01:47	8260B		SK
Acrolein*	<0.005	0.005	0.001	mg/L	1	02/14/26 01:47	8260B		SK
Acrylonitrile*	<0.002	0.002	0.0008	mg/L	1	02/14/26 01:47	8260B		SK
Benzene*	<0.0005	0.0005	0.00005	mg/L	1	02/14/26 01:47	8260B		SK
Bromobenzene*	<0.0005	0.0005	0.00006	mg/L	1	02/14/26 01:47	8260B		SK
Bromochloromethane*	<0.0005	0.0005	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
Bromodichloromethane*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
Bromoform*	<0.0005	0.0005	0.00009	mg/L	1	02/14/26 01:47	8260B		SK
Bromomethane*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
Carbon disulfide*	<0.001	0.001	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
Carbon tetrachloride*	<0.0005	0.0005	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
Chlorobenzene*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
Chloroethane*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
Chloroform*	<0.0005	0.0005	0.00002	mg/L	1	02/14/26 01:47	8260B		SK
Chloromethane*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
cis-1,2-Dichloroethene*	<0.0005	0.0005	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
cis-1,3-Dichloropropene*	<0.0005	0.0005	0.00009	mg/L	1	02/14/26 01:47	8260B		SK
Dibromochloromethane*	<0.0005	0.0005	0.00008	mg/L	1	02/14/26 01:47	8260B		SK
Dibromomethane*	<0.0005	0.0005	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
Dichlorodifluoromethane*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
Ethylbenzene*	<0.0005	0.0005	0.00003	mg/L	1	02/14/26 01:47	8260B		SK
Hexachlorobutadiene*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
Iodomethane	<0.001	0.001	0.00006	mg/L	1	02/14/26 01:47	8260B		SK
Isopropylbenzene*	<0.0005	0.0005	0.00002	mg/L	1	02/14/26 01:47	8260B		SK
m+p - Xylene*	<0.001	0.001	0.00008	mg/L	1	02/14/26 01:47	8260B		SK
Methyl tert-butyl ether	<0.001	0.001	0.0002	mg/L	1	02/14/26 01:47	8260B		SK

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Jeremy D. Allen

Jeremy D Allen, Laboratory Director

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

Weathers #4

2602094-01 (Ground Water)
Sampled Date: 02/05/26 12:00
Sampled By:

Subcontracted -- **Cardinal Laboratories 101 East Marland Hobbs, NM 88240**

VOLATILES BY GC/MS

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
Methylene chloride*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
Naphthalene*	<0.001	0.001	0.00008	mg/L	1	02/14/26 01:47	8260B	R-06	SK
n-Butylbenzene*	<0.0005	0.0005	0.00007	mg/L	1	02/14/26 01:47	8260B		SK
n-Propylbenzene*	<0.0005	0.0005	0.00005	mg/L	1	02/14/26 01:47	8260B		SK
o-Xylene*	<0.0005	0.0005	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
p-Isopropyltoluene*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
sec-Butylbenzene*	<0.0005	0.0005	0.00004	mg/L	1	02/14/26 01:47	8260B		SK
Styrene*	<0.0005	0.0005	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
tert-Butylbenzene*	<0.0005	0.0005	0.00007	mg/L	1	02/14/26 01:47	8260B		SK
Tetrachloroethene*	<0.0005	0.0005	0.00009	mg/L	1	02/14/26 01:47	8260B		SK
Toluene*	<0.0005	0.0005	0.00008	mg/L	1	02/14/26 01:47	8260B		SK
Total Xylenes*	<0.001	0.001	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
trans-1,2-Dichloroethene*	<0.0005	0.0005	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
trans-1,3-Dichloropropene*	<0.0005	0.0005	0.00005	mg/L	1	02/14/26 01:47	8260B		SK
trans-1,4-Dichloro-2-butene	<0.010	0.010	0.0003	mg/L	1	02/14/26 01:47	8260B		SK
Trichloroethene*	<0.0005	0.0005	0.0002	mg/L	1	02/14/26 01:47	8260B		SK
Trichlorofluoromethane*	<0.0005	0.0005	0.0001	mg/L	1	02/14/26 01:47	8260B		SK
Vinyl acetate*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
Vinyl chloride*	<0.0005	0.0005	0.0005	mg/L	1	02/14/26 01:47	8260B		SK
Surrogate: 4-Bromofluorobenzene			*93.2 %*	*79.1-111*		*02/14/26 01:47*	*8260B*		SK
Surrogate: Dibromofluoromethane			*107 %*	*82.4-125*		*02/14/26 01:47*	*8260B*		SK
Surrogate: Toluene-d8			*101 %*	*82.5-115*		*02/14/26 01:47*	*8260B*		SK

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

General Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B260437 - General Prep - Wet Chem										
Blank (B260437-BLK1)				Prepared & Analyzed: 02/12/26						
Oil & Grease (HEM)	ND	5.00	mg/L							
LCS (B260437-BS1)				Prepared & Analyzed: 02/12/26						
Oil & Grease (HEM)	41.4	5.00	mg/L	40.0		104	85-115			
LCS Dup (B260437-BSD1)				Prepared & Analyzed: 02/12/26						
Oil & Grease (HEM)	42.8	5.00	mg/L	40.0		107	85-115	3.33	20	

VOLATILES BY GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6021319 - Volatiles										
Blank (6021319-BLK1)				Prepared & Analyzed: 02/13/26						
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L							
1,1,1-Trichloroethane	ND	0.0005	mg/L							
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L							
1,1,2-Trichloroethane	ND	0.0005	mg/L							
1,1-Dichloroethane	ND	0.0005	mg/L							
1,1-Dichloroethene	ND	0.0005	mg/L							
1,1-Dichloropropene	ND	0.0005	mg/L							
1,2,3-Trichlorobenzene	0.0007	0.0005	mg/L							
1,2,4-Trichlorobenzene	0.0005	0.0005	mg/L							
1,2,4-Trimethylbenzene	ND	0.0005	mg/L							
1,2-Dibromo-3-chloropropane	ND	0.0005	mg/L							
1,2-Dibromoethane	ND	0.0005	mg/L							
1,2-Dichlorobenzene	ND	0.0005	mg/L							
1,2-Dichloroethane	ND	0.0005	mg/L							
1,2-Dichloropropane	ND	0.0005	mg/L							
1,3,5-Trimethylbenzene	ND	0.0005	mg/L							
1,3-Dichlorobenzene	ND	0.0005	mg/L							
1,3-Dichloropropane	ND	0.0005	mg/L							
1,4-Dichlorobenzene	ND	0.0005	mg/L							
1,4-Dioxane	ND	0.020	mg/L							
1,2,3-trichloropropane	ND	0.0005	mg/L							

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

VOLATILES BY GC/MS - Quality Control (Continued)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6021319 - Volatiles (Continued)										
Blank (6021319-BLK1) (Continued)			Prepared & Analyzed: 02/13/26							
2,2-Dichloropropane	ND	0.0005	mg/L							
2-Butanone	ND	0.002	mg/L							
2-Chlorotoluene	ND	0.0005	mg/L							
2-Hexanone	ND	0.001	mg/L							
Surrogate: 4-Bromofluorobenzene	*0.0471*		mg/L	*0.0500*		*94.2*	*79.1-111*			
4-Chlorotoluene	ND	0.0005	mg/L							
4-Methyl-2-pentanone	ND	0.001	mg/L							
Acetone	ND	0.010	mg/L							
Acrolein	ND	0.005	mg/L							
Acrylonitrile	ND	0.002	mg/L							
Benzene	ND	0.0005	mg/L							
Bromobenzene	ND	0.0005	mg/L							
Bromochloromethane	ND	0.0005	mg/L							
Bromodichloromethane	ND	0.0005	mg/L							
Bromoform	ND	0.0005	mg/L							
Bromomethane	ND	0.0005	mg/L							
Carbon disulfide	ND	0.001	mg/L							
Carbon tetrachloride	ND	0.0005	mg/L							
Chlorobenzene	ND	0.0005	mg/L							
Chloroethane	ND	0.0005	mg/L							
Chloroform	ND	0.0005	mg/L							
Chloromethane	ND	0.0005	mg/L							
cis-1,2-Dichloroethene	ND	0.0005	mg/L							
cis-1,3-Dichloropropene	ND	0.0005	mg/L							
Dibromochloromethane	ND	0.0005	mg/L							
Surrogate: Dibromofluoromethane	*0.0502*		mg/L	*0.0500*		*100*	*82.4-125*			
Dibromomethane	ND	0.0005	mg/L							
Dichlorodifluoromethane	ND	0.0005	mg/L							
Ethylbenzene	ND	0.0005	mg/L							
Hexachlorobutadiene	ND	0.0005	mg/L							
Iodomethane	ND	0.001	mg/L							
Isopropylbenzene	ND	0.0005	mg/L							
m+p - Xylene	ND	0.001	mg/L							
Methyl tert-butyl ether	ND	0.001	mg/L							
Methylene chloride	ND	0.0005	mg/L							
Naphthalene	0.0005	0.0005	mg/L							
n-Butylbenzene	ND	0.0005	mg/L							
n-Propylbenzene	ND	0.0005	mg/L							
o-Xylene	ND	0.0005	mg/L							

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

VOLATILES BY GC/MS - Quality Control (Continued)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6021319 - Volatiles (Continued)										
Blank (6021319-BLK1) (Continued)				Prepared & Analyzed: 02/13/26						
p-Isopropyltoluene	ND	0.0005	mg/L							
sec-Butylbenzene	ND	0.0005	mg/L							
Styrene	ND	0.0005	mg/L							
tert-Butylbenzene	ND	0.0005	mg/L							
Tetrachloroethene	ND	0.0005	mg/L							
Toluene	ND	0.0005	mg/L							
Surrogate: Toluene-d8	*0.0505*		mg/L	*0.0500*		*101*	*82.5-115*			
Total Xylenes	ND	0.001	mg/L							
trans-1,2-Dichloroethene	ND	0.0005	mg/L							
trans-1,3-Dichloropropene	ND	0.0005	mg/L							
trans-1,4-Dichloro-2-butene	ND	0.010	mg/L							
Trichloroethene	ND	0.0005	mg/L							
Trichlorofluoromethane	ND	0.0005	mg/L							
Vinyl acetate	ND	0.0005	mg/L							
Vinyl chloride	ND	0.0005	mg/L							
LCS (6021319-BS1)				Prepared & Analyzed: 02/13/26						
1,1,1,2-Tetrachloroethane	0.022	0.0005	mg/L	0.0200		110	83.1-120			
1,1,1-Trichloroethane	0.023	0.0005	mg/L	0.0200		113	50.3-160			
1,1,2,2-Tetrachloroethane	0.021	0.0005	mg/L	0.0200		103	48-136			
1,1,2-Trichloroethane	0.020	0.0005	mg/L	0.0200		101	73.8-123			
1,1-Dichloroethane	0.021	0.0005	mg/L	0.0200		104	72.8-131			
1,1-Dichloroethene	0.021	0.0005	mg/L	0.0200		103	77.6-137			
1,1-Dichloropropene	0.021	0.0005	mg/L	0.0200		103	54.5-156			
1,2,3-Trichlorobenzene	0.027	0.0005	mg/L	0.0200		135	66.2-149			
1,2,4-Trichlorobenzene	0.025	0.0005	mg/L	0.0200		126	63.3-150			
1,2,4-Trimethylbenzene	0.022	0.0005	mg/L	0.0200		112	79.1-124			
1,2-Dibromo-3-chloropropane	0.022	0.0005	mg/L	0.0200		112	34.9-149			
1,2-Dibromoethane	0.021	0.0005	mg/L	0.0200		105	78.5-122			
1,2-Dichlorobenzene	0.021	0.0005	mg/L	0.0200		107	84.3-120			
1,2-Dichloroethane	0.020	0.0005	mg/L	0.0200		99.7	70.4-125			
1,2-Dichloropropane	0.021	0.0005	mg/L	0.0200		105	73.3-122			
1,3,5-Trimethylbenzene	0.023	0.0005	mg/L	0.0200		113	77.3-127			
1,3-Dichlorobenzene	0.021	0.0005	mg/L	0.0200		104	84.5-124			
1,3-Dichloropropane	0.021	0.0005	mg/L	0.0200		105	76-124			
1,4-Dichlorobenzene	0.021	0.0005	mg/L	0.0200		106	83.2-121			
1,4-Dioxane	0.366	0.020	mg/L	0.400		91.4	26-195			
1,2,3-trichloropropane	0.019	0.0005	mg/L	0.0200		95.7	56.5-127			
2,2-Dichloropropane	0.020	0.0005	mg/L	0.0200		100	69.4-132			

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Jeremy D. Allen

Jeremy D Allen, Laboratory Director

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

VOLATILES BY GC/MS - Quality Control (Continued)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6021319 - Volatiles (Continued)										
LCS (6021319-BS1) (Continued)				Prepared & Analyzed: 02/13/26						
2-Butanone	0.038	0.002	mg/L	0.0400		96.0	40.9-157			
2-Chlorotoluene	0.022	0.0005	mg/L	0.0200		109	76.4-123			
2-Hexanone	0.039	0.001	mg/L	0.0400		98.1	15.4-157			
Surrogate: 4-Bromofluorobenzene	*0.0510*		mg/L	*0.0500*		*102*	*79.1-111*			
4-Chlorotoluene	0.021	0.0005	mg/L	0.0200		106	78.7-126			
4-Methyl-2-pentanone	0.041	0.001	mg/L	0.0400		103	31.4-146			
Acetone	0.041	0.010	mg/L	0.0400		102	49.7-187			
Acrolein	0.182	0.005	mg/L	0.200		90.8	4.88-190			
Acrylonitrile	0.039	0.002	mg/L	0.0400		98.5	52.6-154			
Benzene	0.020	0.0005	mg/L	0.0200		98.0	82.4-116			
Bromobenzene	0.020	0.0005	mg/L	0.0200		101	81.5-121			
Bromochloromethane	0.021	0.0005	mg/L	0.0200		107	67.4-139			
Bromodichloromethane	0.022	0.0005	mg/L	0.0200		110	76.5-119			
Bromoform	0.019	0.0005	mg/L	0.0200		93.5	64.6-130			
Bromomethane	0.021	0.0005	mg/L	0.0200		107	63.3-139			
Carbon disulfide	0.043	0.001	mg/L	0.0400		106	66.8-157			
Carbon tetrachloride	0.022	0.0005	mg/L	0.0200		110	73.9-135			
Chlorobenzene	0.021	0.0005	mg/L	0.0200		103	83.5-117			
Chloroethane	0.020	0.0005	mg/L	0.0200		101	67.1-139			
Chloroform	0.021	0.0005	mg/L	0.0200		103	72.8-130			
Chloromethane	0.021	0.0005	mg/L	0.0200		107	45.8-153			
cis-1,2-Dichloroethene	0.021	0.0005	mg/L	0.0200		105	75.7-128			
cis-1,3-Dichloropropene	0.017	0.0005	mg/L	0.0200		86.4	71.6-125			
Dibromochloromethane	0.020	0.0005	mg/L	0.0200		100	78.8-123			
Surrogate: Dibromofluoromethane	*0.0512*		mg/L	*0.0500*		*102*	*82.4-125*			
Dibromomethane	0.021	0.0005	mg/L	0.0200		106	77.8-119			
Dichlorodifluoromethane	0.023	0.0005	mg/L	0.0200		114	46.1-158			
Ethylbenzene	0.021	0.0005	mg/L	0.0200		106	77.9-123			
Hexachlorobutadiene	0.026	0.0005	mg/L	0.0200		129	55.5-185			
Iodomethane	0.043	0.001	mg/L	0.0400		108	74-137			
Isopropylbenzene	0.022	0.0005	mg/L	0.0200		111	77.6-125			
m+p - Xylene	0.043	0.001	mg/L	0.0400		107	76.6-128			
Methyl tert-butyl ether	0.041	0.001	mg/L	0.0400		103	73.6-131			
Methylene chloride	0.022	0.0005	mg/L	0.0200		112	75.1-138			
Naphthalene	0.027	0.0005	mg/L	0.0200		134	55.4-142			
n-Butylbenzene	0.022	0.0005	mg/L	0.0200		109	72.8-143			
n-Propylbenzene	0.021	0.0005	mg/L	0.0200		107	79.8-127			
o-Xylene	0.022	0.0005	mg/L	0.0200		108	72.3-124			
p-Isopropyltoluene	0.022	0.0005	mg/L	0.0200		110	72-135			

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Jeremy D Allen, Laboratory Director

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

VOLATILES BY GC/MS - Quality Control (Continued)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6021319 - Volatiles (Continued)										
LCS (6021319-BS1) (Continued)				Prepared & Analyzed: 02/13/26						
sec-Butylbenzene	0.022	0.0005	mg/L	0.0200		111	78.6-130			
Styrene	0.022	0.0005	mg/L	0.0200		110	78.9-119			
tert-Butylbenzene	0.021	0.0005	mg/L	0.0200		106	79.8-126			
Tetrachloroethene	0.021	0.0005	mg/L	0.0200		105	76.9-130			
Toluene	0.020	0.0005	mg/L	0.0200		101	76.3-120			
Surrogate: Toluene-d8	*0.0494*		mg/L	*0.0500*		*98.8*	*82.5-115*			
Total Xylenes	0.064	0.001	mg/L	0.0600		107	75.9-126			
trans-1,2-Dichloroethene	0.022	0.0005	mg/L	0.0200		109	78.3-134			
trans-1,3-Dichloropropene	0.019	0.0005	mg/L	0.0200		97.4	74.4-126			
trans-1,4-Dichloro-2-butene	0.029	0.010	mg/L	0.0400		73.6	7.48-201			
Trichloroethene	0.020	0.0005	mg/L	0.0200		102	77.5-118			
Trichlorofluoromethane	0.022	0.0005	mg/L	0.0200		111	63.7-149			
Vinyl acetate	0.020	0.0005	mg/L	0.0200		99.8	19.3-171			
Vinyl chloride	0.022	0.0005	mg/L	0.0200		110	64.9-141			
LCS Dup (6021319-BSD1)				Prepared & Analyzed: 02/13/26						
1,1,1,2-Tetrachloroethane	0.022	0.0005	mg/L	0.0200		109	83.1-120	1.32	6.88	
1,1,1-Trichloroethane	0.022	0.0005	mg/L	0.0200		108	50.3-160	4.79	7.43	
1,1,2,2-Tetrachloroethane	0.020	0.0005	mg/L	0.0200		102	48-136	1.41	8.68	
1,1,2-Trichloroethane	0.021	0.0005	mg/L	0.0200		104	73.8-123	2.39	6.82	
1,1-Dichloroethane	0.020	0.0005	mg/L	0.0200		101	72.8-131	3.11	4.3	
1,1-Dichloroethene	0.020	0.0005	mg/L	0.0200		97.9	77.6-137	4.74	16.5	
1,1-Dichloropropene	0.020	0.0005	mg/L	0.0200		102	54.5-156	1.02	5.47	
1,2,3-Trichlorobenzene	0.023	0.0005	mg/L	0.0200		117	66.2-149	14.0	43	
1,2,4-Trichlorobenzene	0.023	0.0005	mg/L	0.0200		115	63.3-150	9.49	22.3	
1,2,4-Trimethylbenzene	0.022	0.0005	mg/L	0.0200		110	79.1-124	2.11	8.94	
1,2-Dibromo-3-chloropropane	0.019	0.0005	mg/L	0.0200		95.6	34.9-149	15.6	15.1	QR-02
1,2-Dibromoethane	0.021	0.0005	mg/L	0.0200		105	78.5-122	0.190	5.83	
1,2-Dichlorobenzene	0.020	0.0005	mg/L	0.0200		102	84.3-120	4.55	8.72	
1,2-Dichloroethane	0.020	0.0005	mg/L	0.0200		102	70.4-125	2.13	8.94	
1,2-Dichloropropane	0.020	0.0005	mg/L	0.0200		102	73.3-122	2.37	5.51	
1,3,5-Trimethylbenzene	0.022	0.0005	mg/L	0.0200		109	77.3-127	3.02	16.5	
1,3-Dichlorobenzene	0.020	0.0005	mg/L	0.0200		101	84.5-124	2.97	9	
1,3-Dichloropropane	0.022	0.0005	mg/L	0.0200		108	76-124	2.67	6.06	
1,4-Dichlorobenzene	0.021	0.0005	mg/L	0.0200		103	83.2-121	2.73	7.71	
1,4-Dioxane	0.267	0.020	mg/L	0.400		66.8	26-195	31.0	35.2	
1.2.3-trichloropropane	0.020	0.0005	mg/L	0.0200		102	56.5-127	6.42	49.2	
2,2-Dichloropropane	0.019	0.0005	mg/L	0.0200		94.5	69.4-132	5.91	9.62	
2-Butanone	0.039	0.002	mg/L	0.0400		96.6	40.9-157	0.675	14.2	

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Jeremy D. Allen, Laboratory Director

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

VOLATILES BY GC/MS - Quality Control (Continued)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6021319 - Volatiles (Continued)										
LCS Dup (6021319-BSD1) (Continued)				Prepared & Analyzed: 02/13/26						
2-Chlorotoluene	0.022	0.0005	mg/L	0.0200		108	76.4-123	1.06	8.62	
2-Hexanone	0.039	0.001	mg/L	0.0400		96.4	15.4-157	1.83	7.28	
Surrogate: 4-Bromofluorobenzene	*0.0501*		mg/L	*0.0500*		*100*	*79.1-111*			
4-Chlorotoluene	0.022	0.0005	mg/L	0.0200		108	78.7-126	1.12	15.5	
4-Methyl-2-pentanone	0.041	0.001	mg/L	0.0400		103	31.4-146	0.656	7.57	
Acetone	0.037	0.010	mg/L	0.0400		93.4	49.7-187	8.64	30.5	
Acrolein	0.165	0.005	mg/L	0.200		82.4	4.88-190	9.75	22.4	
Acrylonitrile	0.039	0.002	mg/L	0.0400		97.9	52.6-154	0.637	7.62	
Benzene	0.019	0.0005	mg/L	0.0200		95.4	82.4-116	2.59	4.16	
Bromobenzene	0.020	0.0005	mg/L	0.0200		102	81.5-121	0.690	8.41	
Bromochloromethane	0.020	0.0005	mg/L	0.0200		102	67.4-139	5.46	5.16	QR-02
Bromodichloromethane	0.021	0.0005	mg/L	0.0200		107	76.5-119	2.49	5.36	
Bromoform	0.019	0.0005	mg/L	0.0200		95.4	64.6-130	1.96	14.1	
Bromomethane	0.020	0.0005	mg/L	0.0200		99.8	63.3-139	7.34	21.5	
Carbon disulfide	0.040	0.001	mg/L	0.0400		101	66.8-157	5.23	20.3	
Carbon tetrachloride	0.021	0.0005	mg/L	0.0200		104	73.9-135	5.75	11.4	
Chlorobenzene	0.021	0.0005	mg/L	0.0200		104	83.5-117	0.532	5.18	
Chloroethane	0.020	0.0005	mg/L	0.0200		99.9	67.1-139	1.14	24.1	
Chloroform	0.021	0.0005	mg/L	0.0200		103	72.8-130	0.292	5.15	
Chloromethane	0.021	0.0005	mg/L	0.0200		104	45.8-153	3.08	27	
cis-1,2-Dichloroethene	0.020	0.0005	mg/L	0.0200		102	75.7-128	3.09	5.73	
cis-1,3-Dichloropropene	0.018	0.0005	mg/L	0.0200		89.4	71.6-125	3.36	6.09	
Dibromochloromethane	0.020	0.0005	mg/L	0.0200		100	78.8-123	0.250	7.24	
Surrogate: Dibromofluoromethane	*0.0502*		mg/L	*0.0500*		*100*	*82.4-125*			
Dibromomethane	0.021	0.0005	mg/L	0.0200		103	77.8-119	2.91	5.75	
Dichlorodifluoromethane	0.022	0.0005	mg/L	0.0200		108	46.1-158	5.55	22.6	
Ethylbenzene	0.021	0.0005	mg/L	0.0200		105	77.9-123	1.14	4.83	
Hexachlorobutadiene	0.022	0.0005	mg/L	0.0200		110	55.5-185	15.7	18.4	
Iodomethane	0.041	0.001	mg/L	0.0400		102	74-137	6.33	24.3	
Isopropylbenzene	0.022	0.0005	mg/L	0.0200		109	77.6-125	1.77	6.25	
m+p - Xylene	0.043	0.001	mg/L	0.0400		107	76.6-128	0.421	5.77	
Methyl tert-butyl ether	0.040	0.001	mg/L	0.0400		101	73.6-131	2.40	12.8	
Methylene chloride	0.021	0.0005	mg/L	0.0200		103	75.1-138	7.58	19.7	
Naphthalene	0.023	0.0005	mg/L	0.0200		117	55.4-142	13.2	33.5	
n-Butylbenzene	0.021	0.0005	mg/L	0.0200		103	72.8-143	4.86	10.1	
n-Propylbenzene	0.021	0.0005	mg/L	0.0200		106	79.8-127	1.08	9.09	
o-Xylene	0.021	0.0005	mg/L	0.0200		106	72.3-124	2.34	6.29	
p-Isopropyltoluene	0.022	0.0005	mg/L	0.0200		108	72-135	1.98	9.26	
sec-Butylbenzene	0.022	0.0005	mg/L	0.0200		110	78.6-130	1.04	9.85	

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Jeremy D. Allen

Jeremy D Allen, Laboratory Director

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Bureau of Reclamation - NM	Project: Misc.	
1235 LaPlata Hwy	Project Name / Number: [none]	**Reported:**
Farmington NM, 87401	Project Manager: Paul Bergstrom	02/16/26 14:57

VOLATILES BY GC/MS - Quality Control (Continued)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6021319 - Volatiles (Continued)										
LCS Dup (6021319-BSD1) (Continued)				Prepared & Analyzed: 02/13/26						
Styrene	0.022	0.0005	mg/L	0.0200		109	78.9-119	1.28	7.55	
tert-Butylbenzene	0.021	0.0005	mg/L	0.0200		107	79.8-126	1.41	18.6	
Tetrachloroethene	0.021	0.0005	mg/L	0.0200		104	76.9-130	1.15	6.38	
Toluene	0.020	0.0005	mg/L	0.0200		98.2	76.3-120	2.36	5.67	
Surrogate: Toluene-d8	*0.0510*		mg/L	*0.0500*		*102*	*82.5-115*			
Total Xylenes	0.064	0.001	mg/L	0.0600		107	75.9-126	0.499	5.83	
trans-1,2-Dichloroethene	0.021	0.0005	mg/L	0.0200		104	78.3-134	5.21	19.1	
trans-1,3-Dichloropropene	0.019	0.0005	mg/L	0.0200		97.2	74.4-126	0.205	6.26	
trans-1,4-Dichloro-2-butene	0.033	0.010	mg/L	0.0400		82.7	7.48-201	11.5	92.8	
Trichloroethene	0.020	0.0005	mg/L	0.0200		98.8	77.5-118	3.19	4.92	
Trichlorofluoromethane	0.021	0.0005	mg/L	0.0200		105	63.7-149	5.36	19.8	
Vinyl acetate	0.020	0.0005	mg/L	0.0200		99.7	19.3-171	0.0501	7.84	
Vinyl chloride	0.021	0.0005	mg/L	0.0200		104	64.9-141	5.75	23	

Notes and Definitions

R-06	The Reporting Limit for this analyte has been raised to account for target analyte concentration in the method blank.
QR-02	The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on percent recoveries and completeness of QC data.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis *Results reported on as received basis unless designated as dry.
RPD	Relative Percent Difference
LCS	Laboratory Control Sample (Blank Spike)
RL	Report Limit
MDL	Method Detection Limit

Green Analytical Laboratories

Jeremy D. Allen

Jeremy D Allen, Laboratory Director

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GAL Analytical
75 Suttle Street
Durango, CO 81303
(970) 247-4220

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST
FORM-006, R 8.0

Note: Wite-Out™ or similar products cannot be used on the Chain of Custody

Company or Client: Bureau of Reclamation
Address: 1225 La Plata Hwy
City: Farmington State: NM Zip: 87401
Phone #: 505-512-6553
Contact Person: Paul Bergstrom
Email Report to: pbergstrom@usbr.gov
Project Name(optional):
Sampler Name (Print): Paul Bergstrom

Bill to (if different):
P.O. #:
Rush? Y N
TAT Needed?

ANALYSIS REQUEST

Lab I.D. (Lab Use Only)	Sample Name or Location	Collected Date	Collected Time	GROUNDWATER	SURFACE WATER	WASTEWATER	PRODUCED WATER	DRINKING WATER	SOIL	OTHER:	No preservation	Nitric Acid	Hydrochloric Acid	Sulfuric Acid	Sodium Hydroxide	OTHER:	VOC	Bacteria/Chloride	Grease/Oil
2602-094	1) Weathers #4	2/5/26	12:00pm	X									5			1			
01	2) Weathers #4	2/5/26	12:00pm	X															
	3) Weathers #4	2/5/26	12:00pm	X															
	4)																		
	5)																		
	6)																		
	7)																		
	8)																		
	9)																		
	10)																		

PLEASE NOTE: GAL's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by GAL within 30 days after completion of the applicable service. In no event shall GAL be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by GAL, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Paul Bergstrom	2/5/26	1:25		2/5/26	1:28pm
	2/5/26	2:31pm		2-5-26	1431

ADDITIONAL REMARKS:

Temperature at receipt: 4.3/3.7 °C | Checked by: MPN | On Ice? Y N | Therm. used: Laser 2

† GAL cannot accept verbal changes. Please email changes to receiving@greenanalytical.com
* Chain of Custody must be signed in "Relinquished By:" as an acceptance of services and all applicable charges.

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Page 14 of 15 2602094_1 GAL 02 16 26 1457 02/16/26 14:57:48

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GAL Analytical

Date/Initials of person examining contents: NBW 2-5-26

Labeled by initials: TN
(if different than above)

SAMPLE CONDITION RECEIPT FORM

Client Name: of Reclamation

Work Order # 2602-094

Courier: ☐Fed Ex ☐UPS ☐USPS ☑Client ☐ Kangaroo ☐ Third Party ☐Other

Custody Seals on Box/Cooler Present: ☐ Yes ☑ No Seals Intact: ☐ Yes ☐ No GAL Cooler #: _____

Thermometer Used: #2 Samples on ice, cooling process has begun: ☑ Yes ☐ No

Type of Ice: ☑ Wet ☐ Blue ☐ None Cooler Temp: Observed Temp: 4.3 °C Correction Factor: -0.6 °C Final Temp: 3.7 °C

Temp: _____ °C
Temp: _____ °C
Temp: _____ °C

* *Temp should be above freezing 6°C, if multiple readings are taken the lowest temp is the final temp recorded.*

Compliance: ☐ Yes ☑ No

Chain of Custody Filled Out:	☑Yes ☐No	1.
COC Signed when Relinquished and Received:	☑Yes ☐No	2.
Sampler Name and Signature on COC: *Required for compliance	☑Yes ☐No	3.
Samples arrived within hold time: *(Excluding pH)*	☑Yes ☐No	4.
Correct Containers Used & Intact:	☑Yes ☐No	5.
Short Hold Time Analysis (<72hr): *(Excluding pH)*	☑Yes ☐No	6. BACT
Rush Turn Around Time Requested:	☐Yes ☑No	7.
Sufficient Volume:	☑Yes ☐No	8.
pH's acceptable upon receipt, where applicable: **Not including metals bottles*	☐Yes ☐No ☑N/A	9.
Dissolved Testing Needed: Field Filtered: ☐Yes ☐No	☐Yes ☑No	10.
Sample Labels match COC: -Includes Date/Time/ID Matrix:	☑Yes ☐No WT SL OT	11.
Trip Blank Present: Trip Blank Custody Seals Present: VOA's meet headspace requirement (<6mm bubbles)	☐Yes ☐No ☑N/A ☐Yes ☐No ☑N/A ☐Yes ☐No ☑N/A	12.
Non-Conformance(s):	☐Yes ☑No	13.

Client Notification/Resolution:

Person Contacted: _____ Date/Time: _____

Comments/Resolution: _____

FORM-039, Rev 6

Page 1 of 1

Page 15 of 15 2602094_1 GAL 02 16 26 1457 02/16/26 14:57:48

SAMPLENAME	METHOD	ANALYTE	RESULT	RL	MDL	Units	Qualifier
Weathers #4	8260B	1,1,1,2-Tetrachloroethane	<0.0005	0.0005	0.00006	mg/L	
Weathers #4	8260B	1,1,1-Trichloroethane	<0.0005	0.0005	0.00006	mg/L	
Weathers #4	8260B	1,1,2,2-Tetrachloroethane	<0.0005	0.0005	0.00006	mg/L	
Weathers #4	8260B	1,1,2-Trichloroethane	<0.0005	0.0005	0.00006	mg/L	
Weathers #4	8260B	1,1-Dichloroethane	<0.0005	0.0005	0.0002	mg/L	
Weathers #4	8260B	1,1-Dichloroethene	<0.0005	0.0005	0.0002	mg/L	
Weathers #4	8260B	1,1-Dichloropropene	<0.0005	0.0005	0.0002	mg/L	
Weathers #4	8260B	1,2,3-Trichlorobenzene	<0.001	0.001	0.0002	mg/L	R-06
Weathers #4	8260B	1,2,4-Trichlorobenzene	<0.001	0.001	0.0001	mg/L	R-06
Weathers #4	8260B	1,2,4-Trimethylbenzene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	1,2-Dibromo-3-chloropropane	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	1,2-Dibromoethane	<0.0005	0.0005	0.00009	mg/L	
Weathers #4	8260B	1,2-Dichlorobenzene	<0.0005	0.0005	0.00007	mg/L	
Weathers #4	8260B	1,2-Dichloroethane	<0.0005	0.0005	0.00006	mg/L	
Weathers #4	8260B	1,2-Dichloropropane	<0.0005	0.0005	0.00008	mg/L	
Weathers #4	8260B	1,3,5-Trimethylbenzene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	1,3-Dichlorobenzene	<0.0005	0.0005	0.00005	mg/L	
Weathers #4	8260B	1,3-Dichloropropane	<0.0005	0.0005	0.0001	mg/L	
Weathers #4	8260B	1,4-Dichlorobenzene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	1,4-Dioxane	<0.020	0.020	0.020	mg/L	
Weathers #4	8260B	1.2.3-trichloropropane	<0.0005	0.0005	0.0001	mg/L	
Weathers #4	8260B	2,2-Dichloropropane	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	2-Butanone	<0.002	0.002	0.002	mg/L	
Weathers #4	8260B	2-Chlorotoluene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	2-Hexanone	<0.001	0.001	0.0003	mg/L	

Weathers #4	8260B	4-Chlorotoluene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	4-Methyl-2-pentanone	<0.001	0.001	0.0001	mg/L	
Weathers #4	8260B	Acetone	<0.010	0.010	0.0009	mg/L	
Weathers #4	8260B	Acrolein	<0.005	0.005	0.001	mg/L	
Weathers #4	8260B	Acrylonitrile	<0.002	0.002	0.0008	mg/L	
Weathers #4	8260B	Benzene	<0.0005	0.0005	0.00005	mg/L	
Weathers #4	8260B	Bromobenzene	<0.0005	0.0005	0.00006	mg/L	
Weathers #4	8260B	Bromochloromethane	<0.0005	0.0005	0.0001	mg/L	
Weathers #4	8260B	Bromodichloromethane	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	Bromoform	<0.0005	0.0005	0.00009	mg/L	
Weathers #4	8260B	Bromomethane	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	Carbon disulfide	<0.001	0.001	0.0001	mg/L	
Weathers #4	8260B	Carbon tetrachloride	<0.0005	0.0005	0.0002	mg/L	
Weathers #4	8260B	Chlorobenzene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	Chloroethane	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	Chloroform	<0.0005	0.0005	0.00002	mg/L	
Weathers #4	8260B	Chloromethane	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	cis-1,2-Dichloroethene	<0.0005	0.0005	0.0002	mg/L	
Weathers #4	8260B	cis-1,3-Dichloropropene	<0.0005	0.0005	0.00009	mg/L	
Weathers #4	8260B	Dibromochloromethane	<0.0005	0.0005	0.00008	mg/L	
Weathers #4	8260B	Dibromomethane	<0.0005	0.0005	0.0002	mg/L	
Weathers #4	8260B	Dichlorodifluoromethane	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	Ethylbenzene	<0.0005	0.0005	0.00003	mg/L	
Weathers #4	8260B	Hexachlorobutadiene	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	Iodomethane	<0.001	0.001	0.00006	mg/L	
Weathers #4	8260B	Isopropylbenzene	<0.0005	0.0005	0.00002	mg/L	

Weathers #4	8260B	m+p - Xylene	<0.001	0.001	0.00008	mg/L	
Weathers #4	8260B	Methyl tert-butyl ether	<0.001	0.001	0.0002	mg/L	
Weathers #4	8260B	Methylene chloride	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	Naphthalene	<0.001	0.001	0.00008	mg/L	R-06
Weathers #4	8260B	n-Butylbenzene	<0.0005	0.0005	0.00007	mg/L	
Weathers #4	8260B	n-Propylbenzene	<0.0005	0.0005	0.00005	mg/L	
Weathers #4	8260B	o-Xylene	<0.0005	0.0005	0.0001	mg/L	
Weathers #4	8260B	p-Isopropyltoluene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	sec-Butylbenzene	<0.0005	0.0005	0.00004	mg/L	
Weathers #4	8260B	Styrene	<0.0005	0.0005	0.0001	mg/L	
Weathers #4	8260B	tert-Butylbenzene	<0.0005	0.0005	0.00007	mg/L	
Weathers #4	8260B	Tetrachloroethene	<0.0005	0.0005	0.00009	mg/L	
Weathers #4	8260B	Toluene	<0.0005	0.0005	0.00008	mg/L	
Weathers #4	8260B	Total Xylenes	<0.001	0.001	0.0002	mg/L	
Weathers #4	8260B	trans-1,2-Dichloroethene	<0.0005	0.0005	0.0001	mg/L	
Weathers #4	8260B	trans-1,3-Dichloropropene	<0.0005	0.0005	0.00005	mg/L	
Weathers #4	8260B	trans-1,4-Dichloro-2-butene	<0.010	0.010	0.0003	mg/L	
Weathers #4	8260B	Trichloroethene	<0.0005	0.0005	0.0002	mg/L	
Weathers #4	8260B	Trichlorofluoromethane	<0.0005	0.0005	0.0001	mg/L	
Weathers #4	8260B	Vinyl acetate	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	8260B	Vinyl chloride	<0.0005	0.0005	0.0005	mg/L	
Weathers #4	EPA 1664 A	Oil & Grease (HEM)	<5.00	5.00	1.70	mg/L	
Weathers #4	SM9223B	E. Coli	Present			No Unit	
Weathers #4	SM9223B	Total Coliform	Present			No Unit	

C. Sampling pictures from the Weather property.

Figure 1: Weathers property excavation around existing Reach 1 pipeline prior to pumping for removal of groundwater. Picture looking north near existing Weathers trailer.

Figure 2: Weathers property excavation around existing Reach 1 pipeline after pumping for removal of groundwater. Picture looking north near existing Weathers trailer.

Figure 3. Location of the Shaw property. The four buildings are marked with blue dots.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 51 00 50

ELECTRONIC MEDIA RELEASE

U.S. Bureau of Reclamation
Electronic Media Release

U.S. Bureau of Reclamation, Contract Number/Solicitation Number: _____

This release for electronic media is dated the ___ day of _____ (month), ____ (year), between _____ (RECIPIENT) and U.S. Bureau of Reclamation, for the exchange of electronic media (CD ROMs, DVD, Flash Drives, External Hard Disk Drives, etc.) containing information on the _____ project (hereinafter referred to as the PROJECT) for use by the RECIPIENT.

Therefore, RECIPIENT and U.S Bureau of Reclamation (Reclamation), agree as follows:

1. All data and intellectual property contained on the electronic files remains the property of U.S. Bureau of Reclamation and may not be copied or distributed to any other party without the written permission of U.S. Bureau of Reclamation.
2. The electronic files provided to RECIPIENT by U.S. Bureau of Reclamation, for the PROJECT may be used or adapted by RECIPIENT for their own use. If RECIPIENT chooses to alter in any way, in whole or in part, the electronic files provided for the PROJECT or any future project(s), RECIPIENT agrees that the use of the altered files shall be without liability or legal exposure to U.S. Bureau of Reclamation.
3. Because information and data provided electronically may be altered, whether inadvertently or otherwise, U.S. Bureau of Reclamation, reserves the right to retain copies of the electronic file(s) and to remove from the electronic files provided to RECIPIENT all identification (such as logo, surveyor's seal, etc.) reflecting the involvement of U.S. Bureau of Reclamation, in their preparation.
4. The electronic files are provided solely as a convenience to RECIPIENT by U.S. Bureau of Reclamation and shall not be considered "Drawings of Record" or "Construction Documents." All documents considered "Drawings of Record" or "Construction Documents" will be hardcopy drawing sheets with signatures or scanned files of the hardcopy drawings with signatures.
5. RECIPIENT is advised to check all electronic media for viruses and malware before loading the files. RECIPIENT is solely responsible for intercepting and disabling viruses, if any, that may be transmitted with the electronic files and hereby agrees to indemnify and hold U.S. Bureau of Reclamation harmless from and against all claims of any type or nature asserted by RECIPIENT or any party as a result of viruses transmitted with the electronic files.
6. Files distributed electronically are subject to data erosion, erasure, and/or alteration, and computer systems and software become obsolete in time. By accepting these electronic files, RECIPIENT acknowledges these risks and agrees to waive all claims against U.S. Bureau of Reclamation, should data erosion, erasure, and/or alteration of these electronic files occur.

7. RECIPIENT agrees to defend, indemnify, and hold U.S. Bureau of Reclamation, harmless from all claims, injuries, damages, losses, expenses, and costs, including attorney's fees, arising out of breach of this agreement, or the modification or reuse of the electronic files.

ACCEPTED FOR RECIPIENT:	RELEASED BY U.S. BUREAU OF RECLAMATION:
By: _____	_____
Title: _____	_____
Date: _____	_____

END OF SECTION

SECTION 51 00 70

BLM HERBICIDES

PART 1 GENERAL

	Herbicides Formulations Approved for Use on Lands		
	The BLM Administers in the 17 Western States		
			Update: April 4, 2019
Restrictions associated with exisitng Environmental Impact Statements and individual Environmental Assessments (EA)			
at the present time, may restrict the use of individual herbicide active ingredients allowed for a particular			
project within that state. Refer to current EAs prior to selecting the active ingredient(s) and subsequent formulation(s).			
Refer to the complete label prior to considering the use of any herbicide formulation. Just because it has a Federal registration,			
it may not be registered in a particular State, for example California. Label changes can also impact the intended use			
through, such things as, creation or elimination of Special Local Need (SLN) or 24 (C) registrations, changes in application sites,			
rates and timing of application, county restrictions, etc.			
ACTIVE			EPA REG.
INGREDIENT	TRADE NAME	MANUFACTURER	NUMBER
Aminopyralid	Milestone	Dow AgroSciences	62719-519
Aminopyralid + 2,4-D	ForeFront HL	Dow AgroSciences	62719-630
	GrazonNext HL	Dow AgroSciences	62719-628
Aminopyralid + Clopyralid	Sendero	Dow AgroSciences	62719-645
Aminopyralid + Metsulfuron methyl	Chaparral	Dow AgroSciences	62719-597
	Opensight	Dow AgroSciences	62719-597
Aminopyralid + Triclopyr	Capstone	Dow AgroSciences	62719-572
Bromacil	Alligare Bromacil 80	Alligare, LLC	81927-4
	Ceannard Bromacil 80DF	Ceannard, Inc.	58035-19
	Hyvar X	Bayer Environmental Science	432-1546
	Hyvar X	DuPont Crop Protection	352-287
	Hyvar X-L	Bayer Environmental Science	432-1548
	Hyvar X-L	DuPont Crop Protection	352-346
Bromacil + Diuron	Alligare Bromacil/Diuron 40/40	Alligare, LLC	81927-3
	Ceannard Diuron/Bromacil 80 DF	Ceannard, Inc.	58035-18
	DiBro 2+2	Nufarm Americas Inc.	228-227
	DiBro 4+2	Nufarm Americas Inc.	228-386
	DiBro 4+4	Nufarm Americas Inc.	228-235
	Krovar I DF	Bayer Environmental Science	432-1551
	Krovar I DF	DuPont Crop Protection	352-505
	Weed Blast 4G	SSI Maxim	34913-19
	Weed Blast Res. Weed Cont.	Loveland Products Inc.	34704-576

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Chlorsulfuron	Alligare Chlorsulfuron 75	Alligare, LLC	81927-43
	Chlorsulfuron E-Pro 75 WDG	Nufarm Americas Inc.	79676-72
	Nufarm Chlorsulf SPC 75 WDG Herbicide	Nufarm Americas Inc.	228-672
	Telar XP	Bayer Environmental Science	432-1561
	Telar XP	DuPont Crop Protection	352-654
Clopyralid	Alligare Clopyralid 3	Alligare, LLC	81927-14
	CleanSlate	Nufarm Americas Inc.	228-491
	Pyramid R&P	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-94
	Reclaim	Dow AgroSciences	62719-83
	Spur	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-89
	Stinger	Dow AgroSciences	62719-73
	Transline	Dow AgroSciences	62719-259
Clopyralid + 2, 4-D	Alligare Cody Herbicide	Alligare, LLC	81927-28
	Commando	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-92
	Curtail	Dow AgroSciences	62719-48
	Cutback	Nufarm Americas Inc.	71368-72
2, 4-D	2,4-D 4# Amine Weed Killer	UAP-Platte Chem. Co.	34704-120
	2,4-D Amine	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-72
	2,4-D Amine 4	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-19
	2,4-D Amine 4	Helena Agri-Enterprises, LLC (Helena Chemical Company)	42750-19-5905
	2,4-D LV 4	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-15
	2,4-D LV 6 Ester	Nufarm Americas Inc.	228-95
	2,4-D LV4	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-90
	2,4-D LV 6	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-20
	2,4-D LV6	Helena Agri-Enterprises, LLC (Helena Chemical Company)	42750-20-5905
	2,4-D LV6	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-93
	Alliagre 2,4-D Amine	Alligare, LLC	81927-38
	Alligare 2,4-D LV 6	Alligare, LLC	81927-39
	Aqua-Kleen	Nufarm Americas Inc.	71368-4
	Aqua-Kleen	Nufarm Americas Inc.	228-378
	Barrage HF	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-529
	Barrage LV Ester	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-504
	Base Camp Amine 4	Wilbur-Ellis Co., LLC (Wilbur-Ellis Co.)	71368-1-2935
	Base Camp LV6	Wilbur-Ellis Co., LLC (Wilbur-Ellis Co.)	2935-553
	Broadrange 55	Wilbur-Ellis Co., LLC (Wilbur-Ellis Co.)	2217-813-2935

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
2,4-D - continued	Clean Amine	Loveland Products Inc.	34704-120
	Clean Crop Amine 4	UAP-Platte Chem. Co.	34704-5 CA
	Clean Crop Low Vol 6 Ester	UAP-Platte Chem. Co.	34704-125
	Clean Crop LV-4 ES	UAP-Platte Chem. Co.	34704-124
	Cornbelt 4 lb. Amine	Van Diest Supply Co.	11773-2
	Cornbelt 4# LoVol Ester	Van Diest Supply Co.	11773-3
	Cornbelt 6# LoVol Ester	Van Diest Supply Co.	11773-4
	D-638	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-36
	Esteron 99C	Nufarm Americas Inc.	62719-9-71368
	Five Star	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-49
	Formula 40	Nufarm Americas Inc.	228-357
	Freelexx	Dow AgroSciences	62719-634
	HardBall	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-549
	Hi-Dep	PBI Gordon Corp.	2217-703
	Low Vol 4 Ester Weed Killer	Loveland Products Inc.	34704-124
	Low Vol 6 Ester Weed Killer	Loveland Products Inc.	34704-125
	Opti-Amine	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-501
	Platoon	Nufarm Americas Inc.	228-145
	Rugged	WinField-United (WinField Solutions, LLC)	1381-247
	Saber	Loveland Products Inc.	34704-803
	Salvo	Loveland Products Inc.	34704-609
	Salvo LV Ester	UAP-Platte Chem. Co.	34704-609
	Savage DS	Loveland Products Inc.	34704-606
	Savage DS	UAP-Platte Chem. Co.	34704-606
	Shredder 2,4-D LV4	WinField-United (WinField Solutions, LLC)	1381-102
	Shredder Amine 4	WinField-United (WinField Solutions, LLC)	1381-103
	Solution Water Soluble	Nufarm Americas Inc.	228-260
	Solve 2,4-D	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-22
	Unison	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-542
	Weedar 64	Nufarm Americas Inc.	71368-1
	WEEDestroy AM-40	Nufarm Americas Inc.	228-145
	Weedone LV-4	Nufarm Americas Inc.	228-139-71368
	Weedone LV-4 Solventless	Nufarm Americas Inc.	71368-14
	Weedone LV-6	Nufarm Americas Inc.	71368-11
	Whiteout 2,4-D	Loveland Products, Inc.	34704-1032
Dicamba	Alligare Cruise Control	Alligare, LLC	42750-40-81927
	Alligare Dicamba 4 Herbicide	Alligare, LLC	81927-55
	Banvel	Arysta LifeScience N.A. Corp.	66330-276
	Clarity	BASF Corporation	7969-137
	Diablo	Nufarm Americas Inc.	228-379
	Dicamba DMA	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-40

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Dicamba - continued	Kam-Ba	Drexel Chemical Company	19713-624
	Rifle	Loveland Products Inc.	34704-861
	Sterling Blue	WinField-United (WinField Solutions, LLC)	7969-137-1381
	Topeka	Rotam North America, Inc.	83100-34-83979
	Vanquish	Syngenta	100-884
	Vanquish Herbicide	Nufarm Americas Inc.	228-397
	Vision	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-576
Dicamba + 2, 4-D	Alligare Dicamba + 2,4-D DMA	Alligare, LLC	81927-42
	Brash	WinField-United (WinField Solutions, LLC)	1381-202
	Brush-Rhap	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-568
	Cimarron MAX - Part B	Bayer Environmental Science	432-1555
	Cimarron MAX - Part B	DuPont Crop Protection	352-615
	KambaMaster	Nufarm Americas Inc.	71368-34
	Latigo	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-564
	Outlaw	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-574
	Range Star	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-55
	Rifle-D	Loveland Products Inc.	34704-869
	Veteran 720	Nufarm Americas Inc.	228-295
	Weedmaster	Nufarm Americas Inc.	71368-34
Dicamba + Diflufenzopyr	Distinct	BASF Corporation	7969-150
	Overdrive	BASF Corporation	7969-150
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management* Lands in 17 Western *States Programmatic Environmental Impact Statement (PEIS), the aerial application of this herbicide* is prohibited.			
Diquat	Alligare Diquat Herbicide	Alligare, LLC	81927-43
	Diquat E-AG 2L	Nufarm Americas Inc.	79676-75
	Diquat E-Pro 2L	Nufarm Americas Inc.	79676-75
	Diquat SPC 2L Herbicide	Nufarm Americas Inc.	228-675
	Nufarm Diquat 2L Herbicide	Nufarm Americas Inc.	228-675
	Reward	Syngenta Professional Products	100-1091
Diuron	Alligare Diuron 4L	Alligare, LLC	81927-44
	Alligare Diuron 80DF	Alligare, LLC	81927-12
	Ceannard Diuron 80DF	Ceannard, Inc.	58035-16
	Direx 4L	DuPont Crop Protection	352-678
	Direx 4L	Makhteshim Agan of N. A. (ADAMA)	66222-54
	Diuron 4L	Drexel Chemical Company	19713-36

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Diuron - continued	Diuron 4L	Loveland Products Inc.	34704-854
	Diuron 4L	Makhteshim Agan of N. A. (ADAMA)	66222-54
	Diuron 80	Drexel Chemical Company	19713-274
	Diuron 80 WDG	Loveland Products Inc.	34704-648
	Diuron 80DF	WinField-United (WinField Solutions, LLC)	9779-318
	Diuron 80WDG	UAP-Platte Chem. Co.	34704-648
	Karmex DF	DuPont Crop Protection	352-692
	Karmex DF	Makhteshim Agan of N. A. (ADAMA)	66222-51
	Karmex IWC	DuPont Crop Protection	352-692
	Karmex XP	DuPont Crop Protection	352-692
	Parrot 4L	Makhteshim Agan of N. A. (ADAMA)	66222-54
	Parrot DF	Makhteshim Agan of N. A. (ADAMA)	66222-51
Fluridone	Alligare Fluridone	Alligare, LLC	81927-45
	Avast!	SePRO	67690-30
	Fluridone 4L	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-280
	Sonar AS	SePRO	67690-4
	Sonar Precision Release	SePRO	67690-12
	Sonar Q	SePRO	67690-3
	Sonar SRP	SePRO	67690-3
Fluroxypyr	Alligare Flagstaff	Alligare, LLC	81927-61
	Alligare Fluroxypyr	Alligare, LLC	66330-385-81927
	Comet Selective	Nufarm Americas Inc.	71368-87
	Vista XRT	Dow AgroSciences	62719-586
Fluroxypyr + 2,4-D + Dicamba	E-2 Herbicide	Nufarm Americas Inc.	228-442
Fluroxypyr + Clopyralid	Truslate Selective Herbicide	Nufarm Americas Inc.	71368-86
Fluroxypyr + Picloram	Alligare Triumph XTR Herbicide	Alligare , LLC	81927-64
	Surmount	Dow AgroSciences	62719-480
	Trooper Pro	Nufarm Americas Inc.	228-599
Fluroxypyr + Triclopyr	Alligare Cleargraze Pasture Herbicide	Alligare, LLC	81927-65
	PastureGard	Dow AgroSciences	62719-637
Glyphosate	Accord Concentrate	Dow AgroSciences	62719-324
	Accord SP	Dow AgroSciences	62719-322
	Accord XRT	Dow AgroSciences	62719-517
	Accord XRT II	Dow AgroSciences	62719-556
	Alligare Dryphosate 75SG	Alligare, LLC	81927-60
	Alligare Glyphosate 4 PLUS	Alligare, LLC	81927-9
	Alligare Glyphosate 5.4	Alligare, LLC	81927-8
	Aqua Neat	Nufarm Americas Inc.	228-365

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Glyphosate - continued	Aqua Star	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-59
	Aquamaster	Monsanto	524-343
	AquaPro Aquatic Herbicide	SePRO Corporation	62719-324-67690
	Buccaneer	Tenkoz	55467-10
	Buccaneer Plus	Tenkoz	55467-9
	Credit Xtreme	Nufarm Americas Inc.	71368-81
	Foresters	Nufarm Americas Inc.	228-381
	Gly Star Gold	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-61
	Gly Star Original	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-60
	Gly Star Plus	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-61
	Gly Star Pro	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-61
	Gly-4	Universal Crop Protection Alliance	42750-60-72693
	Gly-4 Plus	Universal Crop Protection Alliance	72693-1
	Gly-4 Plus	Universal Crop Protection Alliance	42750-61-72693
	GlyphoMate 41	PBI/Gordon Corporation	2217-847
	Glypro	Dow AgroSciences	62719-324
	Glypro Plus	Dow AgroSciences	62719-322
	Honcho	Monsanto	524-445
	Honcho Plus	Monsanto	524-454
	Imitator Aquatic	Drexel Chemical Company	19713-623
	Imitator DA	Drexel Chemical Company	19713-586
	Imitator Plus	Drexel Chemical Company	19713-526
	KleenUp Pro	Loveland Products, Inc.	34704-890
	Mad Dog Plus	Loveland Products, Inc.	34704-890
	Makaze	Loveland Products, Inc.	34704-890
	Mirage	Loveland Products Inc.	34704-889
	Mirage Herbicide	UAP-Platte Chem. Co.	524-445-34704
	Mirage Plus	Loveland Products Inc.	34704-890
	Rattler	Helena Agri-Enterprises, LLC (Helena Chemical Company)	524-445-5905
	Razor	Nufarm Americas Inc.	228-366
	Razor Pro	Nufarm Americas Inc.	228-366
	Rodeo	Dow AgroSciences	62719-324
	Roundup Custom	Monsanto	524-343
	Roundup Original	Monsanto	524-445
	Roundup Original II	Monsanto	524-454
	Roundup Original II CA	Monsanto	524-475
	Roundup PROMAX	Monsanto	524-579
	Roundup PRO	Monsanto	524-475
	Roundup PRO Concentrate	Monsanto	524-529
	Roundup PRO Dry	Monsanto	524-505
	Showdown	Helena Agri-Enterprises, LLC (Helena Chemical Company)	71368-25-5905

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Glyphosate + 2, 4-D	Campaign	Monsanto	524-351
	Imitator + 2,4-D	Drexel Chemical Company	19713-635
	Landmaster BW	Albaugh, LLC (Albuagh, Inc/Agri Star)	42570-62
	Landmaster BW	Monsanto	524-351
Hexazinone	Pronone 10G	Pro-Serve	33560-21
	Pronone 25G	Pro-Serve	33560-45
	Pronone MG	Pro-Serve	33560-21
	Pronone Power Pellet	Pro-Serve	33560-41
	Velosa	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5905-579
	Velpar DF	DuPont Crop Protection	352-581
	Velpar DF VU	Bayer Environmental Science	432-1576
	Velpar L	DuPont Crop Protection	352-392
	Velpar L VU	Bayer Environmental Science	432-1573
	Velpar ULW	DuPont Crop Protection	352-450
Hexazinone + Sulfometuron methyl	Oustar	Bayer Environmental Science	432-1553
	Oustar	DuPont Crop Protection	352-603
	Westar	Bayer Environmental Science	432-1558
	Westar	DuPont Crop Protection	352-626
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management* Lands in 17 Western *States Programmatic Environmental Impact Statement (PEIS), the aerial application of this herbicide* is prohibited.			
Imazapic	Alligare Panoramic 2SL	Alligare, LLC	66222-141-81927
	Nufarm Imazapic 2SL	Nufarm Americas Inc.	71368-99
	Open Range G	Wilbur-Ellis Co., LLC (Wilbur-Ellis Co.)	2935-557
	Plateau	BASF Corporation	241-365
Imazapyr	Alligare Ecomazapyr 2SL	Alligare, LLC	81927-22
	Alligare Imazapyr 4SL	Alligare, LLC	81927-24
	Alligare Rotary 2 SL	Alligare, LLC	
	Arsenal	BASF Corporation	241-346
	Arsenal Applicators Conc.	BASF Corporation	241-299
	Arsenal PowerLine	BASF Corporation	241-431
	Chopper	BASF Corporation	241-296
	EZ-JECT Copperhead Herbicide Shells	EZ-JECT, Inc.	83220-2
	Habitat	BASF Corporation	241-426
	Habitat Herbicide	SePRO	241-426-67690
	Polaris	Nufarm Americas Inc.	228-534
	Polaris AC	Nufarm Americas Inc.	241-299-228
	Polaris AC	Nufarm Americas Inc.	228-480
	Polaris AC Complete	Nufarm Americas Inc.	228-570

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Imazapyr - continued	Polaris AQ	Nufarm Americas Inc.	241-426-228
	Polaris Herbicide	Nufarm Americas Inc.	241-346-228
	Polaris RR	Nufarm Americas Inc.	241-273-228
	Polaris SP	Nufarm Americas Inc.	228-536
	Polaris SP	Nufarm Americas Inc.	241-296-228
	SSI Maxim Arsenal 0.5G	SSI Maxim Co., Inc.	34913-23
	SSI Maxim Arsenal 5.0 G	SSI Maxim Co., Inc.	34913-24
	Stalker	BASF Corporation	241-398
Imazapyr + Diuron	Alligare Mojave 70 EG	Alligare, LLC	81927-25
	Imazuron	Nufarm Americas Inc.	228-654
	Sahara DG	BASF Corporation	241-372
	SSI Maxim Topsite 2.5G	SSI Maxim Co., Inc.	34913-22
Imazapyr + Metsulfuron methyl	Lineage Clearstand	Bayer Environmental Science	432-1578
	Lineage Clearstand	DuPont Crop Protection	352-766
Imazapyr + Sulfometuron methyl +	Lineage HWC	Bayer Environmental Science	432-1577
Metsulfuron methyl	Lineage HWC	DuPont Crop Protection	352-765
	Lineage Prep	Bayer Environmental Science	432-1579
	Lineage Prep	DuPont Crop Protection	352-767
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management* Lands in 17 Western *States Programmatic Environmental Impact Statement (PEIS), the aerial application of this herbicide* is prohibited.			
Metsulfuron methyl	Alligare MSM 60	Alligare, LLC	81927-7
	AmTide MSM 60DF Herbicide	AmTide, LLC	83851-3
	Cimarron MAX - Part A	Bayer Environmental Science	432-1555
	Cimarron MAX - Part A	DuPont Crop Protection	352-615
	Escort XP	Bayer Environmental Science	432-1549
	Escort XP	DuPont Crop Protection	352-439
	Patriot	Nufarm Americas Inc.	228-391
	PureStand	Nufarm Americas Inc.	71368-38
	Rometsol	Rotam North America, Inc.	831000-2-83979
Metsulfuron methyl + Chlorsulfuron	Cimarron Plus	Bayer Environmental Science	432-1572
	Cimarron Plus	DuPont Crop Protection	352-670
	Cimarron X-tra	DuPont Crop Protection	352-669
Picloram	Alligare Picloram 22K	Alligare, LLC	81927-18
	Grazon PC	Dow AgroSciences	62719-181
	OutPost 22K	Dow AgroSciences	62719-6
	Tordon 22K	Dow AgroSciences	62719-6
	Tordon K	Dow AgroSciences	62719-17

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Picloram - continued	Triumph 22K	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-79
	Triumph K	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-81
	Trooper 22K	Nufarm Americas Inc.	228-535
Picloram + 2, 4-D	Alligare Picloram + D	Alligare, LLC	81927-16
	Graslan L	Dow AgroSciences	62719-655
	Grazon P+D	Dow AgroSciences	62719-182
	GunSlinger	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-80
	HiredHand P+D	Dow AgroSciences	62719-182
	Pathway	Dow AgroSciences	62719-31
	Tordon 101 Mixture	Dow AgroSciences	62719-5
	Tordon RTU	Dow AgroSciences	62719-31
	Trooper P + D	Nufarm Americas Inc.	228-530
Picloram + 2, 4-D + Dicamba	Trooper Extra	Nufarm Americas Inc.	228-586
Rimsulfuron	Alligare Laramie 25DF	Alligare, LLC	81927-57
	Hinge	Rotam Borth America, Inc.	83100-40-83979
	Matrix SG	Dupont Crop Protection	352-768
Sulfometuron methyl	Alligare SFM 75	Alligare, LLC	81927-26
	Oust XP	Bayer Environmenatl Science	432-1552
	Oust DF	DuPont Crop Protection	352-401
	Oust XP	DuPont Crop Protection	352-601
	Spyder	Nufarm Americas Inc.	228-408
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management* Lands in 17 Western *States Programmatic Environmental Impact Statement (PEIS), the aerial application of this herbicide* is prohibited.			
Sulfometuron methyl + Chlorsulfuron	Landmark XP	Bayer Environmental Science	432-1560
	Landmark XP	DuPont Crop Protection	352-645
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management* Lands in 17 Western *States Programmatic Environmental Impact Statement (PEIS), the aerial application of this herbicide* is prohibited.			

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Sulfometuron methyl + Metsulfuron methyl	Alligare SFM Extra	Alligare, LLC	81927-5
	Oust Extra	Bayer Environmental Science	432-1557
	Oust Extra	DuPont Crop Protection	352-622
	Spyder Extra Selective	Nufarm Americas Inc.	228-690
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management* Lands in 17 Western *States Programmatic Environmental Impact Statement (PEIS), the aerial application of this herbicide* is prohibited.			
Tebuthiuron	Alligare Tebuthiuron 20 P	Alligare, LLC	81927-41
	Alligare Tebuthiuron 80 WG	Alligare, LLC	81927-37
	Spike 20P	Dow AgroSciences	62719-121
	Spike 80DF	Dow AgroSciences	62719-107
	SpraKil S-5 Granules	SSI Maxim Co., Inc.	34913-10
Tebuthiuron + Diuron	SpraKil SK-13 Granular	SSI Maxim Co., Inc.	34913-15
	SpraKil SK-26 Granular	SSI Maxim Co., Inc.	34913-16
Triclopyr	Alligare Boulder 6.3	Alligare, LLC	81927-54
	Alligare Triclopry 4	Alligare, LLC	81927-11
	Alligare Triclopyr 3	Alligare, LLC	81927-13
	Element 3A	Dow AgroSciences	62719-37
	Element 4	Dow AgroSciences	62719-40
	Forestry Garlon XRT	Dow AgroSciences	62719-553
	Garlon 3A	Dow AgroSciences	62719-37
	Garlon 4	Dow AgroSciences	62719-40
	Garlon 4 Ultra	Dow AgroSciences	62719-527
	Pathfinder II	Dow AgroSciences	62719-176
	Relegate	Nufarm Americas Inc.	228-521
	Relegate RTU	Nufarm Americas Inc.	228-522
	Remedy	Dow AgroSciences	62719-70
	Remedy Ultra	Dow AgroSciences	62719-552
	Renovate 3	SePRO Corporation	62719-37-67690
	Renovate OTF	SePRO Corporation	67690-42
	Tahoe 3A	Nufarm Americas Inc.	228-520
	Tahoe 4E	Nufarm Americas Inc.	228-385
	Tahoe 4E Herbicide	Nufarm Americas Inc.	228-517
	Triclopyr RTU	Albaugh, LLC (Albuagh, Inc/Agri Star)	42750-173
	Trycera	Helena Agri-Enterprises, LLC (Helena Chemical Company)	5906-580
	Vastlan	Dow AgroSciences	62719-687

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER	EPA REG. NUMBER
Triclopyr + 2, 4-D	Alligare Everett	Alligare, LLC	81927-29
	Aquasweep	Nufarm Americas Inc.	228-316
	Candor	Nufarm Americas Inc.	228-565
	Crossbow	Dow AgroSciences	62719-260
Triclopyr + Clopyralid	Alligare Prescott Herbicide	Alligare, LLC	81927-30
	Brazen	Nufarm Americas Inc.	228-564
	Redeem R&P	Dow AgroSciences	62719-337

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 51 02 83

HAZARDOUS MATERIALS SURVEY AND ANALYTICAL RESULTS

PART 1 GENERAL

1.01 FOR INFORMATION ONLY

A. The hazardous materials detailed in these results were removed in the NGWSP Reach 1 Pipeline Repair project. Information is provided for contractor knowledge.

1.02 SURVEYS CONDUCTED.

A. Two properties were surveyed:

1. The Shaw property, located at 36.760458, -108.448676, latitude / longitude, WGS84 and consists of three structures and a debris pile.
2. The Weathers property, property two of two, located at 36.752889, -108.447944, latitude / longitude, WGS84 and consists of one structure.

B. The Shaw property is covered in 1.02 and the Weathers property is covered in 1.03.

1.03 SHAW SURVEY AND ANALYTICAL RESULTS

A. Hazardous Materials Survey and Analytical Results are provided.

B. The Shaw property is one of two properties that are slated to be demolished so asbestos building surveys were performed at each. The Shaw property, located at 36.760458, -108.448676, latitude / longitude, WGS84 and consists of three structures and a refuse pile. See Figure 1 for the location of each Shaw property related buildings.

1. Building 1 is the northern most building, constructed of cinderblock.
2. Building 2 is the shed located between buildings 1 and 3.
3. Building 3 is the third building which is a trailer on the south end of the property.
4. Building 4 is the fourth item which is a refuse pile to the west of the shed.

C. After the summary of findings table, there are pictures of the features and samples locations. Table 51 02 83 - 2 has the entire analytical results list. Following that are copies of the laboratory analytical reports.

1. The coating sample was analyzed for lead and asbestos. Lead was detected but the levels were low, ranging from 11.6 milligrams per kilogram (mg/kg) to 2,570 mg/kg.
2. The remainder of the samples were analyzed for asbestos. Friable asbestos was detected in the interior drywall and roofing materials of Building 1.
3. Electrical light ballasts do not contain PCBs.

D. Summary of findings:

Table 51 02 83 - 1, Summary of Analytical Results for the Shaw Property.

Sample No.	Sample Location	Description	Material	Asbestos	Lead
NGSH0010	Building 1, interior wall	White	Drywall and carpet	X	-
NGSH0011	Building 1, interior wall	White	Drywall and carpet	ND	-
NGSH0012	Building 1, interior wall	White	Drywall and carpet	ND	-
NGSH0020	Building 1, kitchen	White	Drywall and plastic paneling	ND	-
NGSH0021	Building 1, kitchen	White	Drywall and plastic paneling	ND	-
NGSH0022	Building 1, kitchen	White	Drywall and plastic paneling	ND	-
NGSH0030	Building 1 ceiling	White	Drywall	ND	-
NGSH0031	Building 1 ceiling	White	Drywall	ND	-
NGSH0032	Building 1 ceiling	White	Drywall	X	-
NGSH0040	Building 1 flooring	Brown/gray	Vinyl flooring, mastic, subfloor	ND	-
NGSH0041	Building 1 flooring	Brown/gray	Vinyl flooring, mastic, subfloor	ND	-
NGSH0042	Building 1 flooring	Brown/gray	Vinyl flooring, mastic, subfloor	ND	-
NGSH0050	Building 1, exterior window frame	Dark brown	Coating	ND	X
NGSH0051	Building 1, exterior window frame	Dark brown	Coating	ND	-
NGSH0052	Building 1, exterior window frame	Dark brown	Coating	ND	-
NGSH0060	Building 1, exterior	White	Coating	ND	X
NGSH0061	Building 1, exterior	White	Coating	ND	-
NGSH0062	Building 1, exterior	White	Coating	ND	-
NGSH0070	Building 1, roof	Brown/black	Roof shingle, felt	ND	-
NGSH0071	Building 1, roof	Brown/black	Roof shingle, felt	X	-
NGSH0072	Building 1, roof	Brown/black	Roof shingle, felt	ND	-
NGSH0080	Building 1, ceiling	Brown/gray	Blown in insulation	ND	-
NGSH0081	Building 1, ceiling	Brown/gray	Blown in insulation	ND	-
NGSH0082	Building 1, ceiling	Brown/gray	Blown in insulation	ND	-
NGSH0090	Building 2, exterior	Pink	Building material	ND	-
NGSH0091	Building 2, exterior	Pink	Building material	ND	-

Table 51 02 83 - 1, Summary of Analytical Results for the Shaw Property.

Sample No.	Sample Location	Description	Material	Asbestos	Lead
NGSH0092	Building 2, exterior	Pink	Building material	ND	-
NGSH0100	Building 2, exterior	Gray	Building material	ND	-
NGSH0101	Building 2, exterior	Gray	Building material	ND	-
NGSH0102	Building 2, exterior	Gray	Building material	ND	-
NGSH0110	Building 3, walls	Yellow/white	Drywall and coating	ND	-
NGSH0111	Building 3, walls	Yellow/white	Drywall and coating	ND	-
NGSH0112	Building 3, walls	Yellow/white	Drywall and coating	ND	-

Notes:
- : Not tested
X: detected
ND: tested but not detected

E. Sampling pictures from the Shaw property.

Figure 1. Location of the Shaw property. The four buildings are marked with blue dots.

F. Building 1, Cinderblock house at north end of property.

Figure 2. View of "Building 1," the cinderblock house. Samples were collected inside and outside.

Figure 3. View inside Building 1. The kitchen is to the immediate right and the bathroom is at the end.

Figure 4. Sample NGSH0010 was collected from the wall material. The arrow points to the location. Note the light ballast, it does not contain PCB's (circled).

Figure 5. View of sample NGSH0010. The wall construction material is carpet over rigid foam board.

Figure 6. Sample NGSH0011 was collected from wallboard inside the bathroom, on the east side.

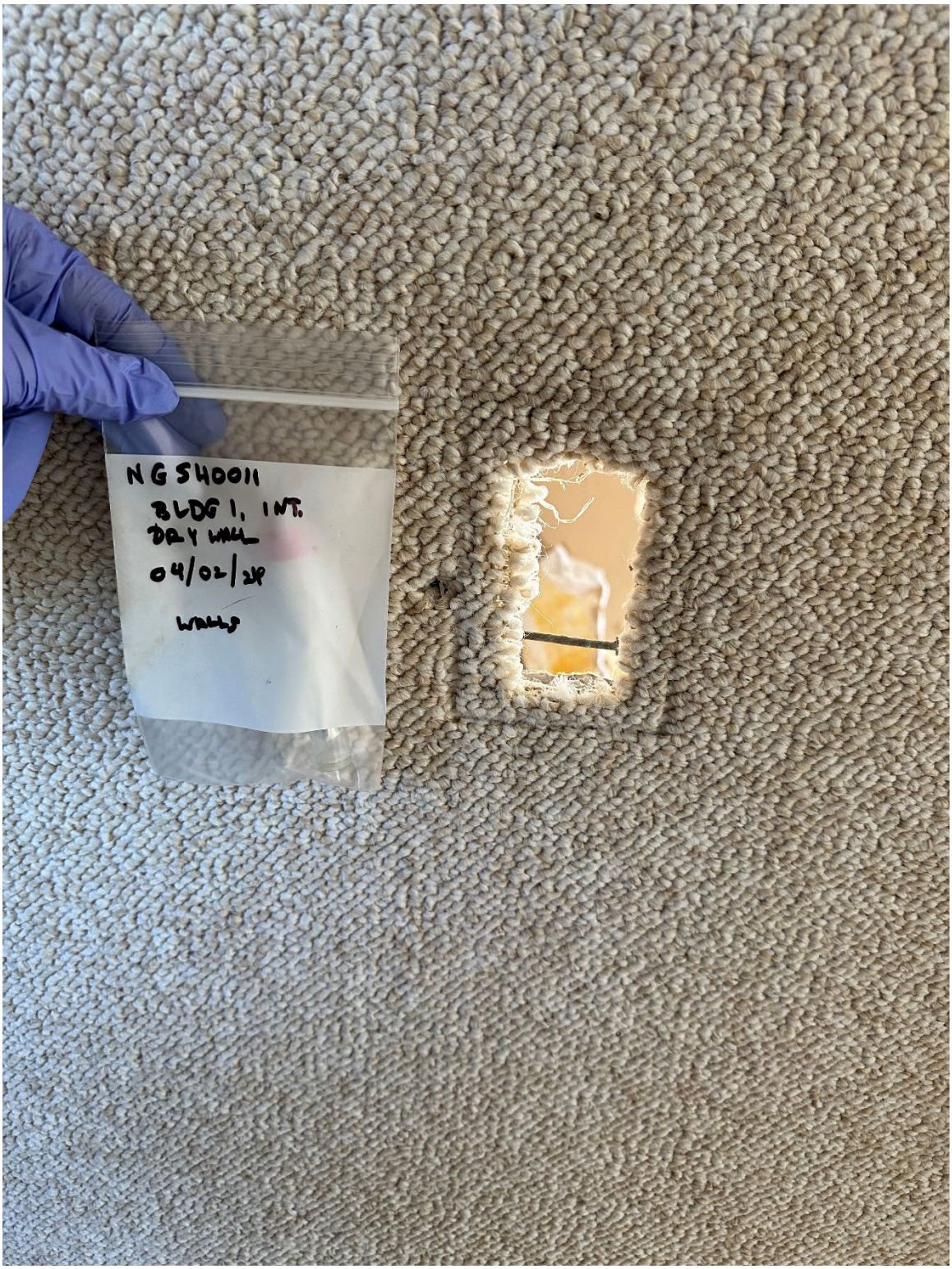

Figure 7. Picture of sample NGSH0011. This wall construction material was carpet over drywall.

Figure 8. Sample NGSH0012 was collected from wallboard in this alcove. The kitchen is to the left.

Figure 9. This is sample NGSH0012, collected from the interior building wall, on the east side of the kitchen.

Figure 10. Sample NGSH0020 was collected from drywall in the southside of the kitchen. The arrow points to the sample bag which is next to the sample location.

Figure 11. Sample NGSH0021 was collected from lower wallboard, below the carpet, in the bathroom. The lower wall covering is a plastic paneling over drywall. Note the light fixture in the background. Note the arrow.

Figure 12. The light fixture ballast does not contain PCB's. The arrow points to the marking.

Figure 13. Sample NGSH0022 was collected from wallboard in the kitchen.

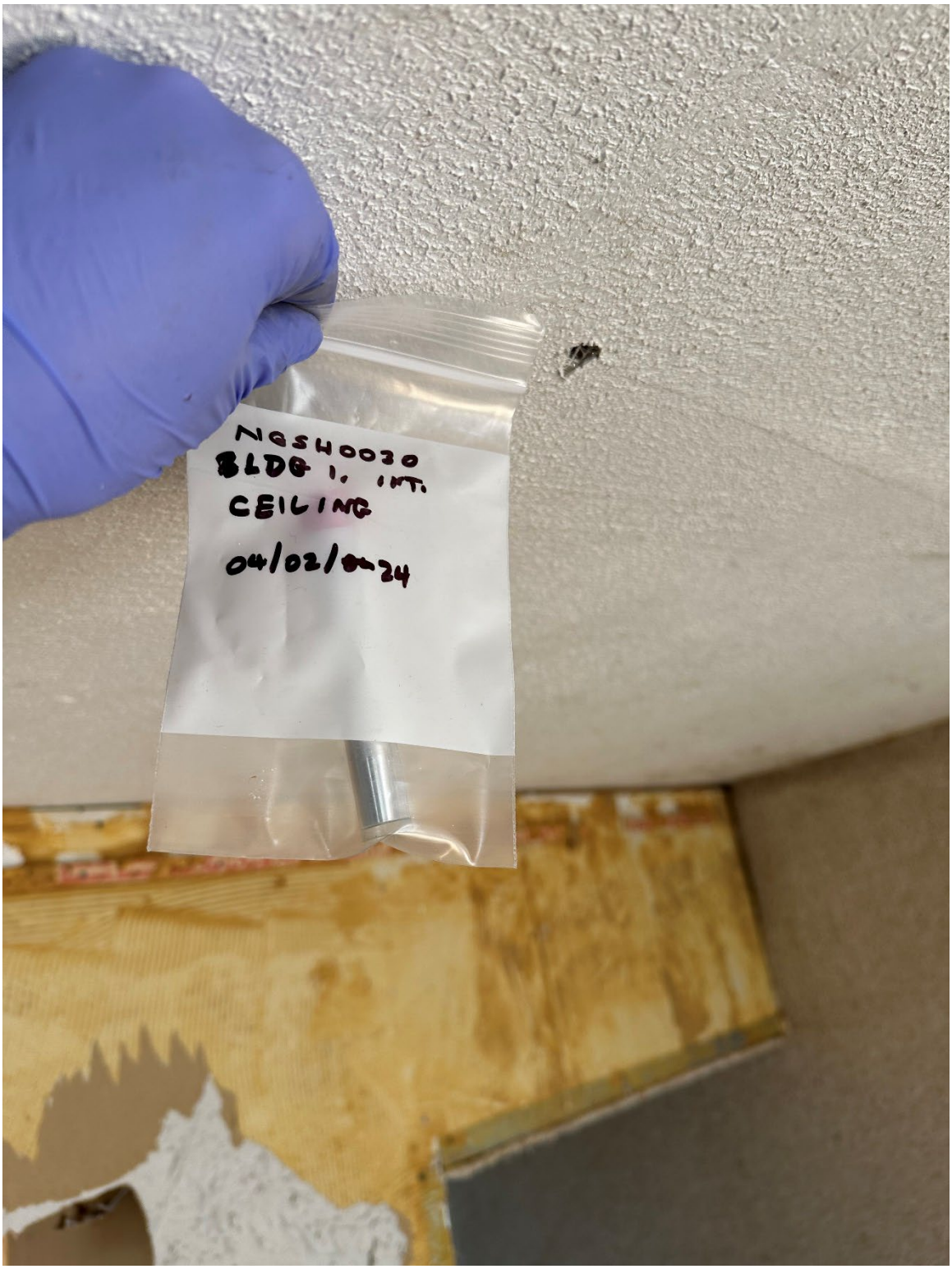

Figure 14. Sample NGSH0030 was collected from the ceiling wallboard, across from the kitchen.

Figure 15. Sample NGSH0031 was collected from ceiling wallboard near a lighting fixture electrical box near the entrance.

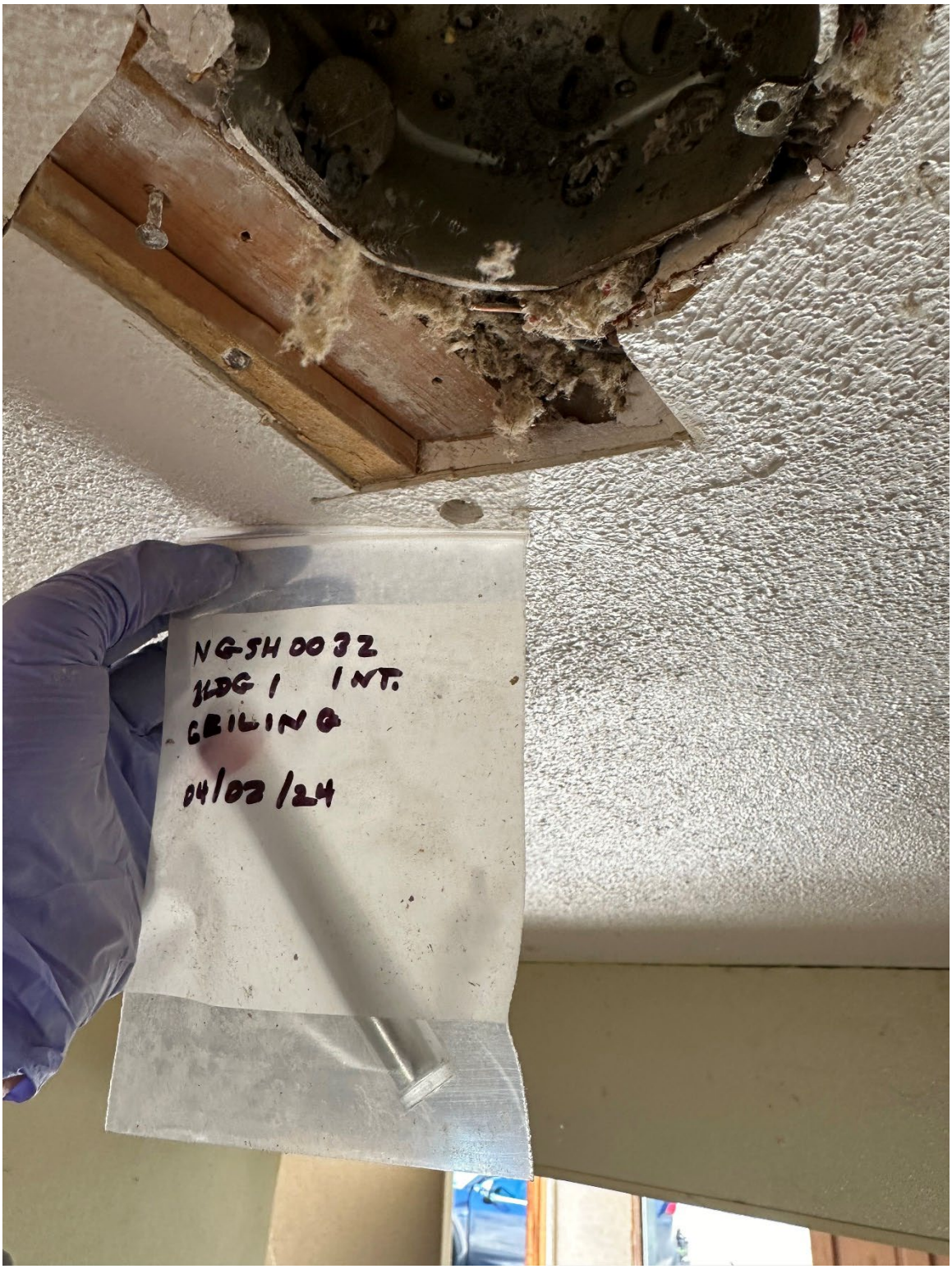

Figure 16. Sample NGSH0032 was collected near another ceiling light fixture electrical box on the west side.

Figure 17. Sample NGSH0040 was collected from the flooring material and mastic. The arrow marks the location.

Figure 18. Sample NGSH0041 was collected from flooring material in the shower area.

Figure 19. Sample NGSH0042 was collected from the flooring material at the entrance.

Figure 20. Samples NGSH0050, NGSH0051, and NGSH0052 were collected from the exterior coating around the windows. They are numbered from left to right. See the arrows.

Figure 21. Sample NGSH0061 was collected from the Building 1 exterior off white eave and block coating on the west side. There is no photograph of NGSH0060.

Figure 22. Sample NGSH0062 was collected from the off-white eave and block coating on the east side.

Figure 23. Sample NGSH0070 was collected from the roofing material on the southeast corner.

Figure 24. Sample NGSH0071 was collect from the roofing material on the northeast side.

Figure 25. Sample NGSH0072 was collected from roofing material on the southwest corner.

Figure 26. Sample NGSH0080 was collected from the attic insulation on the east side.

Figure 27. Sample NGSH0081 was collected from ceiling insulation on the south side, behind the ceiling.

Figure 28. Sample NGSH0082 was collected from attic insulation at a ceiling fixture electrical box near the entrance.

G. Building 2, the shed, on the east side of the property.

Figure 29. This is Building 2, the shed. The materials are marked with an arrow.

Figure 30. Samples NGSH0090, NGSH0091, and NGSH0092 were collected from a pinkish material. The sample bags are laying in front of it. See the arrows marking them, from left to right.

Figure 31. Sample NGSH0100 was collected from a grayish material. It is the bag to the right. The material sampled is to the right of the bag, marked with an arrow.

Figure 32. Sample NGSH0101 was collected from scattered grayish material.

Figure 33. Sample NGSH0102 was collected from a grayish material located above the sample bag.

H. Building 3, the trailer, at the south end of the property.

Figure 34. A view of Building 3, the trailer.

Figure 35. This is a view inside Building 3, the trailer. The door shown at image right, is the secondary exterior door. The main exterior door is located behind to the right of the photo's perspective. The bathroom is not visible in the above photo, but it located on the other side (from photo's perspective) of the yellow wall in the background.

Figure 36. Sample NGSH0110 was collected near the electrical box. This is marked with an arrow.

Figure 37. This is a closer view of sample NGSH0110. The arrow shows the sample location.

Figure 38. Sample NGSH0111 was collected from wallboard near the door on the southwest side.

Figure 39. View inside one of the fluorescent light fixtures. These still contain the fluorescent lamps.

Figure 40. View of a ballast inside one of the lights. It is marked "No PCBs."

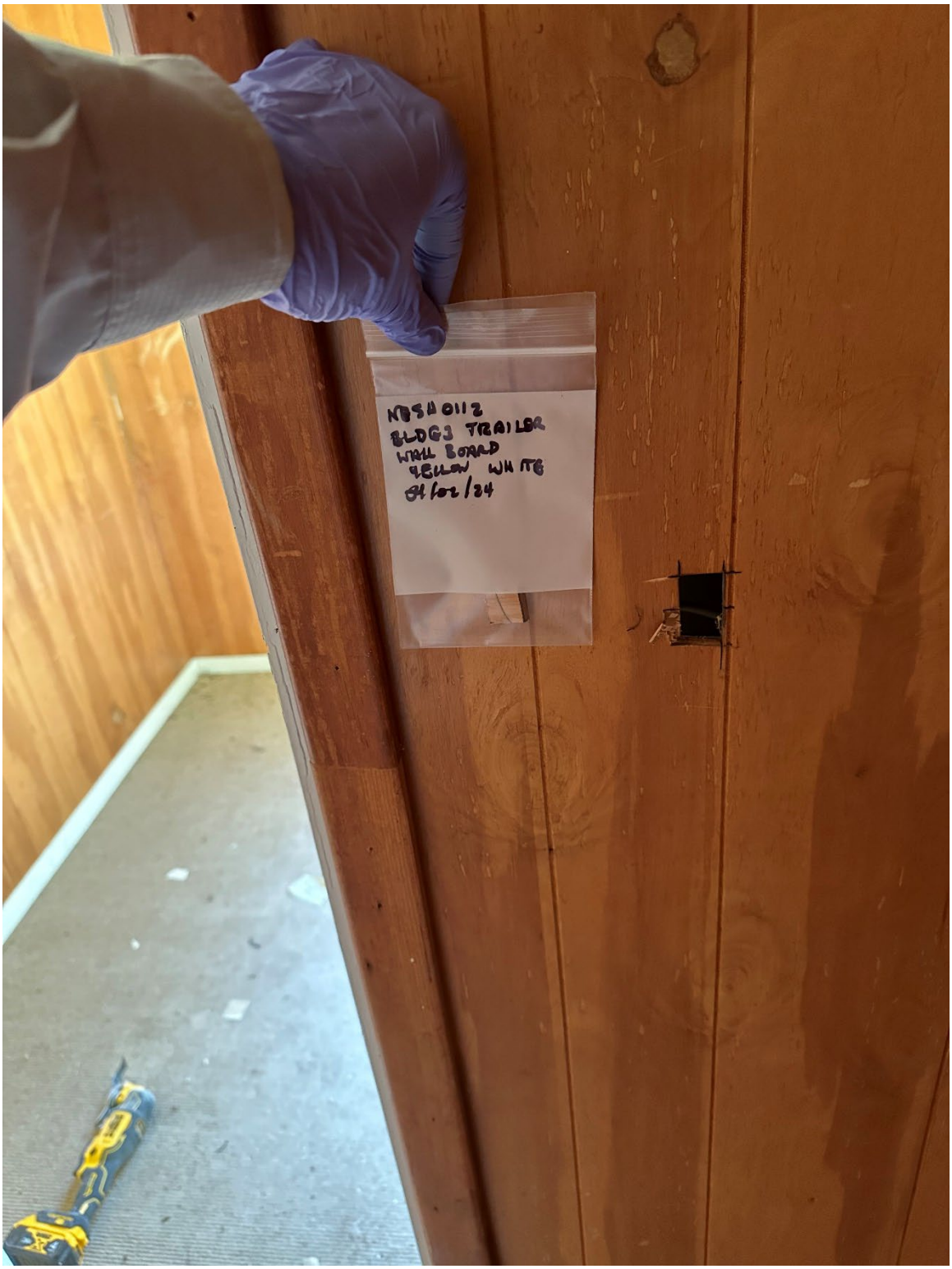

Figure 41. Sample NGSH0112 was collected from interior wallboard inside the trailer.

I. Debris pile (Building 4)

Figure 42. This is the debris pile, located to the west of the shed, and south of Building 1.

Figure 43. These are a stack of 4-foot fluorescent lights. The labels on the ballasts have been worn away.

Figure 44. Picture of one of the fluorescent light ballasts with a semi-legible label noting "no PCB's."

Figure 45. The bottom of the ballast label notes no PCB's. The lights are all of the same manufacturer.

Figure 46. To the left of the stack of fluorescent lights is a refrigerator which may have coolant. The red arrow points to it.

J. Complete analytical results for the Shaw property.

Table 51 02 83 - 2, Complete Analytical Results for the Shaw Property.

Sample No.	Sample Location	Description	Material	Method	Analyte	Results	Units
NGSH0010	Building 1, interior wall	White	Drywall and carpet	EPA 600/R-93-116	Asbestos	2	%
NGSH0011	Building 1, interior wall	White	Drywall and carpet	EPA 600/R-93-116	Asbestos	ND	%
NGSH0012	Building 1, interior wall	White	Drywall and carpet	EPA 600/R-93-116	Asbestos	ND	%
NGSH0020	Building 1, kitchen	White	Drywall and plastic paneling	EPA 600/R-93-116	Asbestos	ND	%
NGSH0021	Building 1, kitchen	White	Drywall and plastic paneling	EPA 600/R-93-116	Asbestos	ND	%
NGSH0022	Building 1, kitchen	White	Drywall and plastic paneling	EPA 600/R-93-116	Asbestos	ND	%
NGSH0030	Building 1 ceiling	White	Drywall	EPA 600/R-93-116	Asbestos	ND	%
NGSH0031	Building 1 ceiling	White	Drywall	EPA 600/R-93-116	Asbestos	ND	%
NGSH0032	Building 1 ceiling	White	Drywall	EPA 600/R-93-116	Asbestos	2.25	%
NGSH0040	Building 1 flooring	Brown/gray	Vinyl flooring, mastic, subfloor	EPA 600/R-93-116	Asbestos	ND	%
NGSH0041	Building 1 flooring	Brown/gray	Vinyl flooring, mastic, subfloor	EPA 600/R-93-116	Asbestos	ND	%
NGSH0042	Building 1 flooring	Brown/gray	Vinyl flooring, mastic, subfloor	EPA 600/R-93-116	Asbestos	ND	%
NGSH0050	Building 1, exterior window frame	Dark brown	Coating	EPA 600/R-93-116	Asbestos	ND	%
NGSH0050	Building 1, exterior window frame	Dark brown	Coating	EPA 6010	Lead	11.6	mg/kg
NGSH0051	Building 1, exterior window frame	Dark brown	Coating	EPA 600/R-93-116	Asbestos	ND	%

Table 51 02 83 - 2, Complete Analytical Results for the Shaw Property.

Sample No.	Sample Location	Description	Material	Method	Analyte	Results	Units
NGSH0052	Building 1, exterior window frame	Dark brown	Coating	EPA 600/R-93-116	Asbestos	ND	%
NGSH0060	Building 1, exterior	White	Coating	EPA 600/R-93-116	Asbestos	ND	%
NGSH0060	Building 1, exterior	White	Coating	EPA 6010	Lead	2570	mg/kg
NGSH0061	Building 1, exterior	White	Coating	EPA 600/R-93-116	Asbestos	ND	%
NGSH0062	Building 1, exterior	White	Coating	EPA 600/R-93-116	Asbestos	ND	%
NGSH0070	Building 1, roof	Brown/black	Roof shingle, felt	EPA 600/R-93-116	Asbestos	ND	%
NGSH0071	Building 1, roof	Brown/black	Roof shingle, felt	EPA 600/R-93-116	Asbestos	12	%
NGSH0072	Building 1, roof	Brown/black	Roof shingle, felt	EPA 600/R-93-116	Asbestos	ND	%
NGSH0080	Building 1, ceiling	Brown/gray	Blown in insulation	EPA 600/R-93-116	Asbestos	ND	%
NGSH0081	Building 1, ceiling	Brown/gray	Blown in insulation	EPA 600/R-93-116	Asbestos	ND	%
NGSH0082	Building 1, ceiling	Brown/gray	Blown in insulation	EPA 600/R-93-116	Asbestos	ND	%
NGSH0090	Building 2, exterior	Pink	Building material	EPA 600/R-93-116	Asbestos	ND	%
NGSH0091	Building 2, exterior	Pink	Building material	EPA 600/R-93-116	Asbestos	ND	%
NGSH0092	Building 2, exterior	Pink	Building material	EPA 600/R-93-116	Asbestos	ND	%
NGSH0100	Building 2, exterior	Gray	Building material	EPA 600/R-93-116	Asbestos	ND	%
NGSH0101	Building 2, exterior	Gray	Building material	EPA 600/R-93-116	Asbestos	ND	%
NGSH0102	Building 2, exterior	Gray	Building material	EPA 600/R-93-116	Asbestos	ND	%
NGSH0110	Building 3, walls	Yellow/white	Drywall and coating	EPA 600/R-93-116	Asbestos	ND	%
NGSH0111	Building 3, walls	Yellow/white	Drywall and coating	EPA 600/R-93-116	Asbestos	ND	%
NGSH0112	Building 3, walls	Yellow/white	Drywall and coating	EPA 600/R-93-116	Asbestos	ND	%

Notes:

ND: not detected.
mg/kg: milligrams per kilogram
%: percent

1.04 WEATHERS PROPERTY SURVEY AND ANALYTICAL RESULTS

A. The Weathers property, property two of two, located at 36.752889, -108.447944, latitude / longitude, WGS84 and consists of one structure.

B. After the summary of findings table for the Weathers Property are pictures of the features and sample locations. Table 51 02 83 - 4 has the entire list of analytical results for the Weathers property.

1. For the sample locations, the bedrooms and bathrooms are numbered from one to three, west to east.

2. The samples were analyzed for asbestos. The samples which tested positive are friable. One of the samples was above the regulatory limit.

C. Summary of findings:

Table 51 02 83 - 3, Summary of Analytical Results for the Weathers Property.

Sample No.	Sample Location	Description	Material	Asbestos
NGW001A	Bathroom 1 wall, east wall	White / yellow	Wallpaper over wood paneling	ND
NGW001B	Bathroom 1 wall, north wall in shower/tub area	Gold	Wallpaper over wood paneling	ND
NGW001C	Bathroom 2 wall, west, above toilet	White / yellow	Wallpaper over wood paneling	ND
NGW002A	East of front door, in hallway	Yellow/red/tan	Flooring	ND
NGW002B	Kitchen	Black/yellow	Flooring	ND
NGW002C	Bedroom 1 closet	Yellow/red/tan	Flooring	ND
NGW003A	Living room, south wall	Brown	Wall paneling	ND
NGW003B	Living room, north wall	Brown	Wall paneling	ND
NGW003C	Living room, south wall	Brown	Wall paneling	ND
NGW003D	Living room, east wall	White	Wall paneling	ND
NGW004A	Bedroom 1, wall, east	Tan	Wall paneling	ND
NGW004B	Bedroom 2, wall, north	Tan	Wall paneling	ND
NGW004C	Bedroom 2, wall, east	Tan	Wall paneling	ND
NGW005A	Kitchen south wall, above the end of the counter	Yellow/red/blue	Wallpaper over wood paneling	ND
NGW005B	South wall above kitchen sink	Yellow/red/blue	Wallpaper over wood paneling	ND
NGW005C	West wall, in between kitchen cabinets	Yellow/red/blue	Wallpaper over wood paneling	ND
NGW006A	Living room	White	Ceiling tile	ND
NGW006B	Bedroom 1	White	Ceiling tile	ND

Table 51 02 83 - 3, Summary of Analytical Results for the Weathers Property.

Sample No.	Sample Location	Description	Material	Asbestos
NGW006C	Bedroom 2	White	Ceiling tile	ND
NGW007A	Roofing, southeast corner	White/black	Roofing	X*
NGW007B	Roofing, northeast corner	White/black	Roofing	X
NGW007C	Roofing, southwest corner	White/black	Roofing	X*
NGW008A	Siding, north side	Tan/brown	Siding	ND
NGW008B	Siding, east side	Tan/brown	Siding	ND
NGW008C	Siding, south side	Tan/brown	Siding	ND

Notes:

ND: Not detected.
X*: detected, below regulatory limit.
X: detected above the regulatory limit.

D. Sampling pictures from the Weathers property.

Figure 47. Sample NGW001A was collected from the bathroom 1 east wall.

Figure 48. NGW001B was collected from the bathroom 1 wall, on the north wall in shower/tub area.

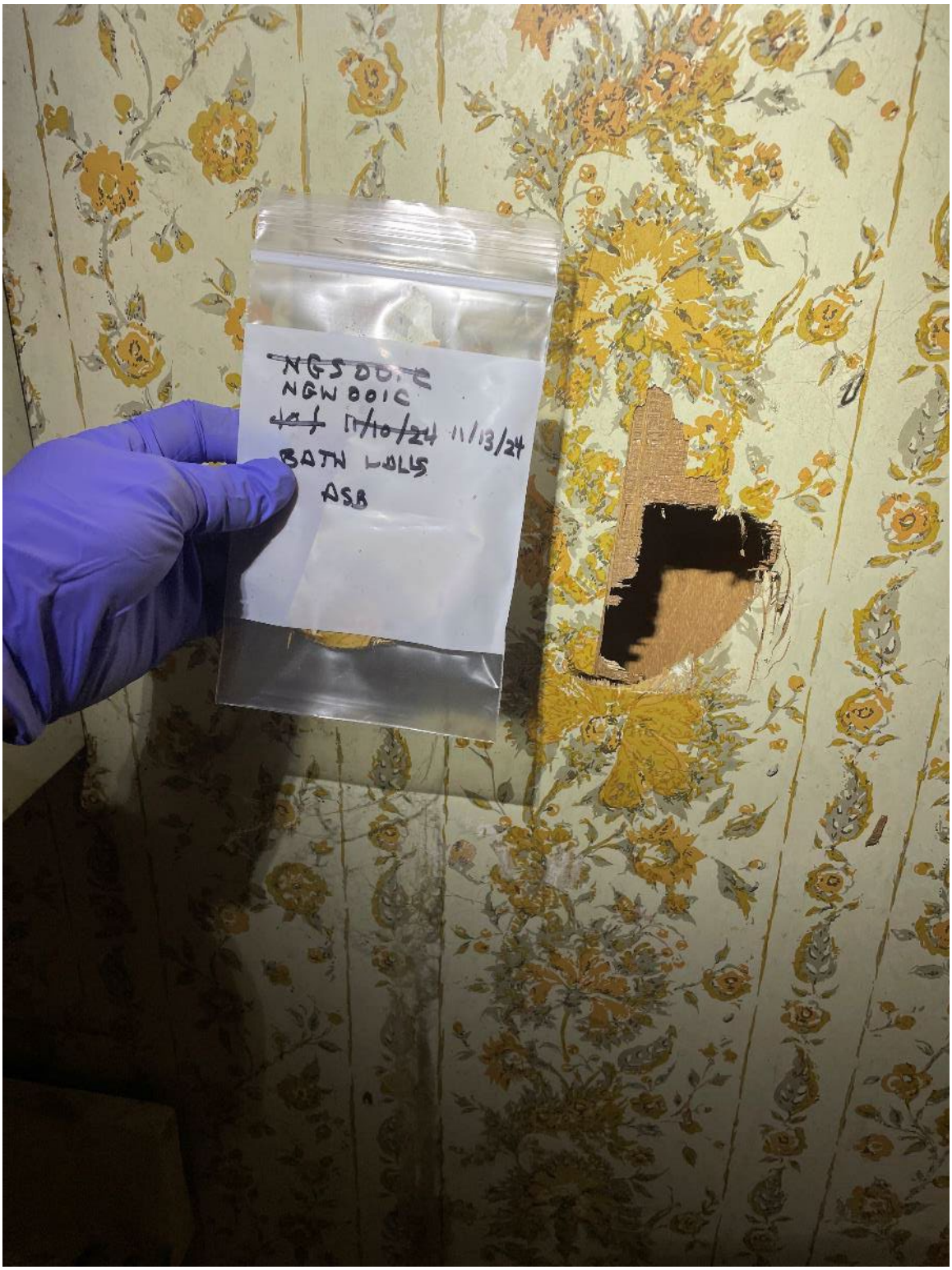

Figure 49. NGW001C was collected from the bathroom 2 wall, west, above the toilet.

Figure 50. NGW002A was collected from the hallway flooring, photo right of the front door which is on the left side of the photo. The living room is forward, in the background of photo. Behind the living room is the kitchen, not visible in photo.

Figure 51. NGW002B was collected from the kitchen flooring.

Figure 52. NGW002C was collected from the bedroom 1 closet flooring.

Figure 53. NGW003A was collected from the living room south wall paneling.

Figure 54. NGW003B was collected from the living room north wall paneling.

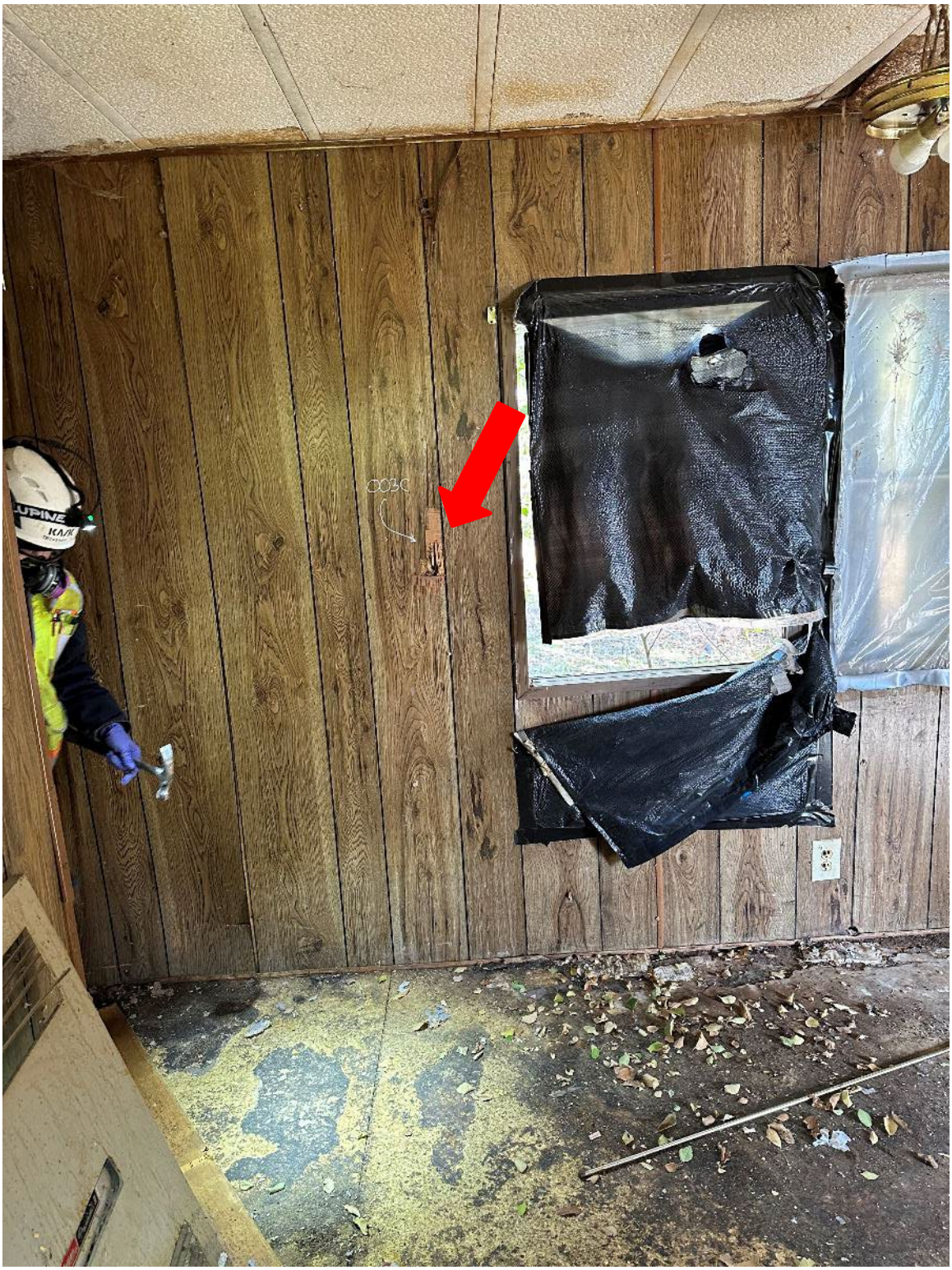

Figure 55. NGW003C was collected from the living room south wall paneling.

Figure 56. NGW003D was collected from the living room east wall paneling. Note the arrow.

Figure 57. NGW004A was collected from the bedroom 1 east wall paneling. Note the arrow.

Figure 58. NGW004B was collected from the bedroom 2 north wall paneling. Note the arrow.

Figure 59. NGW004C was collected from the bedroom 2 east wall paneling. Note the arrow.

Figure 60. NGW005A was collected from the kitchen south wall, above the end of the counter wallpaper over the wood paneling. Note the arrow.

Figure 61. NGW005B was collected from the south wall above kitchen sink wallpaper over wood paneling.

Figure 62. NGW005C was collected from the west wall, in between kitchen cabinets wallpaper over wood paneling.

Figure 63. NGW006A was collected from the living room ceiling tile.

Figure 64. NGW006B was collected from the bedroom 1 ceiling tile.

Figure 65. NGW006C was collected from the bedroom 2 ceiling tile.

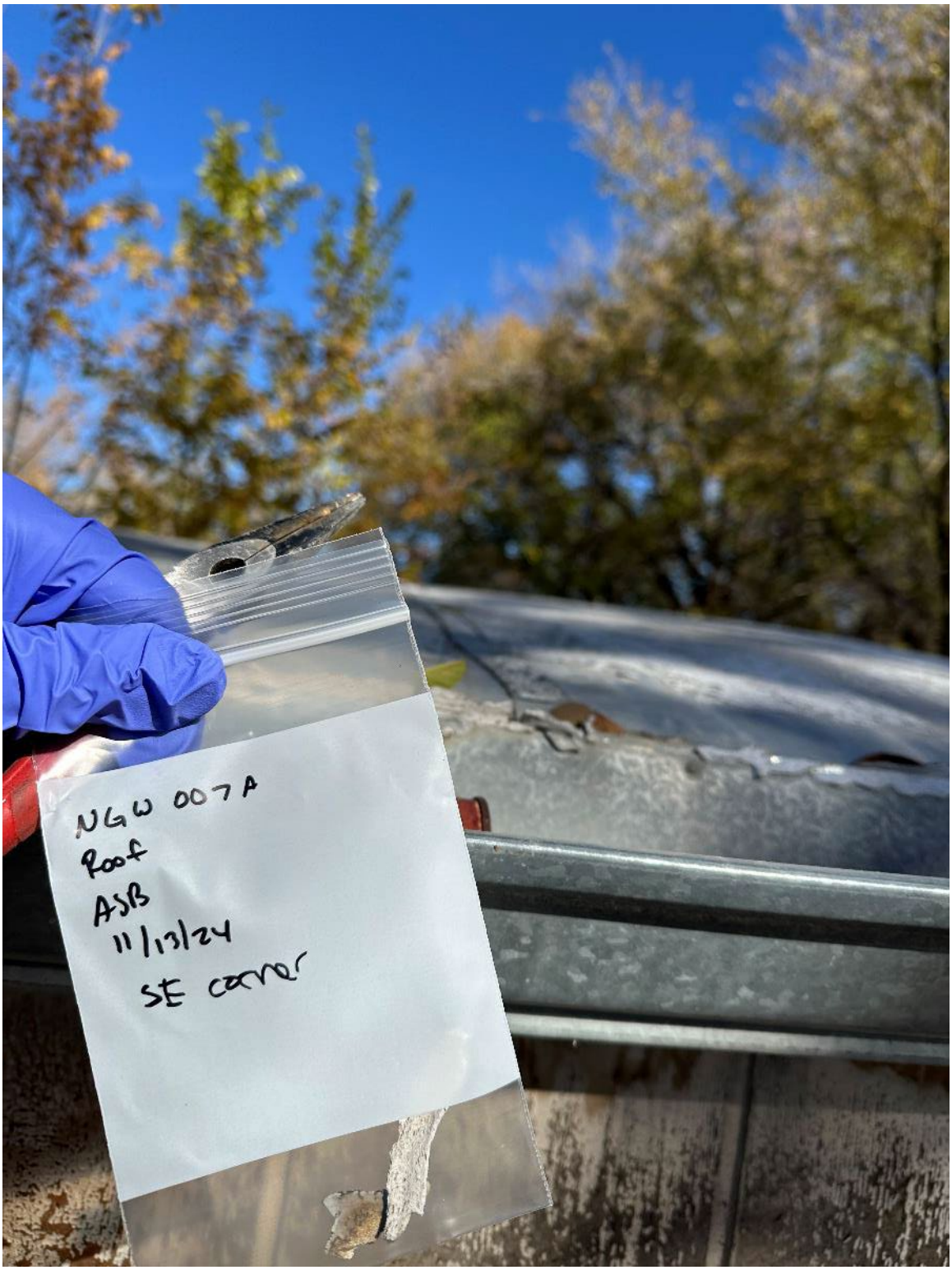

Figure 66. NGW007A was collected from the southeast corner roofing.

Figure 67. NGW007B was collected from the northeast corner roofing.

Figure 68. NGW007C was collected from the southwest corner roofing.

Figure 69. NGW008A was collected from the north side siding. Note the arrow.

Figure 70. NGW008B was collected from the east side siding. Note the arrow.

Figure 71. NGW008C was collected from the south side siding.

E. Complete analytical results for the Weathers property.

Table 51 02 83 - 4, Complete laboratory analytical results for the Weathers Property.

Sample ID	Sample location	Description	Material	Method	Results	Units
NGW001A	Bathroom 1 wall, east wall	White / yellow	Wallpaper over wood paneling	EPA 600/R-93/116	ND	%
NGW001B	Bathroom 1 wall, north wall in shower/tub area	Gold	Wallpaper over wood paneling	EPA 600/R-93/116	ND	%
NGW001C	Bathroom 2 wall, west, above toilet	White / yellow	Wallpaper over wood paneling	EPA 600/R-93/116	ND	%
NGW002A	East of front door, in hallway	Yellow/red/tan	Flooring	EPA 600/R-93/116	ND	%
NGW002B	Kitchen	Black/yellow	Flooring	EPA 600/R-93/116	ND	%
NGW002C	Bedroom 1 closet	Yellow/red/tan	Flooring	EPA 600/R-93/116	ND	%
NGW003A	Living room, south wall	Brown	Wall paneling	EPA 600/R-93/116	ND	%
NGW003B	Living room, north wall	Brown	Wall paneling	EPA 600/R-93/116	ND	%
NGW003C	Living room, south wall	Brown	Wall paneling	EPA 600/R-93/116	ND	%
NGW003D	Living room, east wall	White	Wall paneling	EPA 600/R-93/116	ND	%
NGW004A	Bedroom 1, wall, east	Tan	Wall paneling	EPA 600/R-93/116	ND	%
NGW004B	Bedroom 2, wall, north	Tan	Wall paneling	EPA 600/R-93/116	ND	%
NGW004C	Bedroom 2, wall, east	Tan	Wall paneling	EPA 600/R-93/116	ND	%
NGW005A	South wall, above the end of the counter	Yellow/red/blue	Wallpaper over wood paneling	EPA 600/R-93/116	ND	%
NGW005B	South wall, above kitchen sink	Yellow/red/blue	Wallpaper over wood paneling	EPA 600/R-93/116	ND	%
NGW005C	West wall, in between cabinets	Yellow/red/blue	Wallpaper over wood paneling	EPA 600/R-93/116	ND	%
NGW006A	Ceiling tile	White	Ceiling tile	EPA 600/R-93/116	ND	%
NGW006B	Ceiling tile	White	Ceiling tile	EPA 600/R-93/116	ND	%
NGW006C	Ceiling tile	White	Ceiling tile	EPA 600/R-93/116	ND	%
NGW007A	Roofing, southeast corner	White/black	Roofing	EPA 600/R-93/116	TR	%
NGW007B	Roofing, northeast corner	White/black	Roofing	EPA 600/R-93/116	4.75	%
NGW007C	Roofing, southwest corner	White/black	Roofing	EPA 600/R-93/116	TR	%
NGW008A	Siding, north side	Tan/brown	Siding	EPA 600/R-93/116	ND	%

Table 51 02 83 - 4, Complete laboratory analytical results for the Weathers Property.

Sample ID	Sample location	Description	Material	Method	Results	Units
NGW008B	Siding, east side	Tan/brown	Siding	EPA 600/R-93/116	ND	%
NGW008C	Siding, south side	Tan/brown	Siding	EPA 600/R-93/116	ND	%

Notes:

%: percent
TR: trace, less than 0.25%
ND: non detect.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 52 00 00
DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

A. Inform CO of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction.

B. In accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction, in case of discrepancies, written specifications take precedence over drawings unless otherwise specified.

1.02 PROJECT CONDITIONS

A. Where there are differences as determined by CO between details and dimensions shown on drawings and details and dimensions of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.03 SPECIFICATION DRAWINGS

A. Some drawings show details of fabrication or other details and specifications which are not a part of work under this contract. Disregard specifications and details shown on these drawings which are not applicable to work under this contract.

B. Reference drawings referred to on specification drawings and not considered necessary for contract purposes are not included in specifications.

C. Parts of work for which dimensions are not shown have been drawn to scale as nearly too final dimensions as possible before purchase of machinery or equipment and development of final general and detailed designs.

1.04 TYPICAL DRAWINGS

A. Typical drawings show installations and details of construction which are similar to or approximate to those that are part of work under these specifications. Dimensions and details shown on typical drawings may vary from those shown on construction drawings to be furnished after award of contract.

B. Use typical drawings for bidding purposes only.

1.05 ADDITIONAL OR REVISED DRAWINGS

A. Except as provided in these specifications for drawings to be furnished by Contractor, specifications drawings will be supplemented by additional or revised general and detail drawings as necessary or desirable as work progresses.

B. Do not perform work without proper drawings and instructions.

C. Additional or revised general and detail drawings will show dimensions and details necessary for construction purposes more completely than are shown on these specifications drawings for features of work and for equipment or metalwork not yet purchased.

D. Perform work in accordance with additional general and detail drawings or revisions at applicable prices offered in Price Schedule for such work.

1.06 INFORMATION DRAWINGS

A. Drawings marked "For Information Only" in the drawing list are included to show existing features about which knowledge is required to perform work under this contract. These drawings do not show work to be performed under this contract.

B. If there are differences as determined by the CO between details and dimensions shown on these drawings and those of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.07 STANDARD DRAWINGS

A. Standard drawings may show details which are not a part of work under this contract. Disregard details shown on these drawings which are not applicable to work under this contract.

1.08 LIST OF DRAWINGS

A. Drawings listed in Table 52 00 00A – List of Drawings, are made a part of Section C – Description/Specifications.

1.09 DRAWING NUMBERS IN NUMERICAL ORDER

A. Specification drawings are listed in numerical order in Table 52 00 00B – Drawings in Numerical Order.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
General:		
1	1695-D-60249	San Juan Lateral – Block 2-3 – Line Pipe – Sheet Key – Notes and Symbols
Civil:		
2	1695-D-60776	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Beginning to Sta. 2050+00
3	1695-D-60777	San Juan Lateral – Block 2 - 3 –Reach 2 – Line Pipe – Plan and Profile – Sta. 2050+00 to Sta. 2100+00
4	1695-D-60778	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2100+00 to Sta. 2150+00
5	1695-D-60779	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2150+00 to Sta. 2200+00
6	1695-D-60780	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2200+00 to Sta. 2250+00
7	1695-D-60782	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2250+00 to END
8	1695-D-60783	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Beginning to Sta. 3350+00
9	1695-D-60784	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3350+00 to Sta. 3400+00
10	1695-D-60785	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3400+00 to Sta. 3450+00
11	1695-D-60786	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3450+00 to Sta. 3500+00
12	1695-D-60787	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3500+00 to Sta. 3550+00
13	1695-D-60788	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3550+00 to Sta. 3600+00
14	1695-D-60789	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3600+00 to Sta. 3650+00

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
15	1695-D-60792	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3650+00 to Sta. 3700+00
16	1695-D-60794	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3700+00 to End
17	1695-D-60795	San Juan Lateral – Block 2 - 3 – Line Pipe – Pressure Pipe Trench Installation – Sections and Details
18	1695-D-60796	San Juan Lateral – Block 2 - 3 – Line Pipe – Concrete Blocked Miter Bends – Sections and Details
19	1695-D-60797	San Juan Lateral – Block 2 - 3 – Line Pipe – Concrete Encased Miter Bends – Sections and Details
20	1695-D-60798	San Juan Lateral – Block 2 - 3 – Line Pipe – Air Valve Installation – Sections and Details
21	1695-D-60799	San Juan Lateral – Block 2 - 3 – Line Pipe – Air Valves with Manholes – Sections and Details
22	1695-D-60800	San Juan Lateral – Block 2 - 3 – Line Pipe – Manhole with Blowoff – Sections, Details, and Tables
23	1695-D-60801	San Juan Lateral – Block 2 - 3 – Line Pipe – Sectionalizing Valve Installation – Plan, Sections and Tables
24	1695-D-60802	San Juan Lateral – Block 2 - 3 – Line Pipe – Sectionalizing Valve Installation – Plan, Sections and Details
25	1695-D-60803	San Juan Lateral – Block 2 - 3 – Line Pipe – Collars – Details, Sections and Data Tables
26	1695-D-60804	N.A.P.I. Turnout – Plans, Sections, and Details
27	1695-D-60805	San Juan Lateral – Block 2 - 3 – Line Pipe – Typical Buried Manhole – Plans, Sections and Tables
28	1695-D-60806	San Juan Lateral – Block 2 - 3 – Line Pipe – Precast Concrete Manholes – Plans, Sections, and Details
29	1695-D-60807	San Juan Lateral – Block 2 - 3 – Line Pipe – Typical Road Crossing – Open Cut and Bored Sections
30	1695-D-60808	San Juan Lateral – Block 2 - 3 — San Juan Lateral Water Treatment Plant Regulating Tanks -Access Road – Plan and Profile

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
31	1695-D-60809	San Juan Lateral – Block 2 - 3– San Juan Lateral Water Treatment Plant Regulating Tanks Site Plan
32	1695-D- 60810	San Juan Lateral – Block 2 - 3 – Concrete Blocked Miter Bends – Sections and Details
33	1695-D-60811	San Juan Lateral – Block 2 - 3 – Air Valves and Blowoffs – Data Tables
34	1695-D-60812	San Juan Lateral – Block 2 - 3 – Blowoff – Section and Details
35	1695-D-60813	San Juan Lateral – Block 2 - 3 – Wash Crossing - Erosion Control Details
36	1695-D-60814	San Juan Lateral – Block 2 - 3 – Wash Crossing - Erosion Control Details
37	1695-D-62461	San Juan Lateral – Block 2 - 3 – Reach 2 – Lin++e Pipe – Auger Bore - Powerline Crossing Sta. 2016+95
38	1695-D-62463	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore - State Hwy 64 Crossing Sta. 2108+22
39	1695-D-62464	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore - Road 6700 Crossing Sta. 2134+23
40	1695-D-62465	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore - Powerline Crossing Sta. 2184+59
41	1695-D-62466	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore – ISR N 362 Crossing Sta. 2189+73
42	1695-D-62467	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore - Powerline Crossing Sta. 3331+13
43	1695-D-62468	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore – Powerline Crossing Sta. 3340+33
44	1695-D-62469	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore - ISR 36
45	1695-D-62470	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore - Powerline Crossing Sta. 3633+18
46	1695-D-62471	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore - Powerline Crossing Sta. 3707+02

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
47	1695-D-62503	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore - Powerline Crossing Sta. 3478+93
48	1695-D-62472	San Juan Lateral – Block 2 - 3 – Concrete Water Tank - Plan and Sections
49	1695-D-62473	San Juan Lateral – Block 2 - 3 – Concrete Water Tank - Details and Section
50	1695-D-62474	San Juan Lateral – Block 2 - 3 – Tank Overflow and Drain Apron – Plan and Sections
Mechanical:		
51	1695-D-62475	San Juan Lateral – Block 2 - 3 – Steel Manifold Piping - Plan
52	1695-D-62476	San Juan Lateral – Block 2 - 3 – Steel Manifold Piping - Sections
53	1695-D-62477	San Juan Lateral – Block 2 - 3 – Steel Manifold Piping – Details and Schedules
54	1695-D-62478	San Juan Lateral – Block 2 - 3 – Steel Manifold Piping - Details
55	1695-D-62479	San Juan Lateral – Block 2 - 3 – Tank 2 – Plan, Section and Details
56	1695-D-62480	San Juan Lateral – Block 2 - 3 – Tank 1 - Plan, Section and Details
57	1695-D-62481	San Juan Lateral – Block 2 - 3 – Welded Steel Tank – Sections and Details
58	1695-D-62482	San Juan Lateral – Block 2 - 3 – Welded Steel Tank – Sections and Details
59	1695-D-62483	San Juan Lateral – Block 2 - 3 – Overflow - Sections and Details

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
Electrical:		
60	1695-D-62484	San Juan Lateral – Block 2 - 3 – Electrical – SCADA – Network Diagram
61	1695-D-62485	San Juan Lateral – Block 2 - 3 – Electrical Installation – Electrical Plan
62	1695-D-62486	San Juan Lateral – Block 2 - 3 – Grounding Plan
63	1695-D-62487	San Juan Lateral – Block 2 - 3 – Electrical Installation -Site Panelboard Schedule
64	1695-D-62488	San Juan Lateral – Block 2 - 3 – Electrical Installation – Single Line Diagram
65	1695-D-62489	San Juan Lateral – Block 2 - 3 – Electrical Installation – Conduit Plan
66	1695-D-62490	San Juan Lateral – Block 2 - 3 – Electrical Installation - Cable and Conduit Schedule
67	1695-D-62491	San Juan Lateral – Block 2 - 3 – Electrical Installation - Panel Elevation Views
68	1695-D-62492	San Juan Lateral – Block 2 - 3 – Electrical Installation - Equipment Connection Schedule
Cathodic Protection:		
69	1695-D-62493	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Test Station and Cable Trench Details
70	1695-D-62494	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Galvanic Anode Cathodic Protection Anode Bed
71	1695-D-62495	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Impressed Current Deep Well Anode Bed
72	1695-D-62496	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Joint Bond Details and Cable Identification

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
73	1695-D-62497	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Welded Water Storage Tank Plan and Profile
P&ID:		
74	1695-D-62498	P&ID - Legend
75	1695-D-62499	P&ID – Symbols & Abbreviations
76	1695-D-62500	P&ID – Symbols & Abbreviations
77	1695-D-62501	P&ID – Tank Yard
Information Drawings:		
78	1695-D-61852	San Juan Lateral – Block 2 - 3 – Shumway Arroyo – Plan and Profile (Plastic)
79	1695-D-62450	San Juan Lateral – Block 2 - 3 – Shumway Arroyo – Plan and Profile (Metallic)
80	1695-D-62452	San Juan Lateral – Block 2 - 3 – San Juan River – Plan and Profile
81	1695-D-62454	San Juan Lateral – Block 2 - 3 – Nenahnezad Bluff – Plan and Profile
82	1695-D-62456	San Juan Lateral – Block 2 - 3 – Chaco River – Plan and Profile
83	1695-D-61865	San Juan Lateral – Pumping Plant No. 1 – Manifold Piping – Plan and Profile
84	085-N-1100	SJLWTP Regulating Tank NIP Layout
85	085-D-1101	SJLWTP Regulating Tank NIP Power Distribution
Standard Drawings:		
86	40-D-60001	Electrical Equipment Support, Type 1 – Sections and Detail
87	40-D-60002	Typical Guard Posts – Non Security Application
88	40-D-60003	General Notes for Concrete Outline and Reinforcement
89	40-D-60004	Minimum Requirements for Detailing Reinforcement
90	40-D-6137	Manholes – Class 150 LB. and 300 LB.

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
91	40-D-6234	Standard Nameplates
92	40-D-7016	Chain Link Fencing Requirements Soil Installation
93	40-D-7102	Government Drawing Format - Drawing Border, Sample Title Block, and Signature Lines
94	40-D-4334	Electrical Standards – Typical Grounding Details
95	40-D-4335	Electrical Standards – Typical Grounding Details
96	40-D-4753	Electrical Installation - Typical Grounding Details - For Switchyards and Substations
97	40-D-6463	PVC Waterstops - 12-Inch Type, 9-Inch Type, and 6-Inch Type - Cross-Sections

Table 52 00 00B – Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-	
085-N-1100	3
085-D-1101	2
1695-D-60249	1
1695-D-60776	5
1695-D-60777	6
1695-D-60778	7
1695-D-60779	8
1695-D-60780	9
1695-D-60782	10
1695-D-60783	11
1695-D-60784	12
1695-D-60785	13

Table 52 00 00B – Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-60786	14
1695-D-60787	15
1695-D-60788	16
1695-D-60789	17
1695-D-60792	18
1695-D-60794	19
1695-D-60795	20
1695-D-60796	21
1695-D-60797	22
1695-D-60798	23
1695-D-60799	24
1695-D-60800	25
1695-D-60801	26
1695-D-60802	27
1695-D-60803	28
1695-D-60804	29
1695-D-60805	30
1695-D-60806	31
1695-D-60807	32
1695-D-60808	33
1695-D-60809	34
1695-D- 60810	4
1695-D-60811	35
1695-D-60812	36
1695-D-60813	37
1695-D-60814	38
1695-D-61852	39

Table 52 00 00B – Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-61865	40
1695-D-62450	41
1695-D-62452	42
1695-D-62454	43
1695-D-62456	44
1695-D-62461	45
1695-D-62463	46
1695-D-62464	47
1695-D-62465	48
1695-D-62466	49
1695-D-62467	50
1695-D-62468	51
1695-D-62469	52
1695-D-62470	53
1695-D-62471	54
1695-D-62472	55
1695-D-62473	56
1695-D-62474	57
1695-D-62475	58
1695-D-62476	59
1695-D-62477	60
1695-D-62478	61
1695-D-62479	62
1695-D-62480	63
1695-D-62481	64
1695-D-62482	65
1695-D-62483	66

Table 52 00 00B – Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-62484	67
1695-D-62485	68
1695-D-62486	69
1695-D-62487	70
1695-D-62488	71
1695-D-62489	72
1695-D-62490	73
1695-D-62491	74
1695-D-62492	75
1695-D-62493	76
1695-D-62494	77
1695-D-62495	78
1695-D-62496	79
1695-D-62497	80
1695-D-62498	81
1695-D-62499	82
1695-D-62500	83
1695-D-62501	84
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Table 52 00 00B – Drawings in Numerical Order

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END OF SECTION

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SECTION 53 10 00
GEOLOGIC INVESTIGATIONS

PART 1 GENERAL

1.01 GENERAL

A. General

1. This section describes surface and subsurface geologic conditions for the San Juan Lateral Block 2, Water Treatment Plant Regulating Tanks Site and Block 3 of the Navajo-Gallup Water Supply project areas. Other sections of these specifications contain geological and geotechnical information important for understanding the significance of geologic conditions to construction operations.

2. Project area foundation and site geology are discussed for each major project feature listed below:

   a. Block 2: Pipeline Stations 2002+00 to 2085+12, 2094+89 to 2157+29, 2180+43 to 2190+00 and 2237+63 to 2287+90.28

   b. San Juan Lateral Water Treatment Plant Regulating Tanks Site

   c. Block 3: Pipeline Stations 3302+00 to 3517+30 and 3536+24 to 3744+55

3. Geologic descriptions, drawings, logs of subsurface explorations, water level data, and test data in these specifications include information and records of geologic investigations for the work, and are geologic data upon which the design of this work is based. These data supersede previous versions which may be available for examination by Offerors. These data are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations.

4. Selected samples recovered during investigations were tested by Reclamation Four Corners Construction Office (FCCO) materials laboratory in Farmington, New Mexico and Reclamation Geotechnical Laboratory and Field Support in Denver, Colorado. Summaries of Physical Properties Test Results from laboratory tests performed on these samples are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations. Offerors are encouraged to inspect the site and to obtain their own samples and perform tests on the materials to evaluate properties which the Offeror believes to be significant. Samples are available for examination at Reclamation FCCO in Farmington, NM. Offerors wishing to inspect the samples, visit the site, or take samples at the site should make arrangements with Reclamation FCCO at telephone number (505)-324-5035.

5. Copies of the following reports and memoranda on the area, site geology, and materials properties may be examined at Reclamation FCCO, 1235 LaPlata Highway, Farmington, NM. Offerors wishing to inspect the reports and

memoranda should make arrangements with Reclamation FCCO at (505)-325-1794.

a. Supplemental Geologic Design Data Package, San Juan Lateral Reach 2 Pipeline, Shumway Arroyo HDD, & San Juan Lateral Water Treatment Plant Regulating Tank Site, Navajo Gallup Water Supply Project, Department of the Interior, Bureau of Reclamation, Upper Colorado Basin, Four Corners Construction Office Farmington, New Mexico, April 2025.

b. Geologic Design Data Report, San Juan Generating Station Alignment, Navajo Gallup Water Supply Project, Department of the Interior, Bureau of Reclamation, Upper Colorado Basin, Four Corners Construction Office Farmington, New Mexico, February 2023.

c. Evaluation of Shale and Sandstone from Proposed Reach 3 Horizontal Directional Drilling Alignment, Navajo Gallup Water Supply Project, Upper Colorado Region, New Mexico, U.S. Bureau of Reclamation, Geotechnical Laboratory and Field Support, Denver, Colorado, Technical Memorandum No. 8550-2019-12, September 2019.

d. Evaluation of Shale and Sandstone from Proposed Reach 2 Horizontal Directional Drilling Alignment, Navajo Gallup Water Supply Project, Upper Colorado Region, New Mexico, U.S. Bureau of Reclamation, Geotechnical Laboratory and Field Support, Denver, Colorado, Technical Memorandum No. 8550-2019-13, September 2019.

e. Technical Memorandum No. 86-68320-2023-15, Geophysical Surveys: Electrical Resistivity and P-wave Seismic Refraction Tomography along Navajo Gallup Reaches 2 and 3, Navajo Gallup Water Supply Project, Upper Colorado Region, Controlled by: Bureau of Reclamation, U.S Department of Interior, May 2023.

f. Technical Memorandum No. 86-68320-2025-19, Geophysical Surveys: Seismic and Electrical Resistivity Surveys along Navajo Gallup Reaches 1 and 2, Navajo Gallup Water Supply Project, Upper Colorado Region, Controlled by: Bureau of Reclamation, U.S Department of Interior, April 2025.

g. Technical Memorandum No. 8550-2024-04, Laboratory testing on Sandstone from Morgan Lake Tank Site, Navajo Gallup Water Supply Project, New Mexico, Upper Colorado Basin Region, Technical Service Center, Geotechnical Laboratory and Field Support Group, 86-68550, March 2024.

1) Morgan Lank Tank Site is the same as San Juan Lateral Water Treatment Plant Regulating Tanks Site.

6. The geologic logs of drill holes, test pits, water-level data, and other available geologic information indicate the conditions encountered during the investigations. The water-level data show the conditions at the particular time or

times the information was obtained and may not indicate variations such as those caused by drought, precipitation, changes in the surface elevation of nearby reservoirs, irrigation, or flooding.

7. The geologic drawings portray generalized geologic conditions. The geologic logs of explorations should be consulted for specific details. For General Geologic Legend, Explanation, and Notes, refer to drawing number 1695-529-60340 and 1695-529-60426.

8. General geologic unit definitions, explanations of geologic symbols, and geologic notes are shown on drawing number 1695-529-60340 and 1695-529-60426.

9. Surface geology and location of explorations, cross sections, and note drawings for the work are included in these specifications on Drawing Nos. 1695-529-60340, 1695-529-60426, 1695-529-60354, 1695-529-60355, 1695-529-60357 through 1695-529-60371, 1695-529-60434, 1695-529-60389, 1695-529-60411, 1695-529-60424, and 1695-529-60425.

10. Surficial materials recorded in geologic exploration logs included in these Specifications were classified under current Unified Soil Classification System procedures as described in USBR 5000 (laboratory classification) and USBR 5005 (visual classification). These two procedures are similar to ASTM D 2487 and ASTM D 2488, respectively.

11. Reclamation has established standard descriptors and descriptive criteria for rock and standard descriptors and descriptive criteria for discontinuities. These standards are as shown and defined on standard drawings 40-D-7022 and 40-D-7023. These standards are further explained and defined in the Reclamation Engineering Geology Field Manual. The standards provide the basis for classification and description of rock and discontinuities logged after September 1984.

1.02 REFERENCE STANDARDS

A. ASTM International (ATSM)

1.	ASTM D 2487-11	Classification of Soils for Engineering Purposes (Unified Soil Classification)
2.	ASTM D 2488-09a	Description and Identification of Soils (Visual-Manual Procedure)
3.	ASTM D7382-08	Determination of Maximum Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibrating Hammer

B. Bureau of Reclamation (USBR)

1. USBR EM – Earth Manual, Part 2, Third Edition (1990)

2. Procedure No. and Title

a. USBR 5000-86 Determining Unified Soil Classification (Laboratory Method)

b. USBR 5005-86 Determining Unified Soil Classification (Visual Method)

c. USBR 5500 Performing Laboratory Compaction of Soils -5.5lbm Rammer and 18-inch Drop

d. USBR 7205 Determining Unit Weight of Soils In-place by the Sand-Cone Method

e. Engineering Geology Field Manual, Second Edition (1998)

Copies of the above Reclamation procedures are available for review at Reclamation FCCO, 1235 LaPlata Highway, Farmington, NM.

1.03 GEOLOGIC INVESTIGATIONS

A. Geologic investigations conducted at Block 2, San Juan Lateral Water Treatment Plant Regulating Tank Site and Block 3 are listed below; and available logs of investigations are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations.

B. Only subsurface investigations within about 100-feet from the pipeline alignment and project features have been included in these specifications, unless otherwise noted. Geologic logs and laboratory data from investigations are included in Section 53 20 00 – Records of Geologic Investigations and Subsurface Investigations. Locations of applicable subsurface investigations and stick log data are provided on drawings, 1695-529-60354, 1695-529-60355, 1695-529-60357 through 1695-529-60371, 1695-529-60434, 1695-529-60389, 1695-529-60411, 1695-529-60424, and 1695-529-60425 located in section 53 20 00 – Drawings. Additional geologic information is included on geology drawings included in Section 53 20 00 – Records of Geologic Investigations and Subsurface Investigations. Relevant geologic investigations conducted by Reclamation FCCO include:

1. Geologic mapping at a scale of 1 inch to 200 feet was conducted along the San Juan Lateral Blocks 2-3 pipeline alignment and the San Juan Lateral Water Treatment Plant Regulating Tank Site and is shown on drawing numbers, 1695-529-60357 through 1695-529-60371, 1695-529-60434, 1695-529-60389 and 1695-529-60411 located in section 53 20 00 – Drawings.

2. Drill holes were conducted by the Upper Colorado Basin Regional Drill Crew. Drill holes were advanced using either a truck mounted Central Mining Equipment (CME) 85 drill rig, a CME 850X track mounted drill rig or an Eijkelkamp XL Max sonic rig. Sampling and testing for all drill holes except PWR2-23-1 utilized a hollow stem auger, the Standard Penetration Test (SPT), the California Sampler method and HQ3 diamond bit coring methods. Drilling was conducted using a 4.25-inch outside and 3.25-inch inside diameter by 5-foot-long hollow stem auger with a split tube type sampler. SPTs were accomplished using a 2.0-inch outside and 1.375-inch inside diameter by 2.5-foot-long split

spoon sampler. A 140-pound auto hammer was used to drive the sampler. The SPT sampler was advanced 1.5-feet with blow counts reported per 0.5 foot of advancement. California Sampler had a 2-inch inside diameter, with three, 4- x 1.94-inch brass liners. The central barrel was 16-inches in length. A 140-pound auto hammer was used to drive the sampler. The sampler was advanced 1.0-foot with blow counts reported for every 0.5-foot of advancement. The bottom two brass liners were capped, sealed with tape and labeled for laboratory testing. Drill hole logs are included in section 53 20 00 – Records of Geologic Investigations and Subsurface Investigations.

3. Test pits were conducted by the FCCO geology group with FCCO backhoe operator and laboratory personnel. Test pits were excavated using either a JCB 3CX eco rubber tire backhoe or a Case 580N Backhoe with a 24-inch bucket. Excavation, testing and sampling was performed to the limit of the equipment or to refusal. In-place densities were performed by FCCO materials laboratory using the sand cone replacement method, in accordance with USBR 7205, in most test pits. Results from in-place densities are shown on the test pit logs in Section 53 20 00 – Records of Geologic Investigations and Subsurface Investigations.

4. All soils recovered from test pits and drill holes were logged and visually classified using methods described in USBR 5005 Earth Manual, Part 2, Third Edition, and the Unified Soil Classification System (USCS). All rock core recovered from the drill holes were visually classified using methods described in the Engineering Geology Field Manual, Second addition, Volume II.

5. Laboratory testing of select soil samples from drill holes and test pits, include gradation analysis, laboratory soil classification, Atterberg Limits, specific gravity, and compaction testing.

6. Groundwater monitoring wells were installed in areas where groundwater was encountered within 15 feet of the surface. Monitoring wells were completed with a Schedule 40 riser and U-pack sand filter. The well screens are five or 10-feet-long and have a slot size of 0.010-inches. 16/30 graded sand was backfilled between 2-feet above and below the well screen. A bentonite plug was used above and below the sand filter. The groundwater monitoring wells were completed with either a locking steel standpipe or flush mounted well cover at the ground surface.

1.04 REGIONAL GEOLOGY

San Juan Lateral Block 2, Water Treatment Plant Regulating Tanks Site and Block 3 lie within the San Juan Basin, which is characterized by young plateaus, mesas, and dry-wash canyons presently being eroded in an arid climate. The San Juan Basin is a structural depression on the order of about 5000 feet in elevation and contains Quaternary soils, resting on rocks of Cretaceous age. Prominent geologic features in the area include the Hogback monocline, the San Juan River, Chaco River, Table Mesa, Barber Peak, Shiprock, and Cathedral Cliff. Barber Peak, Ship Rock, and Cathedral Cliff are diatremes of the Navajo Volcanic Field.

1.05 SITE GEOLOGY

San Juan Lateral Block 2, Water Treatment Plant Regulating Tanks Site and Block 3 are located near Fruitland, New Mexico and are the northernmost pipeline alignments of the Navajo Gallup Water Supply Project. The Block 2 pipeline alignment spans from the Frank Chee Willetto Reservoir to the San Juan Lateral Water Treatment Plant Regulating Tank Site. The Block 3 pipeline alignment spans from the San Juan Lateral Water Treatment Plant Regulating Tank Site to the San Juan Lateral Water Treatment Plant site.

A. STRATIGRAPHY
Six Cretaceous-age bedrock formations with varying alluvial cover are present in the project area.

B. Quaternary alluvium deposits (Qal) overlie bedrock through much of Block 2 and 3. For these specifications, Quaternary alluvium (Qal) is used to describe all unconsolidated surficial deposits along the alignment regardless of origin. It is derived from a variety of sources including slope wash, eolian and colluvial deposition as well as weathering and decomposition of in-place bedrock. Alluvium contains variable amounts of plastic to non-plastic fines and may contain sand, gravel, cobbles, and boulders on terraces and in river channels and flood plains. Numerous soil types are encountered, including Silty Sand (SM), Clayey Sand (SC), Lean Clay with Sand (CL)s, and Lean Clay (CL), and Fat Clay (CH).

C. Quaternary terrace gravel (Qtg) is comprised of unconsolidated deposits of gravel, cobbles and boulders in a predominantly sandy matrix with lesser amounts of silt and clay. The terrace gravels originate from the San Juan River alluvium forming terraces and exhibit weak to moderate cementation.

D. The Cretaceous Pictured Cliffs Sandstone (Kpc) is composed of light brown to orange to gray, very fine to medium grained sandstone interbedded with minor gray siltstone and shale. The upper part consists of ledge-forming, moderately- to massively bedded sandstone. The sandstone is calcareous, ferruginous, and exhibits cellular to cavernous weathering. The lower part consists of laminated to thinly bedded sandstone, shale, and claystone. The sandstone is moderately soft (H5) and intensely weathered (W7) to hard (H3) and slightly weathered (W3). The shale and claystone are generally very soft (H7) and intensely weathered (W7) to moderately soft (H5) and moderate weathered (W5). Intermittent hard (H3) sandstone lenses are found within the formation and have a similar appearance to concretions because of their shape and mineral content. They are comprised of Siderite or iron oxide and calcium carbonate cemented, fine grained, thinly to moderately bedded sandstone. The lenses are spheroidal in shape and up to 10-feet in diameter. Lenses are often exposed at the surface due to differential weathering of softer surrounding rock and exhibit spalling of weathered outer layers. They are generally moderately hard (H4) to hard (H3) and moderately weathered (W5).

E. The Cretaceous Lewis Shale (Kl) is comprised of dark brown to gray shale with fine grained brownish gray sandstone interbeds and brownish red sandstone lenses. The shale

is friable, fissile, laminated to thinly bedded with gypsum veins, iron oxide staining and occasional marine fossils. Hardness and weathering vary from very soft (H7) and intensely weathered (W7) to moderately hard (H4) and moderately weathered (H5). The sandstone is fine grained, laminated to moderately bedded, calcareous, and argillaceous. Hardness and weathering vary from soft (H6) and intensely weathered (W7) to moderately hard (H4) and moderately weathered (W5). Like the Pictured Cliffs Sandstone (Kpc), intermittent hard (H3) sandstone lenses are found within the Lewis Shale (Kl) and have a similar appearance to concretions because of their shape and mineral content. They are comprised of Siderite or iron oxide and calcium carbonate cemented, fine grained, thinly to moderately bedded sandstone. The lenses are spheroidal in shape and up to 10-feet in diameter. Lenses are often exposed at the surface due to differential weathering of softer surrounding rock and exhibit spalling of weathered outer layers. They are generally moderately hard (H4) to hard (H3) and moderately weathered (W5).

F. The Cretaceous Cliff House Sandstone (Kch) is comprised of brown to gray sandstone and light gray to dark brown shale. The sandstone is fine grained, argillaceous, laminated to thickly bedded, hard (H3) and slightly weathered (W3) to moderately weathered (W5). The shale is laminated to thinly bedded, with calcite, iron oxide, and thin interbeds of hard (H3) sandstone. Hardness and weathering vary from very soft (H7) and intensely weathered (W7) to moderately soft (H5) and moderately weathered (W5).

G. The Cretaceous Menefee Formation (Kmf) consists primarily of light brown, fine-grained sandstone with interbedded claystone, shale and siltstone but can vary in color and grain size. The sandstone is generally moderately weathered (W5), moderately soft (H5) to soft (H6) and slightly fractured at the surface. The same sandstone unit, when excavated below ground level, can occasionally be moderately hard (H4) and slightly weathered (W3). A calcareous sandstone bed frequently caps the upper 1 to 3 feet in some areas and is occasionally interbedded or lensed within the softer sandstone units. This caprock/interbedded sandstone is often hard (H3) and can only be broken by a heavy hammer blow. The claystone is sandy, light brown to gray in color and is generally laminated to thinly bedded, intensely to moderately weathered (W6) and moderately soft (H5) to soft (H6). The claystone often grades to siltstone and occasionally becomes fissile, grading to shale. Thin coal seams are also sometimes encountered. The coal is subbituminous to bituminous, friable, soft (H6), and moderately to intensely weathered (W6) to moderately to slightly weathered (W4).

H. The Cretaceous Point Lookout Sandstone (Kpl) consists of light brown, gray, or brownish orange, fine grained sandstone with interbedded claystone. The sandstone is moderately soft (H5) to hard (H3), slightly weathered (W3), to intensely weathered (W7), thinly to massively bedded, and has a variable reaction with dilute hydrochloric acid (HCl). Sandstone often contains calcite and gypsum veins, iron and manganese oxide staining and iron-rich concretions. The claystone is dark brown to grayish orange, soft (H6) to very soft (H7), and moderately to intensely weathered (W6). Claystone usually has no reaction with HCl and contains gypsum veins and iron oxide staining.

I. The upper member of the Cretaceous Mancos Shale (Km) consists of interbedded fine-grained, mixed clastic laminations to thin beds of claystone, siltstone and shale. Bedding planes are near horizontal and contacts between shale and claystone can be gradational. The shale and siltstone are calcareous, sandy, fissile, light to dark gray, light to dark brown to black in color and banded or mottled in places. The shale ranges from moderately soft (H5) to hard (H3) and decomposed (W9) to slightly weathered (W3). The claystone is light to dark brown, sandy, and laminated to thinly bedded. The claystone ranges from very soft (H7) to moderately soft (H5) and very intensely weathered (W8) to moderately weathered (W5). The claystone is friable and easily separates on bedding planes, slakes rapidly in water, and exhibits iron and manganese oxide staining. The claystone is carbonaceous, contains calcium carbonate, mica and has thin to moderately thick gypsum infilling in some joints.

J. PIPELINE STATION TO STATION GEOLOGY

1. Approximate Station 2002+00 to 2006+20: Excavation within these Stations is expected to encounter alluvial soil with shallow Pictured Cliffs Sandstone (Kpc) formation bedrock. Subsurface investigations include 1 test pit:

   a. Test pit TPR2-22-24 encountered soil from 0.0 to 2.1 feet and bedrock from 2.1 to 2.2 feet of depth. Clayey Sand with Gravel (SC)g was encountered from 0.0 to 2.1 feet and fine grained, moderately soft (H6) and intensely weathered (W7) sandstone from 2.1 to 2.2 feet of depth. The test pit encountered a buried PVC conduit and was excavated to bedrock by hand with a shovel.

2. Approximate Station 2006+20 to 2016+20: Excavation within these Stations is expected to encounter primarily alluvial soil atop Pictured Cliffs Sandstone (Kpc) formation bedrock. This section crosses the drainage below the Frank Chee Willetto Dam. Surface and groundwater are expected. Subsurface investigations include 3 drill holes and 2 test pits:

   a. Drill hole OWR-23-22 encountered soil from 0.0 to 12.2 feet and bedrock from 12.2 to 37.9 feet of depth. Silty Sand (SM) was encountered from 0.0 to 10.2 feet, Lean Clay with Sand (CL)s from 10.2 to 12.2 feet, very soft (H7), intensely weathered (W7) shale and claystone from 12.2 to 17.9 feet, moderately soft (H5), moderately to intensely weathered (H6) sandstone and shale from 17.9 to 27.2 feet and moderately soft (H5) to hard (H3), moderately to intensely weathered (H6) to slightly weathered (H3) sandstone from 27.2 to 37.9 feet of depth.

   b. Drill hole PWR2-23-1 encountered soil from 0.0 to 21.5 feet and bedrock from 21.5 to 28.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.5 feet, Clayey Sand with Gravel (SC)g from 1.5 to 2.0 feet, Clayey Sand (SC) from 2.0 to 21.5 feet, very soft (H7), very intensely weathered (W8) shale from 21.5 to 23.0 feet, moderately hard (H4), moderately weathered (W5) sandstone from 23.0 to 27.5 feet, and very soft (H7), very intensely weathered (W8) shale from 27.5 to 28.0 feet of depth.

c. Drill hole OWR2-23-21 encountered soil from 0.0 to 16.8 feet and bedrock from 16.8 to 39.4 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 0.5 feet, Silty Sand (SM) from 0.5 to 16.8 feet, very soft (H7), moderately weathered (W5) shale from 16.8 to 28.6 feet, and moderately soft (H5) to hard (H3), moderately weathered (W5) to slightly weathered (H3) sandstone from 28.6 to 39.4 feet of depth.

d. Test pit TPR2-22-23 encountered soil from 0.0 to 6.5 feet of depth. Clayey Sand with Gravel, Cobbles, and Boulders (SC)gcb was encountered from 0.0 to 5.8 feet, and Poorly Graded Sand with Silt, Gravel, and Cobbles (SP-SM)gc was encountered from 5.8 to 6.5 feet.

e. Test pit TPR2-22-22 encountered soil from 0.0 to 13.0 feet of depth. Poorly Graded Sand with Silt and Gravel (SP-SM)g was encountered from 0.0 to 4.0 feet, and Poorly Graded Sand with Silt (SP-SM) from 4.0 to 13.0 feet of depth.

3. Approximate Station 2016+20 to 2071+80: Excavation within these Stations is expected to encounter thin to moderate alluvial soil atop Pictured Cliffs Sandstone (Kpc) bedrock. Subsurface investigations include 5 drill holes and 3 test pits.

a. Drill hole DHR2-22-1 encountered soil from 0.0 to 13.9 feet and bedrock from 13.9 to 19.5 feet of depth. Silty Sand (SM) was encountered from 0.0 to 11.7 feet, Sandy Lean Clay (CL) from 11.7 to 13.9 feet, moderately soft (H5), intensely weathered (W7) sandstone from 13.9 to 16.5 feet, and hard (H3), moderately weathered (W5) sandstone (interpreted from drilling characteristics due to no recovery) from 16.5 to 19.5 feet of depth.

b. Drill hole DHR2-23-33 encountered soil from 0.0 to 4.3 feet and bedrock from 4.3 to 22.2 feet of depth. Silty Sand (SM) was encountered from 0.0 to 4.3 feet, moderately soft (H5), moderately weathered (W5) sandstone from 4.3 to 7.2 feet, moderately soft (H5) to soft (H6), moderately to intensely weathered (W6) interbedded sandstone and claystone from 7.2 to 10.3 feet, moderately soft (H5), moderately weathered (W5) sandstone from 10.3 to 15.7 feet, moderately soft (H5), moderately to intensely weathered (W6) interbedded sandstone and claystone from 15.7 to 20.0 feet, hard (H3), slightly weathered to fresh (W2) sandstone from 20.0 to 20.8 feet, and moderately soft (H5), moderately weathered (W5) interbedded sandstone and shale from 20.8 to 22.2 feet of depth.

c. Drill hole DHR2-23-34 encountered soil from 0.0 to 18.1 feet and bedrock from 18.1 to 36.1 feet of depth. Silty Sand with Gravel (SM) was encountered from 0.0 to 14.0 feet, no recovery from 14.0 to 16.1 feet, gravel cavings recovered from 16.1 to 18.1 feet, moderately soft (H5), intensely weathered (W7) sandstone from 18.1 to 19.7 feet, hard (H3), slightly weathered (W3) sandstone from 19.7 to 20.6 feet, moderately soft (H5) to soft (H6), moderately to intensely weathered (W6) interbedded sandstone, claystone, and shale from 20.6 to 29.0 feet, and hard (H3), slightly weathered (W3) sandstone from 29.0 to 36.1 feet of depth.

d. Test pit TPR2-22-2 encountered soil from 0.0 to 12.0 feet of depth. Poorly Graded Sand with Gravel (SP)g was encountered from 0.0 to 3.6 feet, Poorly Graded Sand with Gravel and Cobbles (SP)gc from 3.6 to 7.5 feet, and Poorly Graded Sand (SP) from 7.5 to 12.0 feet of depth.

e. Test pit TPR2-22-4 encountered soil from 0.0 to 11.0 feet and bedrock from 11.0 to 12.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 0.4 feet, Poorly Graded Sand with Silt (SP-SM) from 0.4 to 5.0 feet, and Clayey Sand (SC) from 5.0 to 11.0 feet. From 11.0 to 12.0 feet, fine-grained, moderately hard (H4), and moderately to intensely weathered (W6) sandstone was encountered.

f. Drill hole DHR2-22-2 encountered soil from 0.0 to 8.3 feet and bedrock from 8.3 to 40.0 feet of depth. Lean Clay (CL) was encountered from 0.0 to 4.3 feet, Sandy Lean Clay (CL) from 4.3 to 8.3 feet, moderately soft (H5), intensely weathered (W7) sandstone from 8.3 to 14.2 feet, moderately soft (H5), moderately weathered (W5) sandstone with very soft (H7) claystone laminations from 14.2 to 40.0 feet of depth.

g. Drill hole DHR2-22-3 encountered soil from 0.0 to 5.4 feet and bedrock from 5.4 to 40.0 feet of depth. Lean Clay (CL) was encountered from 0.0 to 5.4 feet, moderately soft (H5), intensely weathered (W7) sandstone from 5.4 to 15.4 feet, very soft (H7), moderately weathered (W5) shale from 15.4 to 17.0 feet, moderately soft (H5), slightly weathered (W3) sandstone with very soft (H7) claystone laminations from 17.0 to 30.7 feet, very soft (H7), slightly weathered (W3) shale from 30.7 to 38.6 feet, and moderately soft (H5), slightly weathered (W3) sandstone from 38.6 to 40.0 feet of depth.

h. Test pit TPR2-22-5 encountered soil from 0.0 to 2.0 feet and bedrock from 2.0 to 5.5 feet of depth. Silty Sand with Gravel (SM) was encountered from 0.0 to 2.0 feet and soft (H6) to moderately soft (H5), and intensely (W7) to moderately weathered (W5) claystone from 2.0 to 5.5 feet of depth.

4. Approximate Station 2071+80 to 2085+12: Excavation within these Stations is expected to encounter primarily alluvial soil atop Pictured Cliffs Sandstone (Kpc) formation bedrock. Subsurface investigations include 3 drill holes.

a. Drill hole DHR2-22-4 encountered soil from 0.0 to 26.0 feet and bedrock from 26.0 to 50.0 feet of depth. Sandy Lean Clay (CL) was encountered from 0.0 to 10.3 feet, Lean Clay (CL) from 10.3 to 13.6 feet, Silty Sand (SM) from 13.6 to 15.3 feet, Lean Clay (CL) from 15.3 to 19.9 feet, Silty Sand (SM) from 19.9 to 23.6 feet, and Silty Sand with Gravel (SM)g from 23.6 to 26.0 feet. Poor recovery was noted from 26.0 to 31.5 feet, interpreted as very soft (H7) sandstone. From 31.5 to 32.7 feet, moderately soft (H5), intensely weathered (W7) sandstone was encountered, followed by moderately soft (H5), moderately weathered (W5) sandstone from 32.7 to 34.8 feet, moderately soft (H5), moderately weathered (W5) shale from

34.8 to 40.4 feet, and hard (H3), slightly weathered (W3) sandstone from 40.4 to 48.7 feet of depth.

b. Drill hole DHR2-24-35 encountered soil from 0.0 to 15.2 feet and bedrock from 15.2 to 19.8 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 4.0 feet, Poorly Graded Sand with Silt (SP-SM) from 4.0 to 7.3 feet, Clayey Sand (SC) from 7.3 to 8.4 feet, Poorly Graded Sand (SP) from 8.4 to 11.8 feet, and Poorly Graded Sand with Gravel (SP)g from 11.8 to 15.2 feet. Soft (H6), intensely to moderately weathered (W6) to moderately hard (H4), slightly to moderately weathered (W4) sandstone was encountered from 15.2 to 19.8 feet of depth.

c. Drill hole DHR2-24-36 encountered soil from 0.0 to 19.0 feet and bedrock from 19.0 to 60.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 4.5 feet, Poorly Graded Sand with Gravel (SP)g from 4.5 to 8.3 feet, and Poorly Graded Sand (SP) from 8.3 to 19.0 feet. Soft (H6), intensely to moderately weathered (W6) to moderately hard (H4), moderately to slightly weathered (W4) sandstone was encountered from 19.0 to 20.0 feet, very soft (H7), very intensely weathered (W7) claystone from 20.0 to 20.8 feet, interbedded sandstone, siltstone, and claystone from 20.8 to 22.8 feet, moderately hard (H4), moderately to slightly weathered (W4) sandstone from 22.8 to 25.8 feet, very soft (H7), very intensely weathered (W7) claystone from 25.8 to 26.3 feet, moderately hard (H4), moderately to slightly weathered (W4) sandstone from 26.3 to 39.2 feet, moderately hard (H4), moderately to slightly weathered (W4) siltstone from 39.2 to 41.8 feet, moderately hard (H4), moderately to slightly weathered (W4) sandstone from 41.8 to 45.0 feet, interbedded sandstone, siltstone, and claystone from 45.0 to 50.0 feet, and moderately hard (H4), moderately to slightly weathered (W4) interbedded sandstone, siltstone, and claystone from 50.0 to 60.0 feet of depth.

5. Approximate Station 2085+12 to 2094+89 by others.

6. Approximate Station 2094+89 to 2157+29: Excavation within these Stations is expected to encounter alluvial soil and terrace gravel soil atop Pictured Cliffs Sandstone (Kpc) formation bedrock. Subsurface investigations include 4 drill holes and 1 test pit.

a. Drill hole DHR2-22-8 encountered soil from 0.0 to 28.2 feet and bedrock from 28.2 to 40.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 19.3 feet, Clayey Sand (SC) from 19.3 to 22.7 feet, Silty Sand (SM) from 22.7 to 27.6 feet, and Gravely Lean Clay with Sand (CL)s from 27.6 to 28.2 feet. Very soft (H7), intensely weathered (W7) shale was encountered from 28.2 to 31.2 feet, moderately soft (H5), intensely weathered (W7) sandstone with claystone laminations from 31.2 to 38.4 feet, and very soft (H7), intensely weathered (W7) shale from 38.4 to 40.0 feet of depth.

b. Drill hole DHR2-22-9 encountered soil from 0.0 to 34.5 feet of depth. Sandy Lean Clay (CL) was encountered from 0.0 to 18.0 feet, Clayey Gravel (GC) from 18.0 to 18.7 feet, no recovery from 18.7 to 24.0 feet (interpreted as cobbles and boulders), and poor recovery from 24.0 to 34.5 feet, with recovered cobbles and gravels and flowing sand encountered at 28.0 feet.

c. Drill hole DHR2-22-10 encountered soil from 0.0 to 30.4 feet of depth. Sandy Lean Clay (CL) was encountered from 0.0 to 3.5 feet, Silty Sand (SM) from 3.5 to 8.0 feet, and Sandy Lean Clay (CL) from 8.0 to 16.9 feet. Clayey Gravel (GC) was encountered from 16.9 to 21.2 feet, followed by poor recovery from 21.2 to 29.5 feet (recovered cobbles and gravels), and no recovery from 29.5 to 30.4 feet.

d. Drill hole DHR2-22-12 encountered soil from 0.0 to 21.4 feet and bedrock from 21.4 to 40.0 feet of depth. Sandy Lean Clay (CL) was encountered from 0.0 to 2.5 feet, followed by no recovery from 2.5 to 21.4 feet (interpreted as cobbles and boulders with lesser gravel, sand, and silt). No recovery was recorded from 21.4 to 24.0 feet (interpreted as sandstone). Moderately soft (H5), intensely weathered (W7) sandstone was encountered from 24.0 to 27.2 feet, very soft (H7), intensely weathered (W7) claystone from 27.2 to 28.1 feet, moderately soft (H5), intensely weathered (W7) sandstone from 28.1 to 36.4 feet, and moderately soft (H5) sandstone and very soft (H7) siltstone interbedded with shale, moderately weathered (W5), from 36.4 to 40.0 feet of depth.

e. Test pit TPR2-22-10 encountered soil from 0.0 to 7.0 feet of depth. Clayey Sand (SC) from 0.0 to 2.5 feet, and Cobbles and Boulders with Gravel and Sand were encountered from 2.5 to 7.0 feet of depth.

7. Approximate Station 2157+29 to 2180+43 by others.

8. Approximate Station 2180+43 to 2190+00: Excavation within these Stations is expected to encounter primarily terrace gravel soil atop Lewis Shale formation (Kl) bedrock. Subsurface investigations include 1 drill hole and 1 test pit.

a. Drill hole DHR2-22-17 encountered soil from 0.0 to 12.9 feet and bedrock from 12.9 to 50.0 feet of depth. No recovery was recorded from 0.0 to 12.9 feet (interpreted as cobbles and boulders with lesser gravel, sand, and silt), and from 12.9 to 14.0 feet (interpreted as shale). From 14.0 to 50.0 feet, bedrock was encountered, consisting of light to dark gray and black interbedded sandstone and claystone. The sandstone is fine grained, moderately soft (H5), and intensely weathered (W7); the claystone is very soft (H7) and intensely weathered (W7).

b. Test pit TPR2-22-12 encountered soil from 0.0 to 8.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 2.6 feet, Poorly Graded Sand (SP) from 2.6 to 5.0 feet. Poorly Graded Sand with Gravel and Cobbles (SP)gc was encountered from 2.6 to 7.0 feet, and Poorly Graded Sand with

Gravel, Cobbles, and Boulders was encountered from 7.0 to 8.0 feet. Moisture conditions increased with depth, becoming wet at 7.7 feet.

9. Approximate Station 2190+00 to 2237+63 by others.

10. Approximate Station 2237+63 to 2240+00: Excavation within these stations is expected to encounter primarily bedrock of the Pictured Cliffs Sandstone (Kpc). No subsurface investigations were performed within this segment.

11. Approximate Station 2240+00 to 2255+00: Excavation within these stations is expected to encounter alluvial soil atop shallow bedrock of the Pictured Cliffs Sandstone (Kpc). Subsurface investigations include 2 test pits.

    a. Test pit TPR2-22-17 encountered soil from 0.0 to 3.0 feet and bedrock from 3.0 to 7.5 feet of depth. Silty Sand (SM) was encountered from 0.0 to 3.0 feet and soft (H6) to moderately hard (H4), and very intensely (W8) to moderately weathered (W5) shale from 3.0 to 7.5 feet of depth.

    b. Test pit TPR2-22-18 encountered soil from 0.0 to 0.7 feet and bedrock from 0.7 to 2.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 0.7 feet and fine-grained, moderately hard (H4), and moderately weathered (W5) sandstone from 0.7 to 2.0 feet of depth.

12. Approximate Station 2255+00 to 2287+90: Excavation within these stations is expected to encounter primarily bedrock of the Pictured Cliffs Sandstone (Kpc) formation with occasional thin alluvial soil cover. Subsurface investigations include 1 drill hole and 2 test pits.

    a. Test pit TPR2-22-19 encountered soil from 0.0 to 0.3 feet and bedrock from 0.3 to 0.7 feet of depth. Silty Sand (SM) was encountered from 0.0 to 0.3 feet and fine-grained, moderately hard (H4), and moderately weathered (W5) sandstone with siderite nodules from 0.3 to 0.7 feet of depth.

    b. Drill hole DHR2-22-19 encountered bedrock from 0.0 to 20.0 feet of depth. Moderately soft (H5), intensely weathered (W7) sandstone of the Pictured Cliffs Formation (Kpc) was encountered from 0.0 to 12.9 feet. Very soft (H7), intensely weathered (W7) shale of the Lewis Shale (Kl) was encountered from 12.9 to 14.5 feet, followed by moderately soft (H5), intensely weathered (W7) sandstone from 14.5 to 20.0 feet of depth.

    c. Test pit TPR2-22-20 encountered soil from 0.0 to 2.6 feet and bedrock from 2.6 to 3.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 2.6 feet and fine-grained, moderately hard (H4), and moderately weathered (W5) sandstone from 2.6 to 3.0 feet of depth.

13. The San Juan Lateral Water Treatment Plant Regulating Tank Site is located at a high point along the pipeline alignment, above south edge of the San Juan River Valley. Between 2.0-to-7.3-feet of Silty Sand (SM) overlies bedrock of the Pictured Cliffs Sandstone (Kpc). The bedrock is primarily composed of sandstone with claystone interbeds. The sandstone is argillaceous, fine grained, laminated to

thickly bedded, and ranges from very soft (H7) to hard (H3) and very intensely weathered (W7) to fresh (W3). Most sandstone encountered is moderately hard (H4) and moderately weathered (W5). The claystone is very fine grained, very soft (H7) and moderately weathered (W5) to very intensely weathered (W7). Subsurface investigations include 6 drill holes and 3 test pits. See 53 20 00 for individual geologic logs.

14. Approximate Station 3302+00 to 3412+50: Excavation within these Stations will encounter thin to moderate alluvial cover atop shale and sandstone bedrock of the Pictured Cliffs Sandstone (Kpc) formation. Subsurface investigations include 2 drill holes and 11 test pits.

    a. Test pit TPR2-22-21 encountered soil from 0.0 to 2.5 feet and bedrock from 2.5 to 6.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 2.5 feet and fine-grained, soft (H6) to moderately hard (H4), and intensely (W7) to moderately weathered (W5) sandstone from 2.5 to 6.0 feet of depth.

    b. Drill hole DHPNM-21-1 encountered soil from 0.0 to 3.3 feet and bedrock from 3.3 to 19.5 feet of depth. Silty Sand (SM) was encountered from 0.0 to 3.3 feet. Very soft (H7), intensely weathered (W7) sandstone was encountered from 3.3 to 19.5 feet with thin beds of moderately soft (H5) sandstone in the lower portion of the interval.

    c. Test pit TPR3-21-1 encountered soil from 0.0 to 2.0 feet and bedrock from 2.0 to 5.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 2.0 feet and fine-grained, soft (H6) to moderately hard (H4), and intensely (W7) to moderately weathered (W5) argillaceous sandstone from 2.0 to 5.0 feet of depth.

    d. Test pit TPR3-21-2 encountered soil from 0.0 to 6.0 feet and bedrock from 6.0 to 9.2 feet of depth. Silty Sand (SM) was encountered from 0.0 to 3.3 feet, Clayey Sand (SC) from 3.3 to 6.0 feet, and fine-grained, soft (H6) to moderately hard (H4), and intensely (W7) to moderately weathered (W5) argillaceous sandstone from 6.0 to 9.2 feet of depth.

    e. Test pit TPR3-21-3 encountered soil from 0.0 to 4.5 feet and bedrock from 4.5 to 6.7 feet of depth. Silty Sand (SM) was encountered from 0.0 to 4.5 feet and fine-grained, soft (H6) to moderately hard (H4), and intensely (W7) to moderately weathered (W5) argillaceous sandstone from 4.5 to 6.7 feet of depth.

    f. Test pit TPR3-21-4 encountered soil from 0.0 to 5.5 feet and bedrock from 5.5 to 7.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 5.5 feet and fine-grained, soft (H6) to moderately hard (H4), and intensely (W7) to moderately weathered (W5) argillaceous sandstone from 5.5 to 7.0 feet of depth.

    g. Test pit TPR3-21-5 encountered soil from 0.0 to 4.0 feet and bedrock from 4.0 to 6.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 4.0

feet and fine-grained, soft (H6) to moderately hard (H4), and intensely (W7) to moderately weathered (W5) argillaceous sandstone from 4.0 to 6.0 feet of depth.

h. Test pit TPR3-21-6 encountered soil from 0.0 to 5.0 feet and bedrock from 4.5 to 5.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 2.4 feet, Lean Clay (CL) from 2.0 to 4.5 feet, and fine-grained, soft (H6) to moderately hard (H4), and intensely (W7) to moderately weathered (W5) argillaceous sandstone from 4.5 to 5.0 feet of depth.

i. Test pit TPR3-21-7 encountered soil from 0.0 to 2.0 feet and bedrock from 2.0 to 5.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 2.0 feet, fine-grained, soft (H6), and intensely weathered (W7) argillaceous sandstone of the Lewis Shale (Kl) from 2.0 to 4.5 feet, and moderately hard (H4), moderately weathered (W5) shale from 4.5 to 5.0 feet of depth.

j. Test pit TPR3-21-8 encountered soil from 0.0 to 1.8 feet and bedrock from 1.8 to 2.0 feet of depth. Silty Sand with Gravel (SM)g was encountered from 0.0 to 0.5 feet, Silty Sand (SM) from 0.5 to 1.8 feet, and fine-grained, hard (H3), and slightly to moderately weathered (W4) argillaceous sandstone from 1.8 to 2.0 feet of depth.

k. Test pit TPR3-21-9 encountered soil from 0.0 to 4.0 feet and bedrock from 4.0 to 10.0 feet of depth. Silty Sand (SM) was encountered from 0.0 to 3.2 feet, Lean Clay (CL) from 3.2 to 4.0 feet, and soft (H6) to moderately soft (H5), and intensely (W7) to moderately weathered (W5) shale from 4.0 to 10.0 feet of depth.

l. Drill hole DHPNM-21-2 encountered soil from 0.0 to 18.6 feet and bedrock from 18.6 to 19.5 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.5 feet, Sandy Lean Clay (CL) from 1.5 to 8.3 feet, Lean Clay with Sand (CL)s from 8.3 to 18.6 feet, and moderately soft (H5), intensely weathered (W7) sandstone from 18.6 to 19.5 feet of depth.

m. Test pit TPR3-21-10 encountered soil from 0.0 to 0.5 feet and bedrock from 0.5 to 3.7 feet of depth. Silty Sand with Gravel (SM)g was encountered from 0.0 to 0.5 feet, fine-grained, moderately hard (H4), and moderately weathered (W5) argillaceous sandstone from 0.5 to 2.2 feet, and moderately soft (H5) to hard (H3), and moderately (W5) to slightly weathered (W4) shale from 2.2 to 3.7 feet of depth.

15. Approximate Station 3412+50 to 3413+30: Excavation within these Stations is expected to encounter shale and sandstone bedrock of the Pictured Cliffs Sandston (Kpc) formation. No subsurface investigations were performed within these Stations.

16. Approximate Station 3413+30 to 3417+30: Excavation within these stations will encounter shale and sandstone bedrock of the Lewis Shale (Kl) formation. No subsurface investigations were performed within these Stations.

17. Approximate Station 3417+30 to 3424+00: Excavation within these stations will encounter moderate alluvial soil atop Lewis Shale (Kl) formation bedrock. Subsurface investigations include 1 test pit.

    a. Test pit TPR3-21-11 encountered soil from 0.0 to 3.8 feet and bedrock from 3.8 to 9.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 3.8 feet and very soft (H7) to moderately soft (H5), and decomposed (W9) to moderately weathered (W5) shale from 3.8 to 9.0 feet of depth.

18. Approximate Station 3424+00 to 3444+00: Excavation within these stations will encounter primarily alluvial soil atop Lewis Shale (Kl) formation bedrock. Subsurface investigations include 4 drill holes and 1 test pits.

    a. Drill hole DHPNM-21-3 encountered soil from 0.0 to 16.1 feet and bedrock from 16.1 to 39.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 2.3 feet, Lean Clay (CL) from 2.3 to 11.8 feet, Fat Clay (CH) from 11.8 to 16.1 feet, very soft (H7), intensely weathered (W7) shale from 16.1 to 22.2 feet, and moderately soft (H5), moderately weathered (W5) shale from 22.2 to 39.0 feet of depth.

    b. Drill hole DHPNM-21-3A encountered soil from 0.0 to 15.4 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 2.3 feet, Lean Clay (CL) from 2.3 to 11.8 feet, and Fat Clay (CH) from 11.8 to 15.4 feet of depth.

    c. Drill hole DHPNM-21-4 encountered soil from 0.0 to 16.2 feet and bedrock from 16.2 to 39.5 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 0.7 feet, Fat Clay (CH) from 0.7 to 12.2 feet, Lean Clay with Sand (CL)s from 12.2 to 16.2 feet, very soft (H7), intensely weathered (W7) shale from 16.2 to 35.4 feet, and moderately soft (H5), moderately weathered (W5) shale from 35.4 to 39.5 feet of depth.

    d. Drill hole DHPNM-21-4A encountered soil from 0.0 to 14.7 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 0.7 feet, Fat Clay (CH) from 0.7 to 12.2 feet, and Lean Clay with Sand (CL)s from 12.2 to 14.7 feet of depth.

    e. Test pit TPR3-21-12 encountered soil from 0.0 to 9.0 feet and bedrock from 9.0 to 11.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 9.0 feet and moderately soft (H5), moderately weathered (W5) shale from 9.0 to 11.0 feet of depth.

19. Approximate Station 3444+00 to 3474+00: Excavation within these Stations will encounter thin to moderate alluvial soil cover atop bedrock of the Lewis Shale (Kl) formation. Subsurface investigations include 3 test pits.

    a. Test pit TPR3-21-13 encountered soil from 0.0 to 9.5 feet and bedrock from 9.5 to 11.0 feet of depth. Clayey Sand (SC), classified in the laboratory as Lean Clay (CL), was encountered from 0.0 to 9.5 feet. Very soft (H7), very intensely weathered (W8) shale was encountered from 9.5 to 11.0 feet of depth.

b. Test pit TPR3-21-14 encountered soil from 0.0 to 2.0 feet and bedrock from 2.0 to 10.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 2.0 feet, very soft (H7), decomposed (W9) shale was encountered from 2.0 to 3.0 feet, soft (H6), moderately to intensely weathered (W6) shale from 3.0 to 6.0 feet, and moderately soft (H5) to moderately hard (H4), moderately weathered (W5) shale from 6.0 to 10.0 feet of depth.

c. Test pit TPR3-21-15 encountered soil from 0.0 to 3.8 feet and bedrock from 3.8 to 10.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 3.8 feet, very soft (H7), very intensely weathered (W8) shale was encountered from 3.8 to 5.0 feet, soft (H6), moderately to intensely weathered (W6) shale from 5.0 to 8.0 feet, and moderately soft (H5), moderately weathered (W5) shale from 8.0 to 10.0 feet of depth.

20. Approximate Station 3474+00 to 3493+00: Excavation within these Stations will encounter primarily alluvial soil atop bedrock of the Lewis Shale (Kl) formation. Subsurface investigations include 1 drill hole.

    a. Drill hole DHPNM-21-5 encountered soil from 0.0 to 20.2 feet of depth. Lean Clay (CL) was encountered from 0.0 to 13.3 feet, and Lean Clay with Sand (CL)s from 13.3 to 20.2 feet of depth.

21. Approximate Station 3493+00 to 3517+30: Excavation within these stations will encounter thin alluvial soils atop bedrock of the Lewis Shale (Kl) formation. Subsurface investigations include 2 test pits.

    a. Test pit TPR3-21-16 encountered soil from 0.0 to 3.0 feet and bedrock from 3.0 to 8.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 3.0 feet, and moderately soft (H5) to moderately hard (H4), moderately weathered (W5) shale was encountered from 3.0 to 8.0 feet of depth.

    b. Test pit TPR3-21-17 encountered soil from 0.0 to 4.9 feet and bedrock from 4.9 to 8.5 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 4.9 feet, and moderately soft (H5), moderately weathered (W5) shale was encountered from 4.9 to 8.5 feet of depth.

22. Approximate Station 3517+30 to 3536+24 by others.

23. Approximate Station 3536+24 to 3537+80: Excavation within these stations will encounter thin to moderate alluvial cover atop bedrock of the Cliff House Sandstone (Kch) formation. No subsurface investigations were conducted within these stations.

24. Approximate Station 3537+80 to 3545+20: Excavation within these stations will encounter alluvial soils atop bedrock of the Menefee Formation (Kmf). No subsurface investigations were conducted within these stations.

25. Approximate Station 3545+20 to 3571+50: Excavation within these stations will encounter primarily alluvial soils atop bedrock of the Menefee Formation (Kmf). Subsurface investigations include 2 test pits.

a. Test pit TPR3-21-19 encountered soil from 0.0 to 10.5 feet of depth. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 3.6 feet, Clayey Sand (SC), classified in the laboratory as Silty Sand (SM), was encountered from 3.6 to 10.0 feet, and Lean Clay (CL) was encountered from 10.0 to 10.5 feet of depth.

b. Test pit TPR3-21-21 encountered soil from 0.0 to 9.5 feet and bedrock from 9.5 to 10.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 9.5 feet, and soft (H6), intensely weathered (W7) sandstone was encountered from 9.5 to 10.0 feet of depth.

26. Approximate Station 3571+50 to 3579+50: Excavation within these stations will encounter bedrock of the Point Lookout Sandstone (Kpl) formation. Subsurface investigations include 1 test pit.

a. Test pit TPR3-21-22 encountered soil from 0.0 to 2.0 feet and bedrock from 2.0 to 2.5 feet of depth. Silty Sand (SM) was encountered from 0.0 to 2.0 feet, and moderately hard (H4) to hard (H3), moderately weathered (W5) sandstone was encountered from 2.0 to 2.5 feet of depth.

27. Approximate Station 3579+50 to 3651+50: Excavation within these stations will encounter moderate alluvial cover atop bedrock of the Mancos Shale (Kl) formation. Subsurface investigations include 2 drill holes and 5 test pits.

a. Drill hole DHPNM-21-9 encountered soil from 0.0 to 6.8 feet and bedrock from 6.8 to 19.5 feet of depth. Lean Clay with Sand (CL)s was encountered from 0.0 to 6.8 feet, moderately soft (H5), intensely weathered (W7) interbedded shale and claystone from 6.8 to 16.2 feet, and moderately soft (H5), moderately weathered (W5) shale from 16.2 to 19.5 feet of depth.

b. Test pit TPR3-21-23 encountered soil from 0.0 to 6.5 feet and bedrock from 6.5 to 7.5 feet of depth. Clayey Sand (SC), classified in the laboratory as Lean Clay with Sand (CL), was encountered from 0.0 to 6.5 feet, moderately soft (H5), moderately weathered (W5) shale was encountered from 6.5 to 7.0 feet, and moderately hard (H4), slightly to moderately weathered (W4) shale was encountered from 7.0 to 7.5 feet of depth.

c. Test pit TPR3-21-24 encountered soil from 0.0 to 2.0 feet and bedrock from 2.0 to 3.8 feet of depth. Silty Sand (SM) was encountered from 0.0 to 2.0 feet, and moderately soft (H5), moderately weathered (W5) shale was encountered from 2.0 to 3.0 feet, becoming moderately hard (H4), slightly to moderately weathered (W4) shale from 3.0 to 3.8 feet of depth.

d. Test pit TPR3-21-25 encountered soil from 0.0 to 0.8 feet and bedrock from 0.8 to 5.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 0.8 feet, soft (H6) to moderately soft (H5), intensely weathered (W7) shale was encountered from 0.8 to 4.5 feet, and moderately hard (H4),

moderately weathered (W5) shale was encountered from 4.5 to 5.0 feet of depth.

e. Test pit TPR3-21-26 encountered soil from 0.0 to 1.2 feet and bedrock from 1.2 to 6.5 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.2 feet, very soft (H7), decomposed (W9) Lean Clay (CL) interpreted as Mancos Shale was encountered from 1.2 to 3.5 feet, and soft (H6), moderately to intensely weathered (W6) shale was encountered from 3.5 to 6.0 feet, becoming moderately hard (H4), moderately weathered (W5) shale from 6.0 to 6.5 feet of depth.

f. Drill hole DHPNM-21-10 encountered soil from 0.0 to 5.2 feet and bedrock from 5.2 to 19.5 feet of depth. Lean Clay (CL) was encountered from 0.0 to 5.2 feet, very soft (H7), intensely weathered (W7) shale from 5.2 to 15.8 feet, and moderately soft (H5), moderately weathered (W5) shale from 15.8 to 19.5 feet of depth.

g. Test pit TPR3-21-27 encountered soil from 0.0 to 4.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 4.0 feet of depth.

28. Approximate Station 3651+50 to 3662+50: Excavation within these stations will encounter primarily alluvial soils atop bedrock of the Mancos Shale (Km) formation. Subsurface investigations include 2 drill holes.

a. Drill hole DHPNM-21-11 encountered soil from 0.0 to 7.4 feet and bedrock from 7.4 to 40.0 feet of depth. Lean Clay with Sand (CL)s was encountered from 0.0 to 7.4 feet, very soft (H7), intensely weathered (W7) shale from 7.4 to 12.5 feet, very soft (H7), intensely weathered (W7) shale with moderately hard (H5) sandstone laminations from 12.5 to 18.1 feet, and moderately soft (H5), moderately weathered (W5) shale from 18.1 to 40.0 feet of depth.

b. Drill hole DHPNM-21-12 encountered soil from 0.0 to 19.0 feet and bedrock from 19.0 to 40.0 feet of depth. Lean Clay with Sand (CL)s was encountered from 0.0 to 9.5 feet, Lean Clay (CL) from 9.5 to 19.0 feet, moderately soft (H5), moderately weathered (W5) shale from 19.0 to 27.5 feet, very soft, moderately weathered (W5) claystone from 27.5 to 27.8 feet, and moderately soft (H5), moderately weathered (W5) shale from 27.8 to 40.0 feet of depth.

29. Approximate Station 3662+50 to 3744+55: Excavation within these stations will encounter thin to moderate alluvial soils atop bedrock of the Mancos Shal (Km) formation. Subsurface investigations include 1 drill hole and 7 test pits.

a. Drill hole DHPNM-21-13 encountered soil from 0.0 to 4.5 feet and bedrock from 4.5 to 40.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 4.5 feet, very soft (H7), intensely weathered (W7) shale from 4.5 to 16.7 feet, moderately soft (H5), moderately weathered (W5) shale from 16.7 to 25.4 feet, very soft (H7), moderately weathered (W5)

claystone from 25.4 to 25.9 feet and moderately soft (H5), moderately weathered (W5) shale from 25.9 to 40.0 feet of depth.

30. TPR3-21-28 encountered soil from 0.0 to 5.5 feet and bedrock from 5.5 to 6.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.8 feet, Lean Clay with Sand (CL) was encountered from 1.8 to 5.5 feet, and moderately soft (H5), intensely weathered (W7) shale was encountered from 5.5 to 6.0 feet of depth.

31. TPR3-21-29 encountered soil from 0.0 to 3.0 feet and bedrock from 3.0 to 5.3 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.0 feet, Sandy Lean Clay (CL) was encountered from 1.0 to 3.0 feet, and soft (H6), intensely weathered (W7) shale was encountered from 3.0 to 5.0 feet, becoming moderately hard (H4), moderately weathered (W5) shale from 5.0 to 5.3 feet of depth.

32. TPR3-21-30 encountered soil from 0.0 to 5.3 feet and bedrock from 5.3 to 8.5 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 5.3 feet, soft (H6), intensely weathered (W7) shale was encountered from 5.3 to 7.0 feet, and moderately soft (H5) to moderately hard (H4), moderately weathered (W5) shale was encountered from 7.0 to 8.5 feet of depth.

33. TPR3-21-31 encountered soil from 0.0 to 3.5 feet and bedrock from 3.5 to 6.0 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 3.5 feet, soft (H6), intensely weathered (W7) shale was encountered from 3.5 to 4.5 feet, and moderately hard (H4), moderately weathered (W5) shale was encountered from 4.5 to 6.0 feet of depth.

34. TPR3-21-32 encountered soil from 0.0 to 1.1 feet and bedrock from 1.1 to 3.2 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.1 feet, and moderately soft (H5), moderately to intensely weathered (W6) shale was encountered from 1.1 to 3.2 feet of depth.

35. TPR3-21-33 encountered soil from 0.0 to 1.2 feet and bedrock from 1.2 to 5.2 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.2 feet, and very soft (H7) to moderately soft (H5), moderately to intensely weathered (W6) shale was encountered from 1.2 to 5.2 feet of depth.

36. TPR3-21-34 encountered soil from 0.0 to 1.8 feet and bedrock from 1.8 to 4.8 feet of depth. Clayey Sand (SC) was encountered from 0.0 to 1.8 feet, very soft (H7), very intensely weathered (W8) shale was encountered from 1.8 to 3.5 feet, and moderately hard (H4), moderately weathered (W5) shale was encountered from 3.5 to 4.8 feet of depth.

1.06 WATER OCCURRENCE

A. Water level data show conditions at particular time or times information was obtained and may not indicate variations such as those caused by periods of drought, increased rainfall, seasonal fluctuations in precipitation, or application of irrigation water.

B. Sand washes and tributary streams that intersect pipeline alignment may have intermittent surface water flow, particularly after rainfall. Surface flow would have an adverse effect

on excavation and construction of the pipeline and structures in close proximity. Surface flow is likely to increase groundwater elevation in surrounding areas and would likely increase groundwater elevations in areas that are dry (relative to pipeline and structure foundations) when streams do not have flowing surface water.

1. Approximate Station 2004+00 to 2008+00 Frank Chee Willetto Dam outlet crossing: Groundwater and surface water are expected to be encountered within these stations. Surface flow readings at the nearby east trapezoidal flume within the outlet channel, generally range from 20 to 60 gallons per minute (gpm). Groundwater measurements at three nearby wells, PWR2-23-1, OWR2-23-21 and OWR2-23-22 were measured during installation in February and March of 2023. Water levels were 6.0, 4.9 and 6.0 feet below ground surface respectively. The pump well was pumped dry in 20 seconds at a rate of 5 gpm, and it took 15 minutes to recharge, indicating low permeability.

2. Approximate Station 2072+00 to 2085+00 Shumway Arroyo: Groundwater and surface water are expected to be encountered within these stations. Small amounts of surface water are normally observed in the main channel year-round. Precipitation events, particularly during monsoon season and spring snowmelt regularly increases surface flows. Drill hole DHR2-22-4 encountered groundwater at 14.2 feet on March 19th, 2022. A groundwater monitoring well was installed. Groundwater was measured at 19.2 feet below ground surface in the monitoring well at DHR2-22-4 on September 21, 2022. Groundwater was also encountered at 6.8 feet below ground surface in drill hole DHR2-24-35 on September 13th, 2024.

3. Approximate Station 2105+00 to 2157+00: Groundwater is expected at depth. Possible groundwater sources include infiltration from the Shumway arroyo, the Farmers Ditch agricultural irrigation, and precipitation events. Water is often perched atop impervious bedrock units, saturating the alluvium (Qal) or terrace gravel (Qtg) above. Drill hole DHR2-22-9 encountered groundwater at 23.1 feet, drill hole DHR2-22-10 encountered groundwater at 15.2 feet, drill hole DHR2-22-12 encountered groundwater at 17.3 feet.

4. Approximate Station 2180+00 to 2190+00: Groundwater will be encountered within these stations. An alluvial aquifer associated with the San Juan River, extends to both sides of the San Juan River floodplain. Saturated alluvium (Qal) and terrace gravel (Qtg) overly Lewis Shale (Kl) bedrock. Drill hole DHR2-22-17 encountered groundwater at 8.2 feet and a groundwater monitoring well was installed. Test pit TPR2-22-12 encountered groundwater at 7.7 feet.

1.07 ENGINEERING GEOLOGY AND GEOTECHNICAL CONSIDERATIONS

A. Geologic Considerations during trench excavation and pipeline construction include slope stability, soil and rock excavation. Depending on conditions, various excavation and construction methods may be employed.

B. Excavation:

1. Soil and fill can be excavated using common excavation methods. Backhoe refusal in test pits was generally met in moderately hard (H4), and slightly to moderately weathered (W4) to moderately weathered (W5) shale or sandstone bedrock. Backhoe test pits generally reached refusal after excavating 2-to-4 feet into Mancos Shale (Km) shale bedrock.
2. Decomposed to intensely weathered sandstone and decomposed to moderately weathered claystone, siltstone and shale can be excavated using common methods. Less weathered sandstone, claystone, siltstone and shale layers may require rock excavation methods.
3. Local, hard, moderately or less weathered zones and cemented zones may be encountered within decomposed and weathered bedrock. These zones are likely to require rock excavation methods. Excavation of these zones may generate larger blocks that have to be reduced to a manageable size by hydraulic hoe-ram, mechanical splitting or other non-explosives measures.
4. Excavation of bedrock in confined areas with limited access for ripping with a bulldozer and a single ripper shank may require rock excavation methods such as a hydraulic hoe-ram or mechanical splitting:
5. Proper drainage should be provided during construction to prevent water from ponding near trenching operations or contaminating the line pipe.
6. Unconsolidated soils and weathered bedrock can be excavated using common methods.
7. Hard (H3) to moderately hard (H4) bedrock or formations containing hard lenses, concretions and interbeds, will be encountered during excavation. Progress may be slow and difficult and will likely require rock excavation methods, particularly where the trench excavation becomes constricted in width. Rock teeth, hydraulic hammers, ripper shanks and large excavation equipment will be necessary.
8. Trenching in areas with steep topography or below rock outcrops may require rockfall mitigation measures. Trenchless excavation methods in bedrock will require equipment designed for rock boring.

C. Slope Stability

1. Temporary and permanent cut slopes and slope stability: All cut slopes shall be constructed in accordance with Reclamation Safety and Health and OSHA Standards. Recommendations are for dry or adequately drained materials. These recommendations are for all slopes with a vertical height less than 20-feet. Slopes with a vertical height of 20-feet or greater should be designed by a registered professional engineer in accordance with Reclamation Safety and Health and OSHA Standards. Materials with excessive moisture will require further flattening for stability or other slope stability measures:
    a. Temporary and permanent slopes excavated in fill, soil, and bedrock shall conform to OSHA slope requirements.

b. Other specification sections detail slope requirements and shall be used for construction of the pipeline and structures.

2. Recommendations for cut slopes in surficial deposits are based on material type and texture. All cut slopes shall be constructed in accordance with the Reclamation Safety and Health Standards and OSHA standards.

3. Recommendations are for dry or adequately dewatered materials. Cut slopes in materials with excessive moisture will require further flattening for stability.

4. Natural slopes in unconsolidated alluvium are generally stable at approximately 1.5:1 or sometimes flatter in sandy or coarse-grained materials. Bedrock exposures in the area are typically stable at about 1.5:1 or steeper in claystone and shale and 1:1 to vertical in sandstone.

5. Recommendations for cut slopes in surficial deposits are based on material type and texture. All cut slopes shall be constructed in accordance with the Reclamation Safety and Health Standards and OSHA standards. Recommendations are for dry or adequately dewatered materials. Materials with excessive moisture will require further flattening for stability. Recommended cut slopes for type C soils, including granular soils such as Poorly Graded Gravel (GP), Cobbles, Poorly Graded Sand (SP), Poorly Graded Sand with Silt (SP-SM), and Silty Sand (SM), are 1.5:1. Recommended cut slopes for type B soils, including Silty Clayey Sand (SC/SM) and Clayey Sand (SC) are 1:1. Lean Clay (CL) to Fat Clay (CH) soils are classified as type B soils and should have cut slopes of 1:1 or flatter. Cut slopes in bedrock will be dependent upon the rock type and degree of weathering. All decomposed to intensely weathered, very soft bedrock will be classified as a type B or type C soils depending upon the composition of the rock. Moderately weathered to fresh, moderately soft to hard bedrock can be classified as stable rock, if all requirements of the Reclamation Safety and Health Standards are met.

D. Constructability Considerations:

1. Access roads may become muddy and excessively slick with rain, surface run-off, or water applied for construction.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 53 20 00

RECORDS OF GEOLOGIC AND SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.01 GEOLOGY DRAWINGS

A. Some drawings are in color to highlight geologic information. Geologic information shown on drawings is of equal importance regardless of whether or not it is highlighted.

Geology Drawings

Sheet No.	Drawing No.	Title
G1	103-D-347	Unified Soil Classification – Including Identification and Description
G2	40-D-7022	Geology for Design & Specifications, Standard Descriptors and Descriptive Criteria for Rock
G3	40-D-7023	Geology for Design & Specifications, Standard Descriptors and Descriptive Criteria for Discontinuities
G4	1695-529-60340	San Juan Lateral – Block 2-3, PNM Alternative, General Geologic Legend, Explanation and Notes
G5	1695-529-60426	San Juan Lateral – Block 2-3, San Juan Lateral Water Treatment Plant Regulating Tank Site, General Geologic Legend, Explanation and Notes
G6	1695-529-60355	San Juan Lateral, Reach 2 PNM Alternative, Location of Explorations
G7	1695-529-60357	San Juan Lateral, Reach 2 PNM Alternative, Surface Geology
G8	1695-529-60358	San Juan Lateral, Reach 2 PNM Alternative, Surface Geology
G9	1695-529-60359	San Juan Lateral, Reach 2 PNM Alternative, Surface Geology
G10	1695-529-60360	San Juan Lateral, Reach 2 PNM Alternative, Surface Geology
G11	1695-529-60361	San Juan Lateral, Reach 2 PNM Alternative, Surface Geology

Geology Drawings

Sheet No.	Drawing No.	Title
G12	1695-529-60362	San Juan Lateral, Reach 2 PNM Alternative, Surface Geology
G13	1695-529-60434	San Juan Lateral, Shumway Wash – HDD, Geologic Profile
G14	1695-529-60389	San Juan Lateral, Reach 2, Farmers Mutual Ditch HDD Geologic Profile
G15	1695-529-60411	San Juan Lateral - Block 2-3, San Juan Lateral Water Treatment Plant Regulating Tank Site, Surface Geology, Location of Exploration & Location of Geologic Sections
G16	1695-529-60424	San Juan Lateral - Block 2-3, San Juan Lateral Water Treatment Plant Regulating Tank Site, Geologic Sections A-A' and B-B'
G17	1695-529-60425	San Juan Lateral - Block 2-3, San Juan Lateral Water Treatment Plant Regulating Tank Site, Geologic Sections C-C', D-D' and E-E'
G18	1695-529-60354	San Juan Lateral, Reach 3 PNM Alternative, Location of Explorations
G19	1695-529-60363	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology
G20	1695-529-60364	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology
G21	1695-529-60365	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology
G22	1695-529-60366	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology
G23	1695-529-60367	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology
G24	1695-529-60368	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology
G25	1695-529-60369	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology
G26	1695-529-60370	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology

Geology Drawings

Sheet No.	Drawing No.	Title
G27	1695-529-60371	San Juan Lateral, Reach 3 PNM Alternative, Surface Geology

1.02 GEOLOGIC LOGS

Geologic Logs

Sheet No.	Title
Drill Holes	
G28	Geologic Log of Drill Hole No. OWR2-23-22
G29	Geologic Log of Drill Hole No. PWR2-23-1
G30	Geologic Log of Drill Hole No. OWR2-23-21
G31	Geologic Log of Drill Hole No. DHR2-22-1
G32	Geologic Log of Drill Hole No. DHR2-22-2
G33	Geologic Log of Drill Hole No. DHR2-22-3
G34	Geologic Log of Drill Hole No. DHR2-22-4
G35	Geologic Log of Drill Hole No. DHR2-23-33
G36	Geologic Log of Drill Hole No. DHR2-23-34
G37	Geologic Log of Drill Hole No. DHR2-23-35
G38	Geologic Log of Drill Hole No. DHR2-23-36, Sheet 1 of 2
G39	Geologic Log of Drill Hole No. DHR2-23-36, Sheet 2 of 2
G40	Geologic Log of Drill Hole No. DHR2-22-8, Sheet 1 of 2
G41	Geologic Log of Drill Hole No. DHR2-22-8, Sheet 2 of 2
G42	Geologic Log of Drill Hole No. DHR2-22-9
G43	Geologic Log of Drill Hole No. DHR2-22-10, Sheet 1 of 2

Geologic Logs

Sheet No.	Title
G44	Geologic Log of Drill Hole No. DHR2-22-10, Sheet 2 of 2
G45	Geologic Log of Drill Hole No. DHR2-22-12
G46	Geologic Log of Drill Hole No. DHR2-22-17
G47	Observation Well Completion Diagram, Drill Hole: DHR2-22-17
G48	Geologic Log of Drill Hole No. DHR2-22-19
G49	Geologic Log of Drill Hole No. DHMLT-23-1
G50	Geologic Log of Drill Hole No. DHMLT-23-2
G51	Geologic Log of Drill Hole No. DHMLT-23-3
G52	Geologic Log of Drill Hole No. DHMLT-23-4
G53	Geologic Log of Drill Hole No. DHMLT-23-5
G54	Geologic Log of Drill Hole No. DHMLT-23-6, Sheet 1 of 2
G55	Geologic Log of Drill Hole No. DHMLT-23-6, Sheet 2 of 2
G56	Geologic Log of Drill Hole No. DHPNM-21-1
G57	Geologic Log of Drill Hole No. DHPNM-21-2
G58	Geologic Log of Drill Hole No. DHPNM-21-3
G59	Geologic Log of Drill Hole No. DHPNM-21-3A
G60	Geologic Log of Drill Hole No. DHPNM-21-4
G61	Geologic Log of Drill Hole No. DHPNM-21-4A, Sheet 1 of 2
G62	Geologic Log of Drill Hole No. DHPNM-21-4A, Sheet 2 of 2
G63	Geologic Log of Drill Hole No. DHPNM-21-5
G64	Geologic Log of Drill Hole No. DHPNM-21-9
G65	Geologic Log of Drill Hole No. DHPNM-21-10
G66	Geologic Log of Drill Hole No. DHPNM-21-11

Geologic Logs

Sheet No.	Title
G67	Geologic Log of Drill Hole No. DHPNM-21-12
G68	Geologic Log of Drill Hole No. DHPNM-21-13
Test Pits	
G69	Log of Test Pit No. TPR2-22-24
G70	Log of Test Pit No. TPR2-22-23
G71	Log of Test Pit No. TPR2-22-2
G72	Log of Test Pit No. TPR2-22-4
G73	Log of Test Pit No. TPR2-22-5
G74	Log of Test Pit No. TPR2-22-10
G75	Log of Test Pit No. TPR2-22-12
G76	Log of Test Pit No. TPR2-22-17
G77	Log of Test Pit No. TPR2-22-18
G78	Log of Test Pit No. TPR2-22-19
G79	Log of Test Pit No. TPR2-22-20
G80	Log of Test Pit No. TPMLT-23-01
G81	Log of Test Pit No. TPMLT-23-02
G82	Log of Test Pit No. TPMLT-23-03
G83	Log of Test Pit No. TPR2-22-21
G84	Log of Test Pit No. TPR3-21-1
G85	Log of Test Pit No. TPR3-21-2
G86	Log of Test Pit No. TPR3-21-3
G87	Log of Test Pit No. TPR3-21-4
G88	Log of Test Pit No. TPR3-21-5

Geologic Logs

Sheet No.	Title
G89	Log of Test Pit No. TPR3-21-6
G90	Log of Test Pit No. TPR3-21-7
G91	Log of Test Pit No. TPR3-21-8
G92	Log of Test Pit No. TPR3-21-9
G93	Log of Test Pit No. TPR3-21-10
G94	Log of Test Pit No. TPR3-21-11
G95	Log of Test Pit No. TPR3-21-12
G96	Log of Test Pit No. TPR3-21-13
G97	Log of Test Pit No. TPR3-21-14
G98	Log of Test Pit No. TPR3-21-15
G99	Log of Test Pit No. TPR3-21-16
G100	Log of Test Pit No. TPR3-21-17
G101	Log of Test Pit No. TPR3-21-19
G102	Log of Test Pit No. TPR3-21-21
G103	Log of Test Pit No. TPR3-21-22
G104	Log of Test Pit No. TPR3-21-23
G105	Log of Test Pit No. TPR3-21-24
G106	Log of Test Pit No. TPR3-21-25
G107	Log of Test Pit No. TPR3-21-26
G108	Log of Test Pit No. TPR3-21-27
G109	Log of Test Pit No. TPR3-21-28
G110	Log of Test Pit No. TPR3-21-29
G111	Log of Test Pit No. TPR3-21-30

Geologic Logs

Sheet No.	Title
G112	Log of Test Pit No. TPR3-21-31
G113	Log of Test Pit No. TPR3-21-32
G114	Log of Test Pit No. TPR3-21-33
G115	Log of Test Pit No. TPR3-21-34

1.03 LABORATORY TEST DATA

Laboratory Test Data

Sheet No.	Title
Laboratory Test Data for Drill Holes	
G116	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHR2-22-9 PNM
G117	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-1
G118	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-2
G119	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-3
G120	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-4
G121	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-5
G122	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-9
G123	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-10
G124	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-11

Laboratory Test Data

Sheet No.	Title
G125	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHPNM-21-12
Laboratory Test Data for Test Pits	
G126	Summary of Physical Properties Test Results, TPR2-22-4
G127	Summary of Physical Properties Test Results, TPR3-21-2, TPR3-21-12, TPR3-21-13, TPR3-21-19, TPR3-21-21, TPR3-21-23, TPR3-21-6

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION