PROJECT MANUAL

IHS WHITERIVER HOSPITAL

Prepared for: INDIAN HEALTH SERVICE

100% CONSTRUCTION DOCUMENTS
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VOLUME 1

Prepared by:

SMITHGROUP

PHOENIX, ARIZONA

IHS REVIEW AND APPROVAL

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DOCUMENT 000107 - SEALS PAGE

Include on this Seals Page Document the seals of the design professionals of record required by statute to affix their seal to the documents. Where required, include a description of the Specification Sections prepared under the direction of each design professions *EDIT FOR YOUR PROJECT-USE DIVISION AND/OR SECTION NUMBERS*. If such listing is required, you may alternatively use the MasterSpec seals page instead of this SmithGroup seals page.

Architect SmithGroup, Inc. Phoenix, AZ Matthew Hess, AIA, NCARB Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record. 	Structural Engineer PK Associates and Pimara Paul Koehler Scottsdale, Arizona Christa Chau, PE, SE Responsible for: Division 03, Sections 030000 and 032000; Division 04, Section 042000; Division 05, Sections 051200 and 053100; and Division 31, Section 316329
Civil Engineer Dibble & Associates Consulting Engineers, Inc. Phoenix, Arizona Christina Shannon Mauck, PE Responsible for: Division 01, Section 015713, Division 02, Section 024100, Division 09, Section 099713, Division 31, Sections 312213, 312300, 312316.16, 312323.13, 312333, 312500, Division 32, Sections 321123, 321216, 321313, 321315, Division 33, Sections 331000, 331623, 333000, 333213, 333723, 334213 	Fire Protection Engineer SmithGroup, Inc. Phoenix, AZ Andrew Ochsankehl, PE Responsible for: Division 13, Section 131200*; Division 21, Sections 211300, 213000, 210533; Division 27, Section 273226; Division 28, Section 283111 *Fire Protection Related Requirements Only

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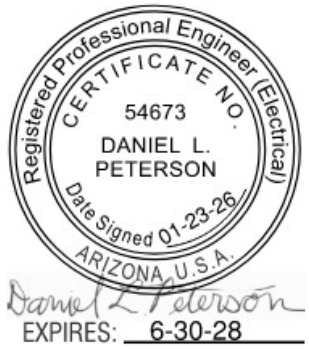

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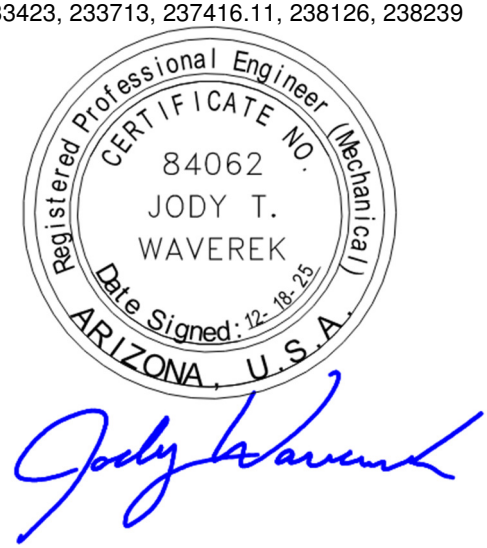
Plumbing Engineer Morrison-Maierle Phoenix, Arizona Jody Waverek, PE Responsible for plumbing specifications for the WWTPs: Division 22: 220517, 220518, 220519, 220523.12, 220523.14, 220529, 220548, 220553, 220719, 221116, 221119, 221123, 221123.13, 221316, 221429, 223300, 224213.13, 224213.16, 224216.13, 224216.16, 224223, 224500 	Mechanical Engineer Morrison-Maierle Phoenix, Arizona Jody Waverek, PE Responsible for mechanical specifications for the WWTPs: Division 23: 230513, 230529, 230548, 230553, 230593, 230713, 230716, 230900, 233113, 233300, 233423, 233713, 237416.11, 238126, 238239 

Environmental Engineer Morrison-Maierle Phoenix, Arizona Ulrike Lashley, PE Responsible for the following specifications for the WWTPs: Division 09: 099600; Division 10: 101400.01, 104352; Division 40: 400205, 400510, 400510.03, 400510.04, 400510.09, 400510.12, 400510.13, 400510.30, 400553, 400555, 400557, 406110, 406115, 406116, 406120, 406120.01, 406120.02, 406120.03, 406120.04, 406121, 406124, 406127, 406128, 406140, 406160, 406171, 406176, 406177, 406180, 406181, 406182, 406191; Division 41: 413313.17; Division 43: 431030, 431111, 432256, 432321, 432331, 432331.01, 432358, 433230, 433269, 434010; Division 46: 460754, 460754.01, 460754.02, 460754.03, 460754.04, 460754.05, 460754.06, 460754.07, 460754.08, 460754.09, 460754.10, 461155, 461155.01, 461155.02, 461155.03, 461155.04, 462113, 462113.01, 462113.02, 462113.03, 465035, 465035.01, 465035.02, 465131, 465131.01, 465131.02 	Hazardous Building Materials Mabbett & Associates, Inc. Stoneham, Massachusetts Michael Delaney, Asbestos Designer Responsible for: 028200, 028313

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work performed by Owner.
5. Work under Owner's Separate Contracts.
6. Owner-furnished/Contractor-installed (OFCI) products.
7. Owner-furnished/Owner-installed (OFOI) products.
8. Contractor's use of site and premises.
9. Work restrictions.
10. Specification and Drawing conventions.

B. Related Requirements:
1. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design.

1.2 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.3 PROJECT INFORMATION

A. Project Identification: IHS Whiteriver Hospital.
1. Project Location: 200 W. Hospital Drive, Whiteriver, Arizona 85941.

B. Owner: Indian Health Service, Two Renaissance Square, 40 North Central Avenue, Suite 601, Phoenix, Arizona 85004.

C. Architect: SmithGroup, 455 North Third Street, Phoenix, Arizona 85004.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
1. The proposed new Whiteriver Hospital will consist of an approximately 407,000 gross square foot building. It will be a modern, technologically advanced facility with enough space and staff to provide an expanded level of health care services specifically designed to meet the health care needs of the American Indian and Alaskan Natives in the Whiteriver service unit. Scope shall include Civil, Landscape, Architectural, Structural, Mechanical, Plumbing, and Electrical; in compliance with the latest applicable building Codes and regulations. The new facility will be constructed to provide the best possible environment for care with emphasis placed on care and safety.

B. Type of Contract:
1. Project will be constructed under a single prime contract.

C. The Engaging of Testing Agencies: All testing required here within is the responsibility of the Contractor, including but not limited to all references to "Owner testing agency", "Owner will engage a qualified testing agency....", et al.

1.5 PHASED CONSTRUCTION

A. Construct the Work in phases, with each phase substantially complete as indicated on the Drawings and as indicated below:
   1. Phase 1 - New Hospital Construction, includes the following:
      a. Civil: Enabling Infrastructure: Refer to all "Phase 1" labeled documents.
         Temporary Parking
         1) Reroute existing site water and sewer utilities
         2) New ADOT driveways, loop road; and drive access reconfiguration of existing hospital to loop road.
         3) Utility improvements beneath the roads noted above.
         4) Selective demolition as required to enable the above.
         5) New Visitor Parking (South).
      b. Civil: New Hospital and Infrastructure Construction: Refer to all "Phase 1" labeled documents.
         1) Utility campuses and accompanying infrastructure.
         2) Remaining roadways and parking lot.
         3) Pumphouse
      c. Architectural: Refer to Sheets A1.00, A1.1.0d, and A1.1.1.
         1) New Hospital
         2) New Hospital Utility Campus
         3) New Hon-Dah Utility Campus
      d. Electrical:
         1) Power: Refer to Sheet E1.1.P1
         2) Lighting: Refer to Sheet E1.4
      e. Fire Alarm: No work.
      f. Landscape:
         1) Overall Tree Plan: Refer to Sheet LP100.
         2) Overall Hardscape Plan: Refer to Sheet LS100.
      g. Note: Existing Helipad shall remain operational at all times.
      h. Note: Existing Hospital shall remain operational at all times.
   2. Phase 2 - Demolish Existing, includes the following (except where otherwise indicated):
      a. Phase 2 shall not commence until Phase 1 is complete, to include the new hospital fully occupied and operational.
      b. Civil: Existing Utility Infrastructure Demolition: Refer to all "Phase 2" labeled documents.
         1) At existing Hospital
         2) At Garret Building
         3) Elsewhere where shown
      c. Civil: New Construction: Refer to Refer to all "Phase 2" labeled documents.
         1) Remaining parking lot construction.
      d. Architectural: Refer to Sheets A1.1.1d and A1.1.2.
         1) New North Parking
         2) Wayfinding Signage

e. Electrical:
   1) Power: Refer to Sheet E1.1.P2
   2) Lighting: Refer to Sheet E1.5
f. Fire Alarm: Refer to sheet FA6.3
   1) Connect the Utility Campuses, SSB, Admin, and Facility Maintenance building fire alarm systems to annunciate at Main Hospital Security Control Room.
g. Landscape:
   1) Overall Tree Plan: Refer to Sheet LP100B.
   2) Overall Hardscape Plan: Refer to Sheet LP100B.
h. Note: Existing Helipad shall remain operational throughout Phase 2 until decommissioned.

B. Before commencing the Work of each Phase, submit an updated copy of Contractor's construction schedule, showing the sequence, commencement and completion dates**,** and move-out and -in dates of Owner's personnel for all phases of the Work.

1.6 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.7 WORK UNDER OWNER'S SEPARATE CONTRACTS

A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

B. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
   1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
   2. Provide for delivery of Owner-furnished products to Project site.
   3. Upon delivery, inspect, with Contractor present, delivered items.
      a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
   4. Obtain manufacturer's inspections, service, and warranties.
   5. Inform Contractor of earliest available delivery date for Owner-furnished products.

C. Contractor's Responsibilities: The Work includes the following, as applicable:
   1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
   2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
   3. Receive, unload, handle, store, protect, and install Owner-furnished products.
   4. Make building services connections for Owner-furnished products.
   5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
   6. Repair or replace Owner-furnished products damaged following receipt.

1.8 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
   1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
   2. Provide for delivery of Owner-furnished products to Project site.
   3. Upon delivery, inspect, with Contractor present, delivered items.
   4. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
   5. Obtain manufacturer's inspections, service, and warranties.
   6. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:
   1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
   2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
   3. Receive, unload, handle, store, protect, and install Owner-furnished products.
   4. Make building services connections for Owner-furnished products.
   5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
   6. Repair or replace Owner-furnished products damaged following receipt.

1.9 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated.

1.10 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits and Phases indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits on Use of Site: Confine construction operations to areas and area of work Phases indicated.
   2. Roadways, Driveways, Walkways, and Entrances: Keep roadways, driveways, loading areas, and entrances serving premises open, clear, and available at all times to Owner, Owner's employees, and emergency vehicles, unless indicated otherwise on the Drawings and as indicated otherwise below:
   3. Do not use these areas for parking or for storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
      c. The indicated Contractor Laydown Area for the duration of Phases 1 and 2 is part of the Base Bid. Voluntary Options will be considered. No spaces shall be used outside Phase 1 boundary.

4. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
5. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.11 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 6 a.m. to 6 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services in accordance with requirements indicated:
1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
1. Maintain list of approved screened personnel with Owner's representative.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012300 - OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for options.

1.2 DEFINITIONS

A. Option: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Options described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each option is the net addition to or deduction from the Contract Sum to incorporate options into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the option into Project.
   1. Include, as part of each option, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted options under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Options" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF OPTIONS

A. Additive Option No. 1, Whole Campus Water Filtration System:
   1. Base Bid: Provide plumbing equipment BP-1 and WT-2 as indicated on Sheet P7.2, and specified in Section 223200 - Domestic Water Filtration Equipment.
   2. Option: Provide whole campus water filtration system as indicated on Sheets P2.1.PH, P7.1.PH, P5.2.1, P7.2, and specified in Section 223200 - Domestic Water Filtration Equipment.

B. Additive Option No. 2, Spray Fields at Hon Dah Waste Water Treatment Plant:
   1. Base Bid: No Spray Fields.
   2. Option: Provide Spray Fields as indicated on Sheets LI1.0.0, LI5.0.0.

C. Additive Option No. 3, Acoustic Floor System:
   1. Base Bid: Provide floor at Warehouse as indicated on Sheet S2.2.1E.
   2. Option: Provide acoustic floor system at Warehouse as indicated on Sheet S2.2.1E, and specified in Section 035400 – Cast Underlayment.

D. Additive Option No. 4, Circadian Lighting System:
   1. Base Bid: Provide lighting as indicated in Electrical Drawings and specified in Division 26.
   2. Option: Provide line-item pricing for circadian lighting system (tunable white) and required controls by functional area in the following list. Spaces are selected to emphasize non-transitional areas where patients and staff spend extended periods such as patient rooms, nurse stations and corridors, open and closed offices, and in-patient areas. Clinical support spaces and operating rooms are not included. System shall be selected to maintain photometric and aesthetic performance to Basis of Design with preference to exact fixture matches where possible and similar type and form factor where exact matches are not available. The system shall be capable of modulating light output and color temperature over a 24hr time cycle between 2200 and 6500 kelvin with both automated networked and user manual control per IES recommendations for healthcare circadian lighting.
      a. Acute Care
      b. Administration
      c. Behavioral Health
      d. Emergency Department
      e. Labor and Delivery
      f. Specialty Care

E. Additive Option No. 5, Bipolar Ionization Air Filters:
   1. Base Bid: Bid Documents as shown.
   2. Option: Provide bipolar Ionization air filters as indicated on Sheets M6.1, M6.2. M6.3, and M7.2, and specified in Section 238610 - Bi-Polar Ionization Air Purification System.

F. Additive Option No. 6, Photovoltaic System and Video Surveillance Cameras:
   1. Base Bid: Provide infrastructure and equipment for emergency help points and video surveillance cameras as shown on Sheets T1.2.1 and TY1.2.1, and as specified in Sections 275123 - Emergency Help Points And Call Boxes, and 282300 - Video Surveillance. Cameras and emergency help points shall be identical to others in the Project design. See sheet keynotes for additional information.
   2. Option: Provide photovoltaic system and video surveillance cameras as indicated on Sheets T1.2.1 and TY1.2.1, and specified in Sections 282300 that will replace the emergency help points. See Drawings for exact locations and quantities. See sheet notes for additional information

G. Additive Option No. 7, Acoustical Panels:
   1. Base Bid: Provide finishes in Conference Rooms as shown in AI Series Drawings.
   2. Option: Provide acoustical panels as shown on AI Series Drawings and as specified in Sections 098433 – Sound Absorbing Wall Units and 097723 - Fabric-Wrapped Panels.

H. Additive Option No. 8, Hon-Dah Utility Campus:
   1. Base Bid: No Hon-Dah Utility Campus.
   2. Option: Provide Hon-Dah Utility Campus per Building Package No. 3 (BP3).

I. Additive Option No. 9, PLC Cabinets at Surface Water Treatment Plant:
   1. Base Bid: Provide new PLC cabinet, PLC programming, operator interface programming, and modifications to the 3 existing PLC's for the new Tonka treatment unit as indicated on the SWTP plans and as specified in Specification Section 460713.
   2. Option: In addition to the Base Bid, remove and replace the 3 existing PLC cabinets and internal components with new PLC cabinets and internal components, including PLC and operator interface programming. New PLC and internal components to match the new PLC for the new Tonka treatment unit, as specified in Specification Section 460713.

END OF SECTION

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

A. Proposed Products List and Substitution Requests:
   1. Intent:
      a. To fully identify, prior to beginning the Work, the products Contractor intends to provide, and substitutions the Contractor requests.
      b. To facilitate timely submittal processing by avoiding rejection of unacceptable products and unspecified products later during construction.
   2. Proposed Products List:
      a. Within 14 calendar days after date of receipt of notice to proceed and before submitting any Product Submittals, submit for approval the list of the products proposed for installation. Include the name of the manufacturer for each product and, where applicable, the name of Subcontractor.
      b. The list shall be tabulated by and be complete for each Specification Section.
      c. For each product listed, clearly indicate: a) As Specified, or b) Not As Specified. For each product designated Not As Specified, clearly indicate: c) Comparable Product, or d) Proposed Substitution.

B. Substitution Requests Accompanying the Proposed Products List:
   1. A request for substitution will be considered, subject to the following requirements:
      a. Include with the proposed products list a completed substitution request form for each proposed substitution anticipated for the Project. Check the box indicating the request is submitted with the proposed products list.
      b. Submit each proposed substitution using a separate copy of the substitution request form. Use substitution request form included in the Project Manual, or request an electronic version of form from the Architect. See Section 012510 - Substitution Request Form.• • Submit in number of copies specified for proposed product list.
      c. The substitution request is submitted at the time the proposed products list is submitted. A request submitted after the time set for submittal of the proposed products list is subject to automatic rejection.

d. Include with the request complete data on the proposed substitution. Such data shall include:
   1) Product Data highlighted to show applicability to the proposed substitution and project conditions;
   2) Performance and test data;
   3) References, and samples, where applicable; and
   4) An itemized comparison of the proposed substitution with the product features specified in the Contract Documents, including data relating to design and artistic effect, where applicable.
e. Include copies of the pertinent Contract Documents, clearly marked and highlighted to show changes necessary to accommodate the proposed substitution.
f. If the proposed substitution is due to unavailability of a specified product, a written statement shall accompany it, written by the supplier of the specified product, confirming lack of availability.
g. By submitting the substitution request, Contractor affirms that: 1) the proposed substitution conforms to the required dimensions and meets or exceeds the standards of required function, appearance, and quality set by the specified product: and 2) the burden of proof rests with the Contractor.
h. By submitting a substitution request, Contractor agrees to absorb all costs resulting from acceptance of the proposed substitution, including both known and subsequently discovered revisions to other construction needed to accommodate the substitution, and other expected and unforeseen costs, such as delays, code approval-related expenses, and additional architectural services.

C. Substitution Requests After Proposed Products List:
1. Use no product in the Work that is not named in the Contract Documents, or not listed in the Proposed Products List, or not approved as a substitute or comparable product. Products specified solely by reference standard or performance requirements do not require naming.
2. During construction of the Work, products not listed on the accepted Proposed Products List shall not be used without receipt of an approved substitution request for a listed product. A substitution request will be considered under one of the following conditions:
   a. The product listed on the accepted Proposed Product List becomes unavailable. Include with the substitution request a letter from the listed manufacturer, on the manufacturer's letterhead, verifying that the product is no longer available.
   b. Conditions uncovered at the Site render the listed product inappropriate, or an undesirable choice for the conditions uncovered. Include with the substitution request a full description of the uncovered conditions and why the requested substitution is preferable to the listed product.
3. Make each substitution request on the specified substitution request form. Fully execute form in accordance with the provisions of Article, Proposed Products List and Accompanying Substitution Requests, except for provisions requiring submittal concurrent with proposed products list. Check the box indicating the Contractor's request is being submitted separate from and after submittal of the proposed products list

D. A request for substitution forwarded by the Contractor means that Contractor:
   1. Has investigated the proposed substitution.
   2. Has determined that the substitution is equal to or superior in quality and serviceability (performance) to the product specified in the Contract Documents.
   3. Will provide the same guarantee for the substitution that is required for the product specified in the Contract Documents.
   4. Waives all claims for additional costs that subsequently become apparent as a result of the substitution.
   5. Will coordinate the installation of the accepted substitution into the Work, and will make such changes in the Work of the various trades as may be required to provide a completed condition.

E. A request for a substitution will not be considered if:
   1. The substitution is merely indicated or implied on the Shop Drawing or Product Data submittal without the specified formal request and documented proof of conformance. Submittal approvals for items not meeting specifications are not valid. Completed construction related to such items is subject to rejection.
   2. Implementation requires a major revision of the Contract Documents in order to accommodate the substitution.
   3. The substitution request is substantially incomplete.

F. Architect's Review of Proposed Products List and Substitution Requests:
   1. The Architect will review properly submitted proposed products list and accompanying substitution requests.
   2. The Architect will evaluate each substitution request and inform Contractor in writing whether the proposed substitution is accepted, accepted as noted, or not accepted.
      a. Substitution requests that do not conform to requirements, including submittal timing, are subject to return without review.
      b. A substitution will not be considered accepted by the Owner until it has been documented by Change Order.
   3. The Architect's decision as to conformance and acceptability will be consistent with the intent of the Contract Documents.
   4. In the absence of written acceptance of a substitution request, proposed substitutions shall be understood as not accepted.
   5. The Architect will endeavor to evaluate the substitution request in a reasonable period of time. With the request, the Contractor shall inform the Architect of the deadline for final decision on the request. In the absence of Architect's decision within the critical time, the Contractor shall proceed with the specified product.

G. Product List and Substitution Request Format:
   1. Product List: Provide PDF of the list.
   2. Substitution Requests: Provide PDF of requests.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Requested substitution provides sustainable design characteristics that specified product provided for compliance with LEED requirements.
      c. Substitution request is fully documented and properly submitted.
      d. Requested substitution will not adversely affect Contractor's construction schedule.
      e. Requested substitution has received necessary approvals of authorities having jurisdiction.
      f. Requested substitution is compatible with other portions of the Work.
      g. Requested substitution has been coordinated with other portions of the Work.
      h. Requested substitution provides specified warranty.
      i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012510 - SUBSTITUTION REQUEST FORM

Date of Request: _____ CM/GC Tracking No.: _____ SG Tracking No.:

This substitution request is governed by the provisions of Section 012500.

☐ This Substitution Request is submitted during the bidding period.
☐ This Substitution Request is submitted with Proposed Products List dated _____
☐ This Substitution Request is submitted separate from and after submittal of the Proposed Products List.

RE: _____
Specifications Section Title Section No. Page Paragraph

PROPOSED SUBSTITUTION:
Reason for Substitution:

General Description:

The accompanying attachments, per 012500, provide a full description of the proposed substitution.

Proposed change:

☐ To Contract Sum: ☐ None ☐ Add: ☐ Deduct: $_____
☐ To Contract Time: ☐ None ☐ Add: ☐ Deduct: _____ days

Assumption of Responsibility for Equal Performance

Requester affirms that the proposed substitution conforms to required dimensions and meets or exceeds the standards of required function, appearance, and quality set by the specified product. Requester understands and affirms compliance with the provisions of Section 012500.

_____
Requester's Name Date

_____
Requester's Firm

ARCHITECT'S EVALUATION:

The proposed substitution is:

☐Not Reviewed; ☐Not Acceptable; ☐Acceptable As Noted; ☐Acceptable

Remarks: _____

_____
Name Date

cc: Owner; Requester; Contractor

Note: Owner's Acceptance of substitution request is not valid until documented through addendum or contract modification.

END OF DOCUMENT

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use form provided as part of web-based Project management software.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect form provided as part of web-based Project management software.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Subject to Contracting Officer approval, Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 WORK CHANGE DIRECTIVE

A. Work Change Directive: Subject to Contracting Officer approval, Architect may issue a Work Change Directive on form provided as part of web-based Project management software. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012614 - REQUESTS FOR INFORMATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section contains the procedures to be followed by the Contractor for submitting a request for clarification or additional information related to the execution of the work.

1.2 PROCEDURES

A. Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in accordance with the terms of the Contract and on form found in the web based project management software.

B. Submit requests for information (RFI) in writing to the Owner's representative if one of the following conditions occur:
   1. Contractor discovers an unforeseen or unknown condition or circumstance that is not described in the Contract Documents. For Differing Site Conditions, the Contractor shall comply with Contract requirements for addressing Differing Site Conditions.
   2. Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents.
   3. Contractor discovers what appears to be an omission from the Contract Documents that cannot be reasonably inferred from the intent of the Contract Documents.

C. Those RFIs which are submitted by entities controlled by but other than the Contractor will be returned without response.

D. Each RFI shall be submitted as to cause no delay in the Contractor's own work and in that of any subcontractor. No adjustments of Contract Time or Contract Sum will be granted because of the failure to submit an RFI with sufficient time to allow for the orderly processing of a response.

E. Submit a new RFI for each question.

F. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Owner name.
   3. Owner's Project number.
   4. Name of Architect.
   5. Architect's Project number.
   6. Date of Request.
   7. Name of Contractor.
   8. RFI number, numbered sequentially.
   9. Requested reply date.
   10. RFI subject.
   11. Specification Section number and title and related paragraphs, as appropriate.
   12. Drawing number and detail references, as appropriate.

13. Field dimensions and conditions, as appropriate.
14. Coordinate the question with the requirements of other sections or trades as applicable and with responses to previous RFI's.
15. Description:
    a. Fully describe the question or type of information requested with specific reference to pertinent drawing number(s), detail number(s), schedule type(s), specification section(s) and paragraph number(s), or other related documents.
    b. Include the date of any referenced drawings or documents.
    c. Verify applicable dimensions, field conditions, drawing requirements (small through large scale details), and/or specification section requirements pertaining to the question.
    d. Coordinate the question with the requirements of other sections or trades as applicable and with responses to previous RFI's.
    e. Attachments: Provide supplementary photos and sketches as required to clarify the RFI at large scale and of sufficient descriptions detail, materials, dimensions, thicknesses, assembly, attachments, relation to adjoining work, structural grid references, and all pertinent data and information for an informed response to be made.
16. Contractor shall provide a recommended solution(s), including cost and/or schedule considerations, if applicable.
17. Each RFI shall be reviewed and signed by Contractor prior to submitting to the Owner's representative.
18. Space for reply to RFI including signature line and date.

G. RFI's will not be recognized or accepted if, in the opinion of the Owner's representative, one of the following conditions exist:
1. RFI fails to conform to the requirements in this section.
2. RFI is submitted as a request for substitution.
3. RFI is submitted as a submittal.
4. Requests for approval of Contractor's means and methods.
5. Requests for adjustments in the Contract Time or the Contract Sum.
6. RFI is submitted in an untimely manner without proper coordination and scheduling of Work of related trades.
7. Incomplete RFIs or inaccurately prepared RFIs
8. RFI is submitted for clarification of review comments on any required submittal or shop drawing.
9. RFI is submitted under pretense of a Contract Documents discrepancy or omission without thorough review of the Contract Documents.
10. RFI is submitted in an untimely manner without proper coordination and scheduling of Work of related trades.

H. Response:
1. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
2. Architect will resolve RFI's and issue instructions to the Contractor within a reasonable time frame. In most cases, RFI's will receive a response within 7 calendar days. In some cases, this time may need to be lengthened for complex issues, or shortened for emergency situations, as mutually agreed in writing.

3. RFIs received by the Owner's Representative after 1:00 p.m. will be considered as received the following business day.
4. Should Contractor proceed with the Work affected before receipt of a written response within the response time described above, any portion of the Work that is not done in accordance with the Architect interpretations, clarifications, instructions, or decisions is subject to removal or replacement and the Contractor shall be responsible for all resultant costs and losses.
5. A reply to an RFI is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.
6. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
7. In the event of failure to agree as to the scope of the Contract requirements, Contractor shall follow procedures set forth in the General Conditions.

I. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Provide electronic software log with not less than the following:
    1. Project name.
    2. Name and address of Contractor.
    3. Name and address of Architect.
    4. RFI number, including RFIs that were returned without action or withdrawn.
    5. RFI description.
    6. Date the RFI was submitted.
    7. Date Architect's response was received.
    8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

J. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SUBMITTALS

A. Submit in accordance with Section 013300 - Submittal Procedures.
   1. Schedule of Values.
   2. Earned Value Report.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architectat earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
   4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Owner's name.
      c. Owner's Project number.
      d. Name of Architect.
      e. Architect's Project number.
      f. Contractor's name and address.
      g. Date of submittal.
   2. Arrange schedule of values consistent with format of AIA Document G703.
   3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
      a. Related Specification Section or division.
      b. Description of the Work.

c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
   1) Labor.
   2) Materials.
   3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site.
6. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
7. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
8. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
9. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 EARNED VALUE REPORT

A. Data Required: This contract requires the use of a cost-loaded Network Analysis Schedule (NAS). The information required for the Schedule of Prices will be entered as an integral part of the Network Analysis Schedule. Within 15 calendar days of notice of award, prepare and deliver to the Owner an Earned Value Report. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices. Costs shall be summarized and totals provided for each construction category.

B. Schedule Instructions: Payments will not be made until the Earned Value Report from the cost-loaded NAS has been submitted to and accepted by the Owner.

C. Real Property Assets: The Owner will provide the Real Property Report. The Contractor shall complete the Draft Real Property Report to represent the final constructed facility and include all associated cost.

1.6 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architectand paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
   1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use template provided by the Owner as form for Applications for Payment.
   1. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
   5. Application for Payment will be processed in accordance with the terms of the Contract. Unless otherwise indicated, the requests for payment shall include the documents listed below.
      a. The Contractor's invoice, showing in summary form, the basis for arriving at the amount of the invoice. Invoice shall include certification by Quality Control (QC) Manager as required by the contract.
      b. The Earned Value Report from the cost-loaded NAS, showing in detail: the estimated cost, percentage of completions, and value of completed performance.
      c. Updated Project Schedule and reports required by the contract.
      d. Contractor Safety self-evaluation checklist.
      e. Other supporting documents as requested.
      f. Updated copy of submittal register.
      g. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies.
      h. Materials on Site.
      i. Solid Waste Disposal Report.

E. Stored Materials: Progress payments may be made to the Contractor for materials delivered on the site, for materials stored off construction sites, or materials that are in transit to the construction sites under the following conditions. Include in Application for Payment amounts applied for such materials or equipment. Differentiate between items stored on-site and items stored off-site.
   1. Materials delivered on the site but not installed, including completed preparatory work, and off-site materials to be considered for progress payment shall be major high cost, long lead, special order, or specialty items.
   2. Materials to be considered for progress payment prior to installation shall be specifically and separately identified in the Contractor's estimates of work submitted for the Owner's approval in accordance with Earned Value Report requirement of this contract. Requests for progress payment consideration for such items shall be supported by documents establishing their value and that the title requirements of the Contract have been met.
   3. Provide certificate of insurance, evidence of transfer of title to Owner, and written consent of surety to payment for stored materials. Insurance of materials shall include adequate protection against theft and exposure.
   4. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   5. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit each Application for Payment to the Owner in accordance with the terms of the Contract. Application shall include waivers of lien and similar attachments if required.
   1. Identify and record appropriate information about application.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
   5. Products list (preliminary if not final).
   6. Sustainable design action plans, including preliminary project materials cost data.
   7. Schedule of unit prices.
   8. Submittal schedule (preliminary if not final).
   9. List of Contractor's staff assignments.
   10. List of Contractor's principal consultants.
   11. Copies of building permits.

12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following. Final invoices not accompanied by the Contractor's Final Release will be considered incomplete and will be returned to the Contractor.
1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

1.7 PAYMENTS TO THE CONTRACTOR

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

B. The obligation of the Owner to make payments required under the provisions of this contract will, at the discretion of the Owner, be subject to reductions and/or suspensions permitted under agency regulations including the following in accordance with the Contract:
1. Reasonable deductions due to defects in material or workmanship;

2. Claims which the Owner may have against the Contractor under or in connection with this contract;
3. Unless otherwise adjusted, repayment to the Owner upon demand for overpayments made to the Contractor; and
4. Failure to provide up to date record drawings not current as stated in the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012973 - SCHEDULE OF VALUES

CONTINUATION SHEET AIA DOCUMENT G703 (Instructions on reverse side) PAGE OF PAGES

AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, containing Contractor's signed Certification, is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED: FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED: THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)

EXAMPLE
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END OF SECTION

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Digital project management procedures.
   4. Web-based Project management software package.
   5. Project meetings.

B. Related Requirements:
   1. Section 012614 “Requests for Information” for definitions, procedures, responsibilities, and other requirements associated with Requests for Information.
   2. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors, including delegated design coordination recommendations, if needed, to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and direction of Project coordinator to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delegated design services.
5. Delivery and processing of submittals.
6. Progress meetings.
7. Preinstallation conferences.
8. Project closeout activities.
9. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information, including delegated design information, to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

f. Indicate required installation sequences.
g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Submittal Format: Submit or post coordination drawing files using PDF format.

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Architect's Digital Data Files: See Section 013300 "Submittal Procedures."

B. Web-Based Project Management Software Package: Provide, administer, and use Owner's preferred web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project management software includes, at a minimum, the following features:
a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
c. Document workflow planning, allowing customization of workflow between project entities.

d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
e. Track status of each Project communication in real time, and log time and date when responses are provided.
f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to seven Project management software user licenses for use of Owner, Owner's Commissioning Authority, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 business days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Artificial intelligence (AI) generated meeting minutes or other transcriptions that record the entire meeting discussion are unacceptable and will not be reviewed by Architect. The entity responsible for conducting the meeting shall review the minutes for accuracy and edit to summarize significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner *and Architect, within three days of the meeting.*

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Sustainable design requirements.
    o. Delegated design requirements.
    p. Preparation of Record Documents.
    q. Use of the premises.
    r. Work restrictions.
    s. Working hours.
    t. Owner's occupancy requirements.
    u. Responsibility for temporary facilities and controls.
    v. Procedures for moisture and mold control.
    w. Procedures for disruptions and shutdowns.
    x. Construction waste management and recycling.
    y. Parking availability.
    z. Office, work, and storage areas.
    aa. Equipment deliveries and priorities.
    bb. First aid.
    cc. Security.
    dd. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Sustainable Design Requirements Coordination Conference: Owner will schedule and conduct a sustainable design coordination conference before starting construction, at a time convenient to Owner Architect, and Contractor.
1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:
a. Sustainable design Project checklist.
b. General requirements for sustainable design-related procurement and documentation.
c. Project closeout requirements and sustainable design certification procedures.
d. Role of sustainable design coordinator.
e. Construction waste management.
f. Construction operations and sustainable design requirements and restrictions.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Sustainable design requirements.
i. Delegated design requirements.
j. Review of mockups.
k. Possible conflicts.
l. Compatibility requirements.
m. Time schedules.
n. Weather limitations.

o. Manufacturer's written instructions.
p. Warranty requirements.
q. Compatibility of materials.
r. Acceptability of substrates.
s. Temporary facilities and controls.
t. Space and access limitations.
u. Regulations of authorities having jurisdiction.
v. Testing and inspecting requirements.
w. Installation procedures.
x. Coordination with other work.
y. Required performance results.
z. Protection of adjacent work.
aa. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for completing sustainable design documentation.
f. Requirements for preparing operations and maintenance data.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.
i. Preparation of Contractor's punch list.
j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
k. Submittal procedures.
l. Coordination of separate contracts.
m. Owner's partial occupancy requirements.

n. Installation of Owner's furniture, fixtures, and equipment.
o. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

F. Progress Meetings: Conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Resolution of BIM component conflicts.
      4) Status of submittals.
      5) Status of sustainable design documentation.
      6) Status of delegated design services and submittals.
      7) Deliveries.
      8) Off-site fabrication.
      9) Access.
      10) Site use.
      11) Temporary facilities and controls.
      12) Progress cleaning.
      13) Quality and work standards.
      14) Status of correction of deficient items.
      15) Field observations.
      16) Status of RFIs.
      17) Status of Proposal Requests.
      18) Pending changes.
      19) Status of Change Orders.
      20) Pending claims and disputes.
      21) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

G. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
   c. Review present and future needs of each contractor present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Resolution of BIM component conflicts.
      4) Status of submittals.
      5) Deliveries.
      6) Off-site fabrication.
      7) Access.
      8) Site use.
      9) Temporary facilities and controls.
      10) Work hours.
      11) Hazards and risks.
      12) Progress cleaning.
      13) Quality and work standards.
      14) Status of RFIs.
      15) Proposal Requests.
      16) Change Orders.
      17) Pending changes.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's Construction Schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Unusual event reports.

B. Related Requirements:
   1. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
   2. Section 014000 "Quality Requirements" for schedule of tests and inspections.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file.
   2. PDF file.

B. Startup construction schedule.
   1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports to contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
   3. Total Float Report: List of activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at monthly intervals.

H. Material Location Reports: Submit at monthly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For schedule preparer.

1.4 QUALITY ASSURANCE

A. Schedule Preparer: Designate an authorized representative to be responsible for the preparation of the schedule and all required updating (activity status) and preparation of reports. The authorized representative shall have previously developed, created, and maintained at least two (2) electronic CPM schedules and reports for projects similar in nature and complexity to this project, and shall be experienced in the use of the scheduling software that meets the requirements of this specification. The schedule preparer shall have the capability to produce CPM reports and diagrams within 24 hours of the Architect's request.

B. General Requirements: Prepare for approval a Project Schedule, as specified herein, pursuant to Schedules for Construction Contracts. Show in the schedule the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool.

C. Approved Project Schedule: Use the approved Project Schedule to measure the progress of the work and to aid in evaluating time extensions. Make the schedule cost loaded and activity coded. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the Owner may withhold approval of progress payments until the Contractor submits the required schedule.

D. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

E. Periodic Schedule Update Meetings: Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining earned value. Meetings shall occur at least monthly within five days of the proposed schedule data date and after the Contractor has updated the schedule with the Owner's concurrence respecting actual start dates, actual finish dates, remaining durations and percent complete for each activity it intends to status. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed schedule update during the meeting. The meeting and resultant approvable schedule update shall be a condition precedent to a formal submission of the update as described in Submission Requirements and to the submission of an invoice for payment. The meeting will be a working interactive exchange which will allow the Owner and the Contractor the opportunity to review the updated schedule on a real time and interactive basis. The

Contractor's Schedule Preparer will organize, sort, filter and schedule the update as requested by the Owner. The meeting will last no longer than 8 hours. A rough draft of the proposed activity logic corrections and narrative report shall be provided to the Owner 48 hours in advance of the meeting. The Contractor's Project Manager and Schedule Preparer shall attend the meeting with the Authorized Representative of the Owner.

1. Update Submission Following Progress Meeting: Submit a complete update of the project schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph Submission Requirements not later than 4 working days after the periodic schedule update meeting, reflecting only those changes made during the previous update meeting.
2. Status of Activities: Update information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete shall be subject to the approval of the Owner prior to the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting:
    a. Start and Finish Dates: Accurately show the status of the AS and/or AF dates for each activity currently in-progress or completed since the last update. The Owner may allow an AF date to be assigned with the percent complete less than 100 percent to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.
    b. Remaining Duration: Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining Durations may exceed the activity OD or may exceed the activity's prior update RD if the Owner considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities
    c. Percent Complete: Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from Owner's pre-final inspection activity(ies) not less than 1 percent of the total contract value, which activity(ies) may be declared 100 percent complete upon completion and correction of all punch list work identified during Owner pre-final inspection(s).
    d. Logic Changes: Specifically identify and discuss all logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, Contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, and other changes that have been made pursuant to contract provisions. The Owner will only approve logic revisions for the purpose of keeping the schedule valid in terms of its usefulness in calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.
    e. Other Changes: Other changes required due to delays in completion of any activity or group of activities include:
        1) Delays beyond the Contractor's control, such as unusual weather.

2) Delays encountered due to submittals, Owner Activities, deliveries or work stoppages which make re-planning the work necessary.
3) Changes required to correct a schedule that does not represent the actual or planned prosecution and progress of the work.

F. Weekly Progress Meetings: Meet weekly with the Owner (or as otherwise mutually agreed to) between the meetings described in paragraph Periodic Schedule Update Meetings for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. The then current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Owner shall attend. The weekly progress meeting will address the status of RFI's, RFP's and Submittals.
1. Provide a bar chart produced by the scheduling software, organized by Total Float and Sorted by Early Start Date, and a two week "look-ahead" schedule by filtering all schedule activities to show only current ongoing activities and activities scheduled to start during the upcoming two weeks, organized by Work Area Code (AREA) and sorted by Early Start Date.
2. The Owner and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date (driving activities), are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action shall be taken immediately. Corrective action includes but is not limited to: increasing the number of work crews; increasing the number of work shifts; increasing the number of hours worked per shift; and determining if Owner responsibility coded activities require Owner corrective action.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that is capable of managing construction schedules.
1. Use scheduling component of Project management software package specified in Section 013100 "Project Management and Coordination".

B. Schedule Preparer shall provide planning, evaluation, and reporting, using CPM scheduling.
1. Meetings: Scheduling consultant to attend all meetings related to Project progress, alleged delays, and time impact.

C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

D. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
      a. Securing of approvals and permits required for performance of the Work.
      b. Temporary facilities.
      c. Construction of mock-ups, prototypes and samples.
      d. Owner interfaces and furnishing of items.
      e. Interfaces with Separate Contracts.
      f. Regulatory agency approvals.
      g. Punch list.
   3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
   5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
   6. Commissioning Time: Include no fewer than 15 days for commissioning.
   7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
   8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

E. Mandatory Tasks: The following tasks shall be included and properly scheduled:
   1. Submission of mechanical/electrical/information systems layout drawings.
   2. Submission and approval of O & M manuals.
   3. Submission and approval of as-built drawings.
   4. Submission and approval of installed equipment lists.
   5. Submission and approval of testing and air balance (TAB).
   6. Submission of TAB specialist design review report.
   7. Submission and approval of fire protection specialist.
   8. Submission and approval of HVAC testing and balancing and Building Commissioning Plan, test data and reports: Prepare a schedule with integrated logic associated for testing and commissioning of building systems. The schedule shall be at a level of detail which identifies activities and integrates specific activity durations and interdependencies of tasks related to all building testing and commissioning of systems. The logic shall be tied to the overall project schedule and it shall be shown that all tasks associated with all building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.
   9. Air and water balancing.
   10. HVAC commissioning.
   11. Controls testing plan submission.

12. Controls testing.
13. Performance Verification testing.
14. Other systems testing, if required.
15. Contractor's pre-final inspection.
16. Correction of punchlist from Contractor's pre-final inspection.
17. Government's pre-final inspection.
18. Correction of punch list from Government's pre-final inspection.
19. Final inspection.

F. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
    1. Phasing: Arrange list of activities on schedule by phase.
    2. Work under More Than One Contract: Include a separate activity for each contract.
    3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
    4. Show Owner and other agency activities that could impact progress. These activities include, but are not limited to: submittal approvals, environmental permit approvals by Tribal or State regulators, inspections, utility tie-in, Owner Furnished Equipment, and Notice to Proceed (NTP) for phasing requirements.
    5. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
    6. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
    7. Work Restrictions: Show the effect of the following items on the schedule:
        a. Coordination with existing construction.
        b. Limitations of continued occupancies.
        c. Uninterruptible services.
        d. Partial occupancy before Substantial Completion.
        e. Use-of-premises restrictions.
        f. Provisions for future construction.
        g. Seasonal variations.
        h. Environmental control.
    8. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
        a. Subcontract awards.
        b. Submittals.
        c. Purchases.
        d. Mockups.
        e. Fabrication.
        f. Sample testing.
        g. Deliveries.
        h. Installation.
        i. Tests and inspections.
        j. Adjusting.
        k. Curing.

l. Building flush-out.
m. Startup and placement into final use and operation.
n. Commissioning.

9. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
   a. Structural completion.
   b. Temporary enclosure and space conditioning.
   c. Permanent space enclosure.
   d. Completion of mechanical installation.
   e. Completion of electrical installation.
   f. Substantial Completion.

G. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

H. Phase of Work Coding: Assign Phase of Work Code to all activities based upon the phase of work in which the activity occurs. Code activities to a Construction Phase. Code fast track construction phases proposed by the Contractor to allow filtering and organizing the schedule by fast track design and construction packages. If the contract specifies construction phasing with separately defined performance periods, identify a Construction Phase Code to allow filtering and organizing the schedule accordingly. Each activity shall be identified with a single project phase and have only one Phase of Work code.

I. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
   1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

J. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and the Contract Time.

K. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

L. Requests for Time Extensions: In the event, the Contractor believes it is entitled to an extension of the Contract performance period or completion date, furnish the following for a determination by the Owner: justification, project schedule data, and supporting evidence as the Owner may deem necessary. Submission of proof of excusable delay, based on revised activity logic, duration, and costs (updated to the specific date

that the delay occurred) is a condition precedent to any approvals by the Owner. In response to each Request For Proposal issued by the Owner, submit a schedule impact analysis demonstrating whether or not the change contemplated by the Owner impacts the critical path.

1. Justification of Delay: The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Owner's determination as to the number of allowable days of contract extension will be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, will not be a cause for an extension to the performance period, completion date, or any interim milestone date.
2. Submission Requirements: Submit a justification for each request for a change in the contract completion date of less than 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:
    a. A list of affected activities, with their associated project schedule activity number.
    b. A brief explanation of the causes of the change.
    c. An analysis of the overall impact of the changes proposed.
    d. A sub-network of the affected area. Identify activities impacted in each justification for change by a unique activity code contained in the required data file.
    e. The Owner may request an interim update with revised activities for any requested time extension of over 2 weeks. Provide this interim within 4 days of the Owner's request.

M. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.8 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the

Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
   1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
      a. Failure to include any work item required for performance of this Contract must not excuse Contractor from completing all work within applicable completion dates.
   2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
   3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.
      h. Work by Owner that may affect or be affected by Contractor's activities.
      i. Testing and inspection.
      j. Commissioning.
      k. Punch list and Final Completion.
      l. Activities occurring following Final Completion.
   2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates to be consistent with Contract milestone dates.
   3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
   4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, sustainable design documentation, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
   a. Each activity cost to reflect an appropriate value subject to approval by Architect.
   b. Total cost assigned to activities to equal the total Contract Sum.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

F. Directed Changes: If the NTP is issued for changes prior to settlement of price and/or time, submit proposed schedule revisions to the Owner within 2 weeks of the NTP being issued. The Owner will approve proposed revisions to the schedule prior to inclusion of those changes within the project schedule.
   1. If the Contractor fails to submit the proposed revisions, the Owner may furnish the Contractor with suggested revisions to the project schedule. Include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated.
   2. If the Contractor has any objections to the revisions furnished by the Owner, the Contractor shall provide written notification to the Owner within 2 weeks of receipt of the revisions. Regardless of the objections, continue to update the schedule with the Owner's revisions until a mutual agreement in the revisions is reached.
   3. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Owner's proposed revisions, the Contractor will be deemed to have concurred with the Owner's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

G. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
   1. Contractor or subcontractor and the Work or activity.
   2. Description of activity.
   3. Main events of activity.
   4. Immediate preceding and succeeding activities.
   5. Early and late start dates.
   6. Early and late finish dates.
   7. Activity duration in workdays.
   8. Total float or slack time.
   9. Average size of workforce.
   10. Dollar value of activity (coordinated with the schedule of values).

H. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

I. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
   a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
   b. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.9 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List to be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement

of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Concealed Work photographs.
   3. Periodic construction photographs.
   4. Time-lapse sequence construction photographs.
   5. Final Completion construction photographs.
   6. Preconstruction video recordings.
   7. Periodic construction video recordings.
   8. Time-lapse sequence construction video recordings.
   9. Construction webcam.
   10. Drone aerial videos.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within seven days of recording.
   1. Submit video recordings by uploading to web-based Project management software site. Include copy of key plan indicating each video's location and direction.
   2. Identification: With each submittal, provide the following information on web-based Project management software site:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date video recording was recorded.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

D. Time-Lapse Video: Submit time-lapse sequence video recordings within seven days of recording.
   1. Submit time-lapse sequence video recordings monthly by uploading to web-based Project management software site.
   2. Identification: For each recording, provide the following information on web-based Project management software site:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date(s) and time(s) video recording was recorded.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

B. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with a record of providing satisfactory services similar to those required for Project.

C. Drone Aerial Videos Provider: A firm specializing in meeting industry standards for progress tracking and surveying, and related services for construction projects, with a record of providing satisfactory services similar to those required for Project.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.

D. Metadata: Record accurate date and time and GPS location data from camera.

E. File Names: Name media files with Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag excavation areas and construction limits before taking construction photographs.
   2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
   3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
   4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
   1. Underground utilities.
   2. Underslab services.
   3. Piping.
   4. Ductwork.
   5. Electrical conduit.
   6. Waterproofing and weather-resistant barriers.

E. Periodic Construction Photographs: Take 20 photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
   1. Frequency: Take photographs weekly, on the same day each week.
   2. Vantage Points: Following suggestions by Architect and Contractor, photographer shall select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time, to create a time-lapse sequence as follows:
      a. Commencement of the Work, through completion of subgrade construction.
      b. Above-grade structural framing.
      c. Exterior building enclosure.
      d. Interior Work, through date of Substantial Completion.

G. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

H. Additional Photographs: Architectmay request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a. Special events planned at Project site.

b. Immediate follow-up when on-site events result in construction damage or losses.
c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
d. Substantial Completion of a major phase or component of the Work.
e. Extra record photographs at time of final acceptance.
f. Owner's request for special publicity photographs.

1.6 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.

B. Preconstruction Video Recording: Before starting excavation, demolition, and construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.
1. Flag excavation areas and construction limits before recording construction video recordings.
2. Show existing conditions adjacent to Project site before starting the Work.
3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of excavation, demolition, and construction.
4. Show protection efforts by Contractor.

C. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes.

D. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.
1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every five minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:
a. Commencement of the Work, through completion of subgrade construction.
b. Above-grade structural framing.
c. Exterior building enclosure.
2. Timer: Provide timer to automatically start and stop video recorder, so recording occurs only during daylight hours.
3. Vantage Points: Following suggestions by Architect and Contractor, photographer shall select vantage points

1.7 CONSTRUCTION WEBCAM

A. Webcam: Provide two fixed-location camera(s) with weatherproof housing, mounted to provide unobstructed view of construction site from location approved by Architect, with the following characteristics:
1. Remotely controllable view with mouse-click user navigation for horizontal pan, vertical tile, and optical zoom of 500 percent minimum.
2. Capable of producing minimum 12 megapixel images.
3. Provide pole mount, power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.

B. Live Streaming Images: Provide web-accessible image of current site image, updated at five -minute intervals when construction is underway.

C. Web-Based Interface: Provide online interface to allow viewing of each high-definition digital still image captured and stored during construction, from the Internet.
   1. Access Control: Provide password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
   2. Software: Provide responsive software interface for use on computer, tablet, and mobile screens with accompanying iPhone/iPad app and Android apps.
   3. Storage: Maintain images on the website for reference during entire construction period, and for not less than 30 days after Final Completion. Provide sufficient memory on remote server to store all Project images.
   4. Online Interface: Provide website interface with Project and client information and logos, calendar-based navigation interface for selecting images, and pan and zoom capability within high-definition images.
   5. Forward and Reverse: Provide capability to browse through images, moving forward and backward in time by individual image and by day.
   6. Slideshow: Provide capability to automatically display current images from sites when there are three or more cameras used.
   7. Time-Lapse: Provide capability for online display of project time-lapse.
   8. Dashboard: Provide capability to view thumbnails of all cameras on one screen.
   9. Weather: Provide corresponding weather data for each image captured.

D. Maintain cameras and web-based access in good working order, in accordance with web-based construction photographic documentation service provider's written instructions until Final Completion. Provide for service of cameras and related networking devices and software.

1.8 DRONE AERIAL VIDEOS

A. Drone: Provide two drones with weatherproof housing, providing unobstructed views of the construction site from locations approved by Architect, with the following characteristics:
   1. Image Resolution: Minimum 20 MP sensor for survey-grade results and high resolution stills.
   2. Video Capabilities: 4K HD video at 30/60 fps for cinematic site overviews and inspections.
   3. Positioning Accuracy: Real-Time Kinematic (RTK) modules for poisition mapping and 3D modeling.
   4. Stabilization: 3-axis mechanical gimbals as required to ensure clear images from drones subject to windy conditions.

B. Provide drone aerial videos on a monthy basis.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Submittal schedule requirements.
   2. Administrative and procedural requirements for submittals.

B. Related Requirements:
   1. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design.

1.2 DEFINITIONS

A. Contractor: Refers to an entity in direct Contract with the Owner to furnish and/or perform any portion of the Work of the Contract, including but not limited to a Construction Manager. Contractor shall review and approve product submittals.
   1. Contractor shall review and approve Product Submittals prior to forwarding them to the Architect.

B. Product Submittals: In general, Product Submittals show characteristics of the proposed construction in one of the following forms:
   1. Shop Drawings: Drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.
   2. Product Data: Illustrations, standard schedules, performance charts, color charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.
      a. Product Data does not include Material Safety Data Sheets. Do not submit MSDS. They will be returned without review.
   3. Samples: Physical examples that illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged

C. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

D. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

E. Closeout Submittals: Written and graphic information that do not require Architect's responsive action. Closeout submittals are those submittals indicated in individual Specification Sections as "closeout submittals."

F. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

G. Submittal Review Stamp: The review stamp used by the Contractor as evidence that submittal has been reviewed for compliance with Contract Documents.

H. Submittal Review Sheet: The document provided by the Architect to the Contractor for inclusion with all submittals.

I. Preconstruction Submittals: Submittals which are required prior to start of construction include: Schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.
1. Certificates of insurance
2. Required performance and payment bonds
3. List of proposed Subcontractors
4. Construction Preliminary Project schedule
5. Submittal Schedule
6. Schedule of prices
7. Health and Safety plan
8. Site Layout Work plan
9. Quality Control (QC) Plan
10. Environmental Protection Plan

1.3 ACTION SUBMITTALS

A. Submittal Compliance Form: Allowed in lieu of some product data and sample submittals. See individual specification sections for specific allowable use. By submitting the form, the Contractor certifies that all products specified in the Section are being submitted exactly as indicated, including all options and features indicated, with no substitutions or comparable products. Where a Basis-of-Design manufacturer/product is indicated, along with a list of other manufacturers, the Contractor certifies that only the Basis-of-Design manufacturer/product will be provided and not any other listed manufacturers/products. Where a single manufacturer/product is indicated, even if specified as "available manufacturer" or manufacturer "included but not limited to the following", Contractor certifies that only the indicated single manufacturer/product will be provided.
1. Fill in the information required for Document 013330 "Submittal Compliance Form" and include as a line item on the Submittal Cover Sheet for each applicable Submittal. An editable version of this form is available from the Architect.
2. Upon receipt, the Architect will complete the form in the space below "Architect Action" and indicate the Action on the Submittal Cover Sheet.
3. Procedures and processing time are the same as indicated in this Section.

B. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections. Note that submittal schedule is a separate document required in addition to the construction schedule.

1. Submit all required types of submittals for each product together. For example: Shop Drawings will not be reviewed when related Samples, Product Data, and test reports have not been submitted.
2. Coordinate submittal schedule with list of subcontractors, the schedule of values, and Contractor's construction schedule.
3. Initial Submittal Schedule: Submit initial Submittals Schedule not more than 7 days after receipt of reviewed Proposed Products List, or concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   a. See Section 012500 "Substitution Procedures" for Proposed Products List requirements.
4. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
   a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
   b. Categorize submittal items by type, and designate the respective types by type code. Refer to code definitions below.

Type	Code Explanation
SD	Shop Drawings
PD	Product Data
S	Sample
DC	Design Calculations
L	Letter
SoC	Statement of Compliance
Cer	Certificate/Certification
Q	Qualifications Statement (such as for Contractor, fabricator, or erector)
SC	Sample Construction (such as mock-up or sample installation)
InI	Installation Instructions
AT	Acceptance Test
OpI	Operating Instructions
MaI	Maintenance Instructions
MAA	Maintenance Agreement
MaM	Maintenance Materials
Rcp	Receipt (such as for keys, tools, and detachable parts, including delivery tickets
RD	Record Documents
SW	Special Warranty
TR	Test Report

5. Third Party Software:
   a. If third party software (i.e. Procore, etc.) is being utilized to distribute and track submittal responses, revise the third party software review codes to match the Architect's review codes.

b. If third party software review codes cannot be modified, then the Architect's review codes, as indicated on the Architect's Submittal Review Sheet, shall take precedence.
c. If a submittal is returned using third party software and the selected review code assigned to the submittal in the software response differs from the Architect's review codes, in all cases the codes indicated on the Architect's Submittal Review Sheet shall take precedence.

6. "Latest possible date" means the date of receipt by Architect. This date allows for review and return to Contractor in time to meet the construction schedule.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Requirements specified for submittals are intended to provide efficient handling, while permitting review responsibilities to be carried out.

B. Architect will accept submittals only from the Contractor. Only items specified to be submitted will be accepted.

C. Bind submittals in a manner suitable for 8-1/2 by 11-inch file folder storage, except where doing so is not workable.

D. Transmit submittals with all transportation charges prepaid.

E. Avoidable Resubmittals: The first two reviews of each specified submittal will be processed without cost to the Contractor. After the second review, the Owner may charge the Contractor for the cost of such additional processing, unless the processing results from approved Change Orders causing revisions to previously approved submittals.

F. MSDS: Do not submit Material Safety Data Sheets. If MSDS are required by the Contract Documents, request clarification of instructions from the Architect.

G. Architect's Digital Data Files:
1. With the Owner's concurrence, Architect's digital data files used to create the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals, subject to the Architect's electronic file transfer agreement. The Contractor shall expect, and shall so agree, to execute and deliver the Architect's agreement before the transfer of such Instruments of Service.
2. The Contractor shall expect, and shall so agree, to pay fees to the Architect related to the transfer of Instruments of Service. Fees shall be paid before transfer. The payment of fees to the Architect reflects administrative costs only and are not, in any way, to indicate a "sale" of goods under the Uniform Commercial Code.
3. Request the Architect's electronic file transfer agreement form. Submit the request for file transfer directly to the Architect. Include the executed agreement, check made payable to SmithGroup, Inc., and a list of documents requested, as identified in the Contract Documents.
4. The files will not be identical to the Contract Drawings. Prior to requesting files, discuss with the Architect how the files will differ from the Contract Documents, and related limitations, such as which Drawings will not be represented, the file format, what information will be included, and method of transmittal.

5. The Architect's fee for providing electronic files to the Contractor is as follows:

1 to 10 drawings:	$250 set-up charge plus $25 per drawing
11 to 100 drawings:	$500 set-up charge plus $5 per drawing
101 to 500 drawings:	$1,000 set-up charge plus $2 per drawing

H. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

I. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 21 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
2. When a large volume of submittal materials is scheduled, additional review time may be required. Similarly, a particular submittal may require review completion in less than the agreed normal time. Due to variations in submittal volume and processing needs, agreed review time is not intended to apply to extreme conditions.
3. Resubmittal Review: Allow 10 business days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 15 business days for initial review of each submittal.

J. Maintain at the Project Site ready access to the latest reviewed Shop Drawings and Product Data, and one set of samples.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Before preparing the initial submittal of each type, request the Architect's direction regarding the Contractor's Transmittal format. All submittals, except for samples, shall be submitted as PDF electronic files unless indicated otherwise.
1. Post electronic submittals as PDF electronic files directly to Project Web sitespecifically established for Project.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit electronic PDF files of each submittal unless otherwise indicated. Architect will return electronic PDF copies.
3. Informational Submittals: Submit electronic PDF files of each submittal unless otherwise indicated. Architect will return a received receipt without further review.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

1.6 PREPARING SUBMITTALS

A. Title Block for Product Submittals
   1. Shop Drawings, the cover sheets for Product Data, and the labels for Samples shall each have an identifying title block containing:
      a. Project title.
      b. Architect's name, Project Number, and Contract Package title.
      c. Brief description of each submittal item matching the itemized descriptions on the Contractor's Submittal Transmittal.
      d. Contractor's name and project or contract number.
      e. Name and phone number of manufacturer, supplier, subcontractor, or other such organization furnishing the submittal to the Contractor.

B. Product Data: Collect information into a single submittal per specification section for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
      a. Mark where selections are to be made.
      b. Tailor large catalogs so that excessive unrelated products are not included.
   3. To highlight and mark-up Product Data information, use bold markings that will be easily seen on electronic file format. Do not use a highlighter, pencil, or color.
   4. Clearly convey the differences between similar products included in the submittal.
      a. Highlight information that differs for different sizes or grades.
   5. Correlate Product Data with Contract Documents:
      a. Where the Contract Documents include designations such as types or marks, mark Product Data with these itemized designations and include them on the Submittal Transmittal. For example: glass types; fixture item numbers.
      b. Clearly highlight information on Product Data that shows compliance with specified requirements. For example: manufacturer only (not supplier, distributor, etc.); model number; rating; performance characteristics.

6. If multiple manufacturers or products are being submitted for similar items, include manufacturer or product name in separate line item descriptions on the Contractor's Submittal Transmittal. Do not use distributor or other supplier names other than manufacturer.
7. Dimensioning on Product Data shall be the same system of measure (inch-pound vs. metric) as on the Contract Drawings. If preprinted catalogs display only the system not used in the Contract Drawings, mark-up the Product Data with the other system's dimensions.
8. Submit Product Data before or concurrent with Samples.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings PDFs formated such that when printed will fit on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Each sheet of the same item or system shall be uniform in size and numbered consecutively.
4. Each sheet shall contain the title block specified below plus an unobstructed space at the right side or bottom, of size not less than 6 by 8 inches for submittal review stamps and notations.
5. Dimensions and units of weight on Shop Drawings shall be the same system of measure (i.e., inch-pound or metric) as on the Contract Drawings.
6. BIM Incorporation: Develop and incorporateShop Drawings into BIM established for Project.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Submit submittal transmittal electronically as directed above. Electronic copy shall contain digital images of samples with identifying labels clearly visible.
2. Submit samples with identifying labels firmly attached.
   a. Labels shall be of a size to contain the Title Block plus unobstructed space for Submittal Review Stamp(s) and notations.
   b. Each sample shall display, as a minimum, the Architect's project number, and the submittal and item numbers. Where Sample size does not permit the full title block without obstructing information, provide a separate sheet of paper,8-1/2 by 11-inch, securely attached to each sample (or sample set), with the information above included.

3. Recording of Sample Installation: Note and preserve the on-site indicators of each area constituting a sample installation, but remove indicators at final clean-up of Project. Use normal submittal form and process to provide record of sample.
4. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of the specified product for comparison if another product is submitted.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.
7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Unless indicated otherwise in individual specification sections, provide three sets of Samples. One to the Architect who will retain it for their records; one to the Owner and one shall be retained at the jobsite.
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.

4. Location within room or space.

F. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
3. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
4. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

H. Test and Research Reports:
1. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
2. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
3. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   a. Name of evaluation organization.
   b. Date of evaluation.
   c. Time period when report is in effect.
   d. Product and manufacturers' names.
   e. Description of product.
   f. Test procedures and results.
   g. Limitations of use.

4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
6. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

I. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

J. Subcontractor List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.7 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark up with review comments before submitting to Architect .

B. The Contractor shall be responsible for quantities, weights, and dimensions to be confirmed and correlated at the site; for information that pertains solely to the fabrication processes and to the means, methods, techniques, sequences, and procedures of construction; and for coordination of the work of all trades.

C. The Contractor shall be responsible for the submittal to be in conformance with information given and the design concept expressed in the Contract Documents.

D. The Contractor with each submission shall provide specific written notice of any variation from the requirements of the Contract Documents by causing a specific notation to be made on the Submittal attachments or the Submittal-Transmittal.

E. The Contractor shall affix its own Submittal Review Stamp to all submittals. Architect will not review submittals that do not include a completed Contractor's Submittal Review stamp.

1.8 ARCHITECT'S AND GENERAL CONTRACTOR'S ACTION

A. General: Architect will not review submittals that do not include the Submittal Review Sheet.

B. Action Submittals: Architect's staff and consultants will review the submittal, and mark the Submittal Review Sheet with an action code. The code meanings are described below.

C. Additional codes may be provided within comments or as an electronic submittal review stamp and shall be used in help indicating return of partial submittals.

D. The Final Review Code on the Submittal Review Sheet prevails and governs the action of the overall submittal.

E. Review Code meanings are as follows:
   1. Action Codes Permitting Use:
      a. When an action code permitting use is assigned to a submittal, it does not authorize work that does not comply with the requirements of the Contract Documents. Acceptance of the Work will depend on compliance.
      b. Code AP - Approved: The Work covered by the submittal item may proceed, provided it complies with Contract Document requirements.
      c. Code AN - Approved as Noted: The Work covered by the submittal item may proceed, provided it complies with the Architect's notations and Contract Document requirements.
      d. Code AN-R - Approved as Noted - Resubmit: Do not deliver or install the related work until the resubmittal has received Code AP or AN. However, fabrication and other off-site work covered by the submittal item may proceed, at the Contractor's risk, provided it complies with the Architect's notations and Contract Document requirements.
   2. Action Code Prohibiting Use:
      a. Action Code REJ - Not Approved: The Work covered by the submittal item, including purchasing, fabrication, delivery, and other activity, shall not proceed. Revise the submittal item or prepare a new item in accordance with the Architect's notations. Resubmit the corrected or new item without delay; do not permit submittal items marked "Not Approved" to be used. Work incorporating such items will be rejected.
   3. Action Code for Items Not Required:
      a. Action Code X - Not Requested by Contract Documents: The submittal item is not called for by the Contract Documents and is being returned unreviewed by the Architect except to the extent necessary to determine its status.

F. Informational Submittals: For Architect's information only. Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
   1. Action Code for Information Only:
      a. Action Code INF - Information Only - Received: The submittal item is not called for a return with a reviewed action code by the Contract Documents and is being returned unreviewed by the Architect except to the extent necessary to determine its status.

G. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

H. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned without review.

I. Architect will return without review or discard submittals received from sources other than the Contractor.

J. Submittals not required by the Contract Documents may be returned by the Architect without action.

1.9 SUBMITTAL TRANSMITTAL REQUIREMENTS

A. General**:** The Contractor's Submittal Transmittal shall be a PDF electronic file. It is recommended, to expedite the submittal review, the electronic form be emailed for review to the Architect as early as possible.
   1. Submittal Numbering: See below.
   2. Contact Information: Full Name, Phone Number and Email Address.

B. Submittal Definition:
   1. Each submittal consists of items from only ONE specifications section.
   2. Complete Submittal: If ALL the items required by the specifications section are listed on one Submittal Form (including continuation sheet), it is a complete submittal.
   3. Partial Submittals: If it is necessary to divide the required items of a given specifications section into two or more submittals to meet schedule or handling requirements, the separate submittals are partial submittals. All partial submittals have the same submittal number, and are differentiated by sequential P-numbers (see below).
   4. All items in each submittal, whether complete or partial, will be processed together: Individual items will not be 'broken out' for special handling. Arrange submittals accordingly.

C. Submittal Numbering:
   1. Number submittals as described below to assist tracking.
   2. Number each submittal in the format nnnnnn-nn.
      a. The 6-digit number is the number of the section that requires the submittal. For example, 044200.
      b. The 2-digit number is based on the numerical sequence of submittals from that section. In other words, for each section, the first submittal is 01, the second is 02, and so on. The 2-digit number does not change for partial or re-submittals, so that the submittal can be tracked.
      c. P-Number for Partial Submittals: Number each partial submittal in the P space, beginning with P1, and increasing by one for each partial submittal of that submittal. If the submittal is a complete submittal, leave the P space blank.
      d. R-Number for Re-submittals: Number each re-submittal in the arr space, beginning with R1, and increasing by one for each re-submittal of that submittal. Do not include an R-Number for the initial submittal.
      e. Examples:

1) Initial Complete Submittal: 044200-01. First Re-Submittal: 044200-01-R1.
2) Initial Partial Submittal: 044200-01-P1. Second Partial Submittal: 0044200-01-P2. First Re-submittal of Second Partial Submittal: 044200-R1-P2.

D. Item Kind: Identify each submittal item using the code explanation specified for submittal schedule entries.

E. Shop Drawings: Include a description of each drawing, matching the description on the drawing itself.

F. Description: Provide a brief, clear generic description of each line item, using the Drawings or Specifications as a guide. If more than one manufacturer's model numbers are included in the submittal package, indicate the model numbers in parentheses in the affected line items. Do not list distributors or suppliers other than the manufacturer.

G. Resubmittals: In addition to providing the R-number, enter the information using the same line item number as the original submittal package. Doing so will avoid delay in handling the resubmittal package. Resubmit only those items that previously received Code No. AN-R or REJ.

1.10 SUBMITTAL REVIEW SHEET REQUIREMENTS

A. General: The Contractor shall obtain the Submittal Review Sheet from the Architect's Project Manager.

B. The Submittal Review Sheet obtained shall be in PDF format, and shall be submitted as the page after the Submittal Transmittal.

C. When attached, the Submittal Review Sheet shall not obscure information contained in the submittal.

D. The Contractor shall not edit any of the information contained within the Submittal Review Sheet except as follows:
1. Submittal Number: See Submittal Numbering in Submittal Transmittal Requirements paragraph.

E. The Contractor shall submit the PDF file in a manner that will allow editing of the Submittal Review Sheet fields by Architect and its consultants.

1.11 WITHHOLDING OF PAYMENT

A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

DOCUMENT 013330 - SUBMITTAL COMPLIANCE FORM

Instructions:

1. *Use the Submittal Compliance Form only with items that specify its use. Use a separate form each product. If this Form is used for items that do not specify its use, the submittal will be returned without review.*
2. *Do not submit Product Data and/or Samples for products covered by this form.*
3. *This form is available for completing on-screen with Microsoft Word.*

Date Submitted: ____/____/202_

Submittal Package No / Partial No / Revision No: ____/____/____ Item No. ____

Construction Manager/General Contractor: ____ Project No: ____

Trade or Subcontractor: ____

This *Submittal Compliance Form* is required by:

Spec Section No ____ Paragraph Reference(s): ____

Description of Item: ____

Manufacturer: ____

Model No. or Series: ____

Phone No: ____ Website Address: ____

By signing below, Contractor certifies that:

1. The item represented by this Submittal Compliance Form conforms to all Contract requirements and the intent expressed in the Contract Documents.
2. There is not a substitution of specified products. The exact named product and characteristics will be provided.
3. Contractor is responsible for: quantities, weights, and dimensions to be confirmed and correlated at the site; information that pertains solely to the fabrication processes; the means, methods, techniques, sequences, and procedures of construction; coordination of the work of all trades.

Reviewed and approved for Contractor by: Print Name: _____ Date: _____

Architect Action:

Architect's review is only for the limited purpose of checking that the item is allowed to be submitted under this form.

Legend - Submittal is:	Code
APPROVED	AP
REJECTED	REJ
NOT REQUESTED BY CONTRACT DOCUMENTS	X

Discipline	Date	Reviewed By	Code
☐ Architect:			
☐ Structural:			
☐ Mechanical:			
☐ Electrical:			
☐ Other:			

END OF DOCUMENT

SECTION 013526 - GOVERNMENT SAFTEY REQUIREMENTS

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.32 (2012) Fall Protection

ASSE/SAFE A10.34 (2001; R 2012) Protection of the Public on or Adjacent to Construction Sites

ASSE/SAFE Z359.1 (2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

ASME INTERNATIONAL (ASME)

ASME B30.22 (2010) Articulating Boom Cranes

ASME B30.3 (2012) Tower Cranes

ASME B30.5 (2011) Mobile and Locomotive Cranes

ASME B30.8 (2010) Floating Cranes and Floating Derricks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2013) Standard for Portable Fire Extinguishers

NFPA 241 (2013) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NFPA 306 (2009) Standard for Control of Gas Hazards on Vessels

NFPA 51B (2009; TIA 09-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work

NFPA 70 (2011; Errata 2 2012) National Electrical Code

NFPA 70E (2012; Errata 2012) Standard for Electrical Safety in the Workplace

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

A. CFR 20 Standards for Protection Against Radiation

B. CFR 1910 Occupational Safety and Health Standards

C. CFR 1910.146 Permit-required Confined Spaces

D. CFR 1910.147 Control of Hazardous Energy (Lock Out/TagOut)

E. CFR 1915 Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment

F. CFR 1919 Gear Certification

G. CFR 1926 Safety and Health Regulations for

Construction

H. CFR 1926.1400 Cranes & Derricks in Construction

I. CFR 1926.16 Rules of Construction

J. CFR 1926.450 Scaffolds

K. CFR 1926.500 Fall Protection

CPL 2.100 (1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

A. High Visibility Accident. Any mishap which may generate publicity or high visibility.

B. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

C. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
1. Death, regardless of the time between the injury and death, or the length of the illness;
2. Days away from work (any time lost after day of injury/illness onset);
3. Restricted work;
4. Transfer to another job;
5. Medical treatment beyond first aid; (6) Loss of consciousness; or
6. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 013300 SUBMITTAL PROCEDURES:
1. Preconstruction Submittals
2. Accident Prevention Plan (APP)
3. Activity Hazard Analysis (AHA)
4. Crane Critical Lift Plan
5. Proof of qualification for Crane Operators
6. Test Reports
7. Notifications and Reports

B. Submit reports as their incidence occurs, in accordance with the requirements of the paragraph, "Notifications and Reports."
1. Accident Reports
2. Crane Reports
3. Certificates
4. Confined Space Entry Permit
5. Hot work permit
6. License Certificates
7. Contractor Safety Self-Evaluation Checklist Third Party Certification of Barge-Mounted Mobile Cranes

8. Certificate of Compliance (Crane)

C. Submit one copy of each permit/certificate attached to each:
1. Daily Quality Control Report.
2. Machinery & Mechanized Equipment Certification Form

1.4 SITE QUALIFICATIONS, DUTIES AND MEETINGS

A. Personnel Qualifications

B. Site Safety and Health Officer (SSHO)

C. A Competent Person shall be provided for all of the hazards identified in the Contractor's Safety and Health Program in accordance with the accepted Accident Prevention Plan, and shall be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the Owner for acceptance in consultation with the Safety Office.

D. Contractor Quality Control (QC) Person:
1. The Contractor Quality Control Person cannot be the SSHO on this project, even though the QC has safety inspection responsibilities as part of the QC duties.
2. Additional Site Safety and Health Officer (SSHO) Requirements and Duties.
a. The SSHO shall have completed the "40 Hour Construction Safety Hazard Awareness Training Course for Contractors".
3. 40 Hour Construction Safety Hazard Awareness Training Course for Contractors
The training requirements for the SSHO must include the successful completion of the course entitled "40 Hour Construction Safety Hazard Awareness Training Course for Contractors". If the SSHO does not have a current certification, they shall obtain the course certification within sixty (60) calendar days from award.

E. Qualified Trainer Requirements:
1. Qualified Trainer Requirements for 40 Hour Construction Safety Hazard Awareness Training Course for Contractors and completion of the following courses:
a. OSHA 510, Occupational Safety and Health Standards for Construction
b. OSHA 500, Trainer Course in OSHA Standards for Construction
c. OSHA 3095, Electrical Standards
d. OSHA 7115, Lockout/Tagout
e. OSHA 3110, Fall Arrest Systems
f. OSHA 2264, Permit-Required Confined Space Entry
g. OSHA 3010, Excavation, Trenching and Soil Mechanics

F. Scaffolds in accordance with 29 CFR 1926.450, Subpart L
1. The Contractor Quality Control (QC) Personnel:
a. The Contractor Quality Control (QC) person cannot be the SSHO on this project, although the QC has safety inspection responsibilities as part of the QC duties.

b. The Project Superintendent or other Contractor personnel may act as the SSHO provided that the individual meets the same competency level of the SSHOs, demonstrates the proficiency required, and is approved by the Owner.

G. Competent Person for Confined Space Entry
1. Provide a "Competent Person" to supervise the entry into each confined space. All confined space and enclosed space work shall comply with NFPA 306, OSHA 29 CFR 1915, Subpart B, "Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment" or as applicable, 29 CFR 1910.147 for general industry.

H. Crane Operators
1. For mobile cranes with Original Equipment Manufacturer (OEM) rated capacitates of 50,000 pounds or greater, designate crane operators as qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualification.

1.5 PERSONNEL DUTIES

A. Site Safety and Health Officer (SSHO) shall:

B. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily quality control report.

C. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.

D. Maintain applicable safety reference material on the job site.

E. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.

F. Implement and enforce accepted APPS and AHAs.

G. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. Post a list of unresolved safety and health deficiencies on the safety bulletin board.

H. Ensure sub-contractor compliance with safety and health requirements.

I. Maintain a list of hazardous chemicals on site and their material safety data sheets.

Failure to perform the above duties will result in dismissal of the superintendent, QC Manager, and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.6 MEETINGS

A. Preconstruction Conference

1. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
2. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Owner's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
3. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

B. Safety Meetings
1. Conduct and document meetings. Attach minutes showing contract title, signatures of attendees and a list of topics discussed to the Contractors' daily quality control report.

1.7 ACCIDENT PREVENTION PLAN (APP)

A. Use a qualified person to prepare the written site-specific APP. Specific requirements for some of the APP elements are described below:
1. The APP shall be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. The Owner considers the General Contractor to be the "controlling authority" for all work on site. Contractors are responsible for informing subcontractors of the safety provisions under the terms of the contract and the penalties for non-compliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are carried out.
2. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer, the Contractor Quality Control Manager, and any designated CSP or CIH.
3. Submit the APP to the Owner 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.
4. Once accepted by the Owner, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Owner Officer, until the matter has been rectified.

5. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Owner, project superintendent, SSHO and quality control manager. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Owner within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34,) and the environment.
6. Copies of the accepted plan will be maintained at the job site.
7. Continuously review and amend the APP, as necessary, throughout the life of the contract.
8. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered.

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

A. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

B. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

C. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Owner.

1.9 RADON TESTING

A. The Contractor shall conduct radon tests of the property using a method which complies with the U.S. Environmental Protection Agency's (EPA) "Radon Standards of Practice".
   1. Closed-House Condition: The Contractor shall ensure a "closed-house condition" is mantained during the tests. This condition requires that all windows remain closed and external doors are opened as infrequently as possible throughout the testing period.
   2. The number of tests, their locations, and their timeframes shall be as directed by the Owner.
   3. If the test results indicate a radon level greater than that recommended by the EPA according to building occupancy, the Owner will negotiate the type of radon mitigation system(s) to be installed.

1.10 DISPLAY OF SAFETY INFORMATION

A. Within one calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Owner, that is accessible and includes all mandatory information for employee and visitor review, shall be deemed as meeting the requirement for a bulletin board. Items required to be posted include:
   1. Confined space entry permit.
   2. Hot work permit.

1.11 SITE SAFETY REFERENCE MATERIALS

A. Maintain safety-related references applicable to the project, including those listed in the article "References". Maintain applicable equipment manufacturer's manuals.

1.12 EMERGENCY MEDICAL TREATMENT

A. Contractors will arrange for their own emergency medical treatment. The Owner has no responsibility to provide emergency medical treatment.

1.13 NOTIFICATIONS and REPORTS

A. Accident Notification
   1. Notify the Owner as soon as practical, but no more than four hours after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $2,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Owner investigation team arrives on-site and Owner investigation is conducted.

B. Accident Reports
   1. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, property damage accidents resulting in at least $20,000 in damages to establish the root cause(s) of the accident. Complete the applicable Accident Report Form and provide the report to the Owner within 5 calendar day(s) of the accident. The Owner will provide copies of any required or special forms.
   2. Conduct an accident investigation for any weight handling equipment accident (including rigging gear accidents) to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Owner within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Owner will provide a blank copy of the accident report form.

C. Crane Reports
   1. Submit crane inspection reports as specified herein with Daily Reports of Inspections.

D. Radon Test Reports.

1.14 HOT WORK

A. "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices.

B. Provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work".
   1. All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal.
   2. When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency phone number.

1.15 RADIATION SAFETY REQUIREMENTS

A. License Certificates for radiation materials and equipment shall be submitted to the Contracting Officer for all specialized and licensed material and equipment that could cause fatal harm to construction personnel or to the construction project.

B. Workers shall be protected from radiation exposure in accordance with 10 CFR 20 Standards for Protection against Radiation

C. Transportation of Regulated Amounts of Radioactive Material will comply with 49 CFR, Subchapter C, Hazardous Material Regulations. Local Fire authorities and the site Radiation Safety officer (RSO) shall be notified of any radioactive material use.

1.16 FACILITY OCCUPANCY CLOSURE

A. Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

1.17 SEVERE STORM PLAN

A. In the event of a severe storm warning, the Contractor must:
   1. Secure outside equipment and materials and place materials that could be damaged in protected areas.
   2. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
   3. Ensure that temporary erosion controls are adequate.

1.18 CONFINED SPACE ENTRY REQUIREMENTS.

A. Contractors entering and working in confined spaces while performing general industry work are required to follow the requirements of OSHA 29 CFR 1926 and comply with the requirements in OSHA 29 CFR 1910, and OSHA 29 CFR 1910.146.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

A. Comply with NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails. PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be carried/available on each person.

B. Mandatory PPE includes:
   1. Hard Hat
   2. Appropriate Safety shoes
   3. Reflective Vests

3.2 HAZARDOUS MATERIAL EXCLUSIONS

A. Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Owner, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Owner approval.

3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

A. Ensure that each employee is familiar with and complies with these procedures.

3.4 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

A. Establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with ASSE/SAFE Z359.1.

B. Training
   1. Institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection.

C. Fall Protection Equipment and Systems

1. Enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500 and ASSE/SAFE A10.32.
2. Personal Fall Arrest Equipment
    a. Personal fall arrest equipment, systems, subsystems, and components shall meet ASSE/SAFE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m. The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

D. Fall Protection for Roofing Work
1. Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

E. Low Sloped Roofs:
1. For work within 6 feet of an edge, on low-slope roofs, protect personnel from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.
2. For work greater than 6 feet from an edge, erect and install warning lines in accordance with 29 CFR 1926.500.
3. Steep-Sloped Roofs: Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.
    a. Horizontal Lifelines
        1) Design, install, certify and use under the supervision of a qualified person horizontal lifelines for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).
    b. Guardrails and Safety Nets
        1) Design, install and use guardrails and safety nets in accordance with 29 CFR 1926 Subpart M.
    c. Rescue and Evacuation Procedures

1) When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall protection and Prevention Plan, and APP.

3.5 SCAFFOLDING

A. Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access scaffold platforms greater than 6 m in height by use of a scaffold stair system. Do not use vertical ladders commonly provided by scaffold system manufacturers for accessing scaffold platforms greater than 20 feet maximum in height. The use of an adequate gate is required. Ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Give special care to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Place work platforms on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.6 EQUIPMENT

A. Material Handling Equipment
   1. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.
   2. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.
   3. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

B. Weight Handling Equipment
   1. Comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

2. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.
3. Under no circumstance shall a Contractor make a lift at or above 90 percent of the cranes rated capacity in any configuration.
4. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and follow the requirements of ASME B30.5 or ASME B30.22 as applicable.
5. Do not crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane.
6. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
7. All employees must keep clear of loads about to be lifted and of suspended loads.
8. Use cribbing when performing lifts on outriggers.
9. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
10. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.
11. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.
12. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.
13. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

3.7 USE OF EXPLOSIVES

A. Explosives shall not be used or brought to the project site without prior written approval from the Owner. Such approval shall not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

B. Storage of explosives, when permitted on Owner's property, shall be only where directed and in approved storage facilities. These facilities shall be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

3.8 EXCAVATIONS

A. Soil classification must be performed by a competent person in accordance with 29 CFR 1926.

B. Utility Locations
   1. All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any station locating service and coordinated with the station utility department.

C. Utility Location Verification

1. Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system.
2. Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces
    a. Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company shall locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.9 ELECTRICAL

A. Portable Extension Cords
1. Size portable extension cords in accordance with manufacturer ratings for the tool to be powered and protected from damage. Immediately removed from service all damaged extension cords. Portable extension cords shall meet the requirements of NFPA 70E, and OSHA electrical standards.

3.10 WORK IN CONFINED SPACES

A. Comply with the requirements in OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, OSHA Directive CPL 2.100 and OSHA 29 CFR 1926.

B. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.

C. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.

D. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

END OF SECTION

SECTION 013573 - DELEGATED DESIGN REQUIREMENTS AND PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes procedures for portions of Work under this Contract that include delegated design requirements and procedures.

1.2 DEFINITIONS

A. Delegated Design: A portion or component of the Work identified by the Contract Documents to be designed by the Contractor, or an entity assigned by the Contractor, to satisfy performance and design criteria specified in the Contract Documents for that portion or component.

B. Registered Design Professional: Design professional, assigned by the Contractor, who is responsible for providing the delegated design work, and for certifying that the work is in compliance with the specified performance requirements and design criteria. Design professional shall be legally qualified to practice in jurisdiction where Project is located and shall be experienced in providing delegated design services of the kind indicated. Delegated design services are defined as those performed for installation of the system, assembly or product that are similar in material, design, and extent to those indicated for this Project.

C. AHJ: Authority having jurisdiction.

D. Technical Sections: Specification sections included in Divisions 02 through 35 of the Project Manual.

1.3 SUBMITTAL PROCEDURES

A. Performance and Design Criteria: Where delegated design services are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If specific performance and design criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
   2. Architect's and Engineer's review of delegated design submittal shall be for conformance with performance and design criteria only.

B. Delegated-Design Services Submittal: Include Shop Drawings, Product Data, and other required submittals indicated in individual technical sections. Submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. In addition to other submittal requirements specified in other technical sections, at minimum, include the following in delegated design submittal:
      a. Statement of design and performance criteria identified by the Contract Documents.
      b. Assumptions.
      c. Details, calculations, etc. related to the performance criteria.
      d. Reactions to structure (where applicable).

e. Instructions for fabrication, assembly, installation, and interface with other trades.

2. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

D. Submittal Procedures for Delegated Design Components:

1. Comply with requirements specified for other types of submittals included in this Section, including, but not limited to, form and procedures for delivering submittals.
   a. Submit delegated design documents for approval prior to fabrication of components included in delegated design work.
   b. Architect's review of delegated design submittals is for the limited purpose of checking for general conformance with information given and the design intent expressed in the Contract Documents. Architect will review submittals consistent with this limited purpose.
      1) Architect's review does not lessen nor shift burden or responsibility from Contractor to Architect or Owner.
      2) If during submittal review, Architect notes any deficiencies or errors, submittal will be returned with comments. Otherwise, there will be no responsive action by Architect.
2. Delegated Design Submittal Schedule: Submit list of items identified in the Contract Documents that require delegated design. For each item, include the delegated design entity and the registered design professional.
   a. If required, submit schedule to the authority having jurisdiction.
3. Preliminary Submission: In order to avoid engineering and detailing of an unacceptable design, and if required by individual technical section, submit to Architect, preliminary documentation describing registered design professional's design prior to preparing engineering calculations and shop drawings.
4. Delegated Design Submission: Submit final delegated design documents to Architect and AHJ if required for review, allowing not less than 10 days for review by Architect, Architect's consultants, and AHJ.
   a. Comply with AHJ requirements.
   b. Ensure registered design professional's signed seal is affixed to documents in accordance with jurisdictional requirements.
   c. Make corrections noted by Architect and comply with AHJ requirements.

1.4 RESPONSIBILITIES

A. General Contractor's Responsibilities:

1. Ensure drawings, calculations, specifications, and other documentation provided by registered design professional are complete and are sealed and signed by the registered design professional in accordance with requirements of AHJ. Architect and Owner shall be entitled to rely on the completeness and accuracy of the documentation provided by the registered design professional.

2. Coordinate and assign complete responsibility for design, documentation, calculations, and submittal of delegated design components.
3. Coordinate components requiring delegated design with adjacent or related systems whether designed by Architect or another entity. Ensure complete, operational systems that perform their intended are provided.
4. When required to be reviewed by AHJ, submit delegated design documentation for in a timely manner that will not negatively impact Project's construction schedule.
5. Performance requirements and design criteria are described in each technical section requiring delegated design. Conduct thorough review of other related portions of the Contract Documents to ensure inclusion of full scope of work in delegated design preparation and submittals.
    a. Provide products and systems complying with specific performance and design criteria indicated.
6. Comply with quality assurance requirements specified in individual technical sections containing delegated design requirements.
7. Comply with accessibility guidelines, codes, policies, and standards required by the AHJ, applicable to the project, and as indicated.

B. Registered Design Professional: Responsibilities include, but are not limited to, the following:
1. Sole responsibility to ensure delegated design accommodates all building movements, including, but not limited to deflection, rotation, creep, shrinkage, live loads, wind loads, and loads, interim and otherwise, resulting from means and methods.
2. If applicable, prepare documentation required by AHJ.
3. Prepare delegated design submittals that are sealed and signed by registered design professional.

C. Architect's Responsibilities: Architect will review and mark submittals in accordance with procedures defined in Section 013300 "Submittal Procedures", using the action codes defined in that section.

1.5 SCHEDULING

A. Schedule delegated design activities and submittals to occur in a timely manner that will not negatively impact Project's construction schedule.
1. Allow sufficient time for Architect's review of delegated design submittals.
2. If Architect's approval of shop drawings relating to delegated design components is required prior to application for permit, schedule and sequence delegated design shop drawing review prior to permit submittal. Comply with requirements of Section 013300 "Submittal Procedures."

B. Owner will not be responsible to pay for delays, additional products, additional hours of work, including overtime, restocking or rework required due to failure by Contractor to coordinate delegated design work with work of other trades.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "As Otherwise Directed": Used in relation to items to be determined after Contract by agreement between Owner, Architect, and Contractor, with input from other entities as appropriate.

D. "Certified": Guaranteed in writing over the signature of an authorized representative of the certifying organization.

E. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."

F. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."

G. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

H. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

I. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

J. "N.I.C" or "NIC": Not in Contract.

K. "Necessary": That which is reasonably necessary to the proper completion of the Work.

L. "Per": In accordance with the requirements of.

M. "Products": Materials, equipment, or systems.

N. "Provide": Furnish and install, complete and ready for the intended use.

O. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

P. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

Q. "Replace": To put something new in place of.

R. "Required": Referring to requirements of the Contract Documents, unless its use clearly implies a different interpretation.

S. "Shown" or "Indicated": Appearing on the Drawings, unless their use clearly implies a different interpretation.

T. "Supply": Same as Furnish.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
   1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations, List: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. AABC - Associated Air Balance Council; www.aabc.com.
   2. AAMA - American Architectural Manufacturers Association; (see FGIA).
   3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
   4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
   5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
   6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
   7. ABMA - American Boiler Manufacturers Association; www.abma.com.
   8. ACI - American Concrete Institute; www.concrete.org.
   9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
   10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
   11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.

12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.
24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International; American Society of Mechanical Engineers (The); www.asme.org.
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; www.bwfbadminton.com.
50. CARB - California Air Resources Board; www.arb.ca.gov.

51. CDA - Copper Development Association Inc.; www.copper.org.
52. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
53. CEA - Canadian Electricity Association; www.electricity.ca.
54. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
55. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
56. CGA - Compressed Gas Association; www.cganet.com.
57. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
58. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
59. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
60. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
61. CPA - Composite Panel Association; www.compositepanel.org.
62. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
63. CRRC - Cool Roof Rating Council; www.coolroofs.org.
64. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
65. CSA - CSA Group; www.csagroup.org.
66. CSI - Cast Stone Institute; www.caststone.org.
67. CSI - Construction Specifications Institute (The); www.csiresources.org.
68. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
69. CTA - Consumer Technology Association; www.cta.tech.
70. CTI - Cooling Technology Institute; www.coolingtechnology.org.
71. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
72. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECIA - Electronic Components Industry Association; www.ecianow.org.
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
78. ESTA - Entertainment Services and Technology Association; www.esta.org.
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FGIA - Fenestration and Glazing Industry Alliance; https://fgiaonline.org.
82. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
83. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
84. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
85. FM Global - FM Global; www.fmglobal.com.
86. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
87. FSA - Fluid Sealing Association; www.fluidsealing.com.
88. FSC - Forest Stewardship Council U.S.; www.fscus.org.
89. GA - Gypsum Association; www.gypsum.org.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).

93. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
94. IAS - International Accreditation Service; www.iasonline.org.
95. ICC - International Code Council; www.iccsafe.org.
96. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
97. ICPA - International Cast Polymer Association (The); www.theicpa.com.
98. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
99. IEC - International Electrotechnical Commission; www.iec.ch.
100. IEEE SA - IEEE Standards Association; https://standards.ieee.org.
101. IES - Illuminating Engineering Society; www.ies.org.
102. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
103. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
104. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
105. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
106. Intertek - Intertek Group; www.intertek.com.
107. ISA - International Society of Automation (The); www.isa.org.
108. ISFA - International Surface Fabricators Association; www.isfanow.org.
109. ISO - International Organization for Standardization; www.iso.org.
110. ITU - International Telecommunication Union; www.itu.int.
111. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
112. LPI - Lightning Protection Institute; www.lightning.org.
113. MBMA - Metal Building Manufacturers Association; www.mbma.com.
114. MCA - Metal Construction Association; www.metalconstruction.org.
115. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
116. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
117. MHI - Material Handling Industry; www.mhi.org.
118. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
119. MPI - Master Painters Institute; www.paintinfo.com.
120. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
121. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
122. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
123. NADCA - National Air Duct Cleaners Association; www.nadca.com.
124. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
125. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
126. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
127. NBI - New Buildings Institute; www.newbuildings.org.
128. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
129. NCMA - National Concrete Masonry Association; www.ncma.org.
130. NEBB - National Environmental Balancing Bureau; www.nebb.org.
131. NECA - National Electrical Contractors Association; www.necanet.org.
132. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
133. NEMA - National Electrical Manufacturers Association; www.nema.org.
134. NETA - InterNational Electrical Testing Association; www.netaworld.org.

135. NFHS - National Federation of State High School Associations; www.nfhs.org.
136. NFPA - National Fire Protection Association; www.nfpa.org.
137. NFPA - NFPA International; (see NFPA).
138. NFRC - National Fenestration Rating Council; www.nfrc.org.
139. NGA - National Glass Association; www.glass.org.
140. NHLA - National Hardwood Lumber Association; www.nhla.com.
141. NLGA - National Lumber Grades Authority; www.nlga.org.
142. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
143. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
144. NRCA - National Roofing Contractors Association; www.nrca.net.
145. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
146. NSF - NSF International; www.nsf.org.
147. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
148. NSPE - National Society of Professional Engineers; www.nspe.org.
149. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
150. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
151. NWFA - National Wood Flooring Association; www.nwfa.org.
152. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
153. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
154. PDI - Plumbing & Drainage Institute; www.pdionline.org.
155. PLASA - PLASA; www.plasa.org.
156. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
157. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; (see WWPA).
161. SAE - SAE International; www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
167. SIA - Security Industry Association; www.securityindustry.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.
169. SMA - Screen Manufacturers Association; www.smainfo.org.
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
178. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.

179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
184. TIA - Telecommunications Industry Association (The); www.tiaonline.org.
185. TMS - The Masonry Society; www.masonrysociety.org.
186. TPI - Truss Plate Institute; www.tpinst.org.
187. TPI - Turfgrass Producers International; www.turfgrasssod.org.
188. TRI - Tile Roofing Industry Alliance; www.tileroofing.org.
189. ULSE - UL Standards & Engagement Inc.; www.ulse.org.
190. UL - UL Solutions Inc.; www.ul.com.
191. USAV - USA Volleyball; www.usavolleyball.org.
192. USGBC - U.S. Green Building Council; www.usgbc.org.
193. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
194. WA - Wallcoverings Association; www.wallcoverings.org.
195. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
196. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
197. WDMA - Window & Door Manufacturers Association; www.wdma.com.
198. WI - Woodwork Institute; www.woodworkinstitute.com.
199. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
200. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
   1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
   2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
   3. ICC - International Code Council; www.iccsafe.org.
   4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
   1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
   2. DOC - U.S. Department of Commerce; www.commerce.gov.
   3. DOD - U.S. Department of Defense; www.defense.gov.
   4. DOE - U.S. Department of Energy; www.energy.gov.
   5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
   6. DOS - U.S. Department of State; www.state.gov.
   7. EPA - United States Environmental Protection Agency; www.epa.gov.
   8. FAA - Federal Aviation Administration; www.faa.gov.
   9. GPO - U.S. Government Publishing Office; www.gpo.gov.
   10. GSA - U.S. General Services Administration; www.gsa.gov.
   11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.

12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
3. DSCC - Defense Supply Center Columbus; (see FS).
4. FED-STD - Federal Standard; (see FS).
5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from U.S. General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
6. MILSPEC - Military Specifications and Standards; (see DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014339 - EXTERIOR WALLS MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for mockup construction, laboratory mockups, on-site mockups and testing.

B. Mockups, testing, and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific mockup and testing requirements for individual elements of the Work are specified in the Sections that specify that Work. Requirements in those Sections may also cover production of standard products.
   2. Specified mockups, tests, inspections, and related actions do not limit Contractor's other quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide mockup construction and testing, including those required by authorities having jurisdiction, are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between adjacent materials and systems; and to demonstrate compliance with specified installation tolerances. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
   2. Standalone Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
   3. Building Integrated Exterior Mockups: Mockups of the exterior envelope erected into the building fabric. These mockups, if successful, may be left in place as part of the completed work at the sole discretion of the Architect and Owner.

B. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

C. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

D. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

E. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

G. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

1.3 ACTION SUBMITTALS

A. Shop Drawings: For each type of exterior mockup, provide plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Sample Construction: Process submittal for field samples as specified for product submittal, for documentation.

C. Delegated-Design Submittal: For standalone mockups to comply with structural requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer and testing agency.

B. Installation Instructions:
   1. Include instructions specific to the use and conditions, including:
      a. Sequence of component/assembly
      b. Direction of operations for installation, unitized systems erection.
      c. Surface preparation requirements.
      d. All components of the system.
      e. Coordination requirements for adjacent systems where appropriate.
   2. Provide 3 dimensional and "exploded views" to address components not easily expressed in orthographic drawings.
   3. Maintain mockup installation instructions for mockup erection on location and make available to all parties throughout mockup construction, testing, and reference.

C. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities

D. Qualification Data: For Contractor's quality-control personnel.

E. Testing Agency Qualifications: Demonstrate testing agency capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

F. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests.
3. Description of test.
4. Identification of applicable standards.
5. Identification of test methods.
6. Number of tests required.
7. Time schedule or time span for tests.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

G. Mock-up Completion: Process submittal for documentation when mock-up is complete.

1.5 CONTRACTOR'S MOCKUP AND TESTING PLAN

A. Mockup and Testing Plan, General: Submit plan for mockup fabrication, construction, and testing before proceeding with Project submittals for associated exterior envelope Work.
   1. Include the following information in this plan, at a minimum:
      a. Mockup shop drawing and submittals schedule.
      b. Lead time for obtaining required mockup materials.
      c. Times for testing, and if necessary, retesting of mockups.

1.6 REPORTS AND DOCUMENTS

A. Test Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests.
   5. Names of individuals making tests.
   6. Description of the Work and test method.
   7. Identification of product and Specification Section.
   8. Complete inspection data.
   9. Test results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of testing.
   11. Comments or professional opinion on whether tested Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

1.7 QUALITY CONTROL

A. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

B. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups as indicated to adequately demonstrate capability of products to comply with performance requirements.
      d. Where size and configuration are not indicated by documents, provide sizes and configurations of test assemblies, mockups, and laboratory mockups to replicate project conditions at full scale.
      e. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      f. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      g. When testing is complete, remove and dispose test specimens, assemblies, and mockups unless otherwise indicated; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

C. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect 14 days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers to construct mockups that will be employed during the construction of the Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect'sand Owner's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Notify Architect 14 days prior to proposed date of mockup removals. Proceed with demolition only upon written agreement by Architect .
   8. Demolish and remove mockups only when directed by Architect or Owner unless otherwise indicated.

D. Standalone Exterior Mockups: Prior to commencing exterior construction, build freestanding mockup of exterior assemblies according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

E. Building Integrated Exterior Mockups: Prior to commencing exterior construction, build freestanding mockup of exterior assemblies according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
   1. Construct in-place mockup 2-bay wide, 2-story tall for field quality control testing indicated.

F. Laboratory Mockups: Comply with requirements of preconstruction testing as specified in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. Owner Responsibilities: Where quality-assurance services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
   3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Quality Control Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Schedule testing agencies functions sufficiently in advance of testing or inspecting to allow Architect observations.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's/Fabricator's Technical Services: Engage manufacturer's technical representatives to observe and inspect the mockups. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed mockups, witnessing testing, and submittal of written reports.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Coordinate the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-assurance services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the mockups and testing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TRACKING AND RELOGGING

A. Tracking: Prepare plan and elevations indicating locations and results of testing for integrated exterior mockups. Update testing completion as work proceeds.

B. Submit: With record documents.

1. Provide updated copies of documents to Architect upon completion of mockups and testing by type and location.

3.2 REPAIR AND PROTECTION

A. General:
1. Protect standalone mockups until released for demolition or removal from Site by Architect.

END OF SECTION

SECTION 014500.0010 – QUALITY CONTROL

PART 1 - GENERAL

1.1 REFERENCES

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

B. ASTM INTERNATIONAL (ASTM)
   1. ASTM D3740 (2019) Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
   2. ASTM E329 (2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special inspection

C. INTERNATIONAL CODE COUNCIL (ICC)
   1. ICC IBC (2024) International Building Code

1.2 PAYMENT

A. Separate payment will not be made for providing and maintaining an effective Quality Control program, and all associated costs will be included in the applicable Bid Schedule unit or lump-sum prices.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Establish and maintain an effective quality control (QC) system in compliance with the Contract requirements. Quality Control (QC) consists of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. Cover all construction operations, both onsite and offsite, and be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent must maintain a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 QUALITY CONTROL PLAN

A. Submit no later than 15 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The Government will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to

begin until acceptance of a CQC Plan or another interim plan containing the additional work.

1. Content of the CQC Plan: Include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:
    a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager who reports to the project superintendent.
    b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
    c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Copies of these letters shall be furnished to the Government.
    d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 013300 - Submittal Procedures.
    e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer must be used.)
    f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
    g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
    h. Reporting procedures, including proposed reporting formats.
    i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.
    j. All special inspection requirements as required in accordance with ICC IBC.
2. Acceptance of Plan: Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3. Notification of Changes: After acceptance of the CQC Plan, notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

A. After the Preconstruction Conference and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 15 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

A. Personnel Requirements:
   1. The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance.
   2. The Safety and Health Manager must receive direction and authority from the CQC System Manager and serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization.
   3. The Contractor's CQC staff must maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer.
   4. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization.
   5. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

B. CQC System Manager:

C. Identify as CQC System Manager an individual within the onsite work organization who is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor.
   1. The CQC System Manager must be a construction person with a minimum of 10 years in related work.

2. This CQC System Manager must be on the site at all times during construction and be employed by the prime Contractor.
3. The CQC System Manager must be assigned no other duties. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence.
4. The requirements for the alternate are the same as the CQC System Manager.

D. CQC Personnel:
1. In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas:
   a. Electrical, mechanical, civil, structural, environmental, architectural, materials technician, submittals clerk. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience.
   b. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan.
   c. A single person may cover more than one area provided that they are qualified to perform QC activities in each designated and that workload allows.

E. Organizational Changes:
1. Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

A. Submittals, if needed, must comply with the requirements in Section 013300 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. All systems identified to go through Commissioning shall be coordinated with Section 013300 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL

A. Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The Contractor is responsible for all testing requirements and Special Inspections performed by a third party. At least three phases of control must be conducted by the CQC System Manager for each definable feature of the construction work as follows:
1. Preparatory Phase: This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:
   a. This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

b. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
c. Review of the contract drawings.
d. Check to assure that all materials and/or equipment have been tested, submitted, and approved.
e. Review of provisions that have been made to provide required control inspection and testing.
f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
g. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
h. Review of the appropriate activity hazard analysis to assure safety requirements are met.
i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
k. Discussion of the initial control phase.
l. The Government must be notified at least 48 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

2. Initial Phase: This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:
a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
d. Resolve all differences.
e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
f. The Government must be notified at least 48 hours in advance of beginning the initial phase. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3. Follow-up Phase:
   a. Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work.
   b. Record the checks in the CQC documentation.
   c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.
4. Additional Preparatory and Initial Phases:
   a. Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

A. Testing Procedure:
1. Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. Procure the services of a Government approved testing laboratory or establish an approved testing laboratory at the project site.
2. Perform the following activities and record and provide the following data:
   a. Verify that testing procedures comply with contract requirements.
   b. Verify that facilities and testing equipment are available and comply with testing standards.
   c. Check test instrument calibration data against certified standards.
   d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
   e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

B. Testing Laboratories:
1. Capability Check: The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel must meet criteria detailed in ASTM D3740 and ASTM E329.

2. Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $500 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.
3. Onsite Laboratory: The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

A. Punch-Out Inspection:
1. Conduct an inspection of the work by the CQC Manager near the end of the work, or any increment of the work established by a time stated in the SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications.
2. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected.
3. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

B. Pre-Final Inspection:
1. The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection.
2. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled.
3. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph must be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

C. Final Acceptance Inspection:
1. The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative must be in attendance at the final acceptance inspection.
2. Additional Government personnel including, but not limited to, those from the IHS Area Office and Service Unit may also be in attendance.
3. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection.

4. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

A. Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:
   1. Contractor/subcontractor and their area of responsibility.
   2. Operating plant/equipment with hours worked, idle, or down for repair.
   3. Work performed each day, giving location, description, and by whom.

B. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
   1. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
   2. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
   3. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
   4. Offsite surveillance activities, including actions taken.
   5. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
   6. Instructions given/received and conflicts in plans and/or specifications.

C. Contractor's verification statement.
   1. Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered.
   2. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the contract.
   3. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed.
   4. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period.
   5. All calendar days must be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only.
   6. Reports must be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

3.10 NOTIFICATION OF NONCOMPLIANCE

A. The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements.

1. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification.
2. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order suspending all or part of the work until satisfactory corrective action has been taken.
3. No part of the time lost due to such suspension of work orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:
   1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. Temporary Utilities: Provide temporary utilities as required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

B. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

C. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

D. Water Service: Pay water-service use charges for water used by all entities for construction operations.

E. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

F. Water from Existing System: Water from Owner's existing water system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.

G. Sanitation:
   1. Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Owner and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility.
   2. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. All penalties and/or fines associated with improper discharge will be the responsibility of the Contractor. Maintain these conveniences at all times without nuisance. Include provisions for pest control and elimination of odors. Owner toilet facilities will not be available to Contractor's personnel.

H. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.

1.3 ACTION SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, traffic control, and parking areas for construction personnel.
   1. Construction Site Plan: Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify all areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
   1. Submit shop drawings for approval showing structure, exact dimensions, copy, confirmation of specified colors and typefaces, and location(s) on site. Receive approval before erection.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
   1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
   2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
   3. Indicate methods to be used to avoid trapping water in finished work.

F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   4. Waste-handling procedures.
   5. Other dust-control measures.

G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
   1. Methods used to meet the goals and requirements of the Owner.
   2. Concrete cutting method(s) to be used.
   3. Location of construction devices on the site.
   4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
   5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.

H. Indicate locations of sensitive patient areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.Product Data: Backflow Preventers.

I. Test Reports: Backflow Preventer Tests.

J. Certificates:
   1. Backflow Tester Certificate: Prior to testing, submit to the Owner certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester shall not be affiliated with any company participating in any other phase of this Contract.
   2. Backflow Preventers Certificate of Full Approval: Certificate of Full Approval from State or local authority attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.
   3. Backflow Prevention Training Certificate: Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate shall be current.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design and ICC A117.1 unless the accessibility standards that apply to this project as indicated on the Drawings are more rigorous.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Prior to the start of work, enclose those areas at the construction site which are not within the construction fence with a temporary safety fence, including gates and warning signs, to protect the public from construction activities.
   1. Provide fencing along the construction site at all open excavations and tunnels to control access by unauthorized people. Fencing shall be installed able to restrain a force of at least 250 pounds against it. Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails, with galvanized barbed-wire top strand. Support and tightly secure fencing to steel posts located on minimum 10 foot centers. Remove the fence from the work site upon completion of the contract.

B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.

D. Dust-Control: Dust control methods and procedures shall be approved by the Contracting Officer. Treat dust abatement on access roads with applications of calcium chloride, water sprinklers, or similar methods or treatment

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices:
   1. Provide and maintain administrative field office facilities within the construction area at the designated location. Owner's office and warehouse facilities will not be available to the Contractor's personnel.
   2. Prefabricated or mobile weathertight units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Securely anchor to the ground at all four corners to guard against movement during high winds.
   3. At completion of the project, the offices shall remain the property of the Contractor and shall be removed from the site. Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of the Owner.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities, to include work stations for at least 10 personnel and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, folding chairs, and 4-foot- square tack and marker boards.
3. Drinking water, private toilet and lavatory, refrigerator, and sink.
4. 20 sets of PPE, each set to include safety vest, hard hat, eye protection; for use by Owner's personnel, hung and located on office wall where directed.
   a. 10 Sets: Large size.
   b. 10 Sets: Extra-Large size.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
7. Internet service as specified for each work station.
8. Doors with Cylinder locks and windows with locking hardware.

C. Third Party Quality Assurance Office: Adjacent to the common-use field office, provide an office for the exclusive use of the Third Party Quality Assurance persons, minimum of three persons. In addition to the applicable requirements specified above for the common-use field office, provide a 4 ft x 8 ft plan table, standard size office desk and chair, internet service as specified for each work station, door with cylinder lock and windows with locking hardware.

D. Storage Area: Construct a temporary 6 foot high fence around trailers and materials. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day
   1. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   2. Store combustible materials apart from building.

E. Temporary Signage:
   1. Bulletin Board: Immediately upon beginning of work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Owner. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Owner.
   2. Project and Safety Signs: Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

F. Project Sign: Prior to initiating any work on site, provide project identification sign(s) at the locations designated by the Owner. Maintain signs throughout the life of the Project. Upon completion of the Project, remove the signs from the site. The Owner will provide the Contractor a copy of the rendering to use in the production of the final signboard art work. Reproduce the rendering on the signboard.

G. Maintain sign(s) until final acceptance of the Work, and repaint sign(s) at least once in each 12-month period.
   1. The field of the sign shall consist of a 4 by 8 foot sheet of grade B-B medium density overlaid exterior plywood.
   2. Lumber shall be B or better Southern pine, pressure-preservative treated in accordance with AWPA C1 (All Timber Products - Preservative Treatment by Pressure Processes) and AWPA C2 (Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes). Nails shall be aluminum or galvanized steel.
   3. The entire signboard and supports shall be given one coat of exterior alkyd primer and two coats of exterior alkyd enamel paint. The lettering and sign work shall be performed by a skilled sign painter using paint known in the trade as bulletin colors. The colors, lettering sizes, and lettering styles shall be as indicated. Utilize only cured pressure-treated wood which has had the chemicals leached from the surface of the wood prior to painting.

2.3 TEMPORARY TRAFFIC CONTROL

A. Haul Roads: At Contractor’s expense construct access and haul roads necessary for proper prosecution of the work under this contract. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are to be avoided. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to approval by the Owner. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during all night work operations.

B. Protection of Traffic: Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Owner. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment, the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of all damage to roads caused by construction operations.

C. Maintenance of Traffic:
   1. Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic on railways or highways except with written permission of the Owner at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan shall be in accordance with State and local regulations.

      Make all notifications and obtain all permits required for modification to traffic movements. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

2. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Owner prior to starting any activity that will obstruct traffic.
3. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, of the authority having jurisdiction.

2.4 EQUIPMENT

A. Fire Protection: Provide temporary fire protection equipment for the protection of personnel and property during construction.Remove debris and flammable materials daily to minimize potential hazards.
   1. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. Maintain negative air pressure within work area, using HEPA-equipped air-infiltration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
    1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
    1. Connect temporary sewers to private system indicated as directed by authorities having jurisdiction.

C. Water Service:
    1. Install water service and distribution piping in sizes and pressures adequate for construction.
    2. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
    1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
    1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service:
    1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
    2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
        a. Install electric power service underground unless otherwise indicated.

b. Connect temporary service to Owner's existing power source, as directed by Owner.

3. Temporary Wiring Where Required: Provide temporary wiring in accordance with NFPA 241 and NFPA 70. Include frequent inspection of all equipment and apparatus.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Obstruction Lighting of Cranes: Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation shall comply with FAA AC 70/7460-1. Lights shall be operational during periods of reduced visibility, darkness, and as directed by the Owner.

I. Backflow Preventers: Reduced pressure principle type conforming to the applicable requirements AWWA C511. The particular make, model/design, and size of backflow preventers to be installed shall be compliant with State and local regulations. After installation, conduct Backflow Preventer Tests and provide test reports verifying that the installation meets State and local regulations.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.

1. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Contractor's emergency after-hours telephone number.
   e. Architect's office.
   f. Engineers' offices.
   g. Owner's office.

K. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

L. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Core i5 or i7.
2. Memory: 16 gigabyte.
3. Disk Storage: 1 terabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 24-inch LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows 10 Professional.
8. Productivity Software:
   a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.

b. Adobe Reader DC.
c. WinZip 10.0 or higher.

9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0-Mbps upload and 15-Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 2 terrabytes, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:
1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Apperance of Trailers: Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and be in a state of good repair. Trailers which, in the opinion of the Owner, require exterior painting or maintenance will not be allowed on site. Securely anchor trailers to the ground to guard against movement during high winds.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. Rush Hour Restrictions: Do not interfere with the peak traffic flows preceding and during normal operations without notification to and approval by the Owner.

E. Construction Personnel Parking: Provide temporary offsite parking areas for construction personnel.

F. Storage and Staging: Provide temporary offsite area for storage and staging needs.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings and as specified.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touch up signs, so they are legible at all times.

I. Waste Disposal Facilities:
1. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
2. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

K. Temporary Elevator Use: Use of elevators is not permitted.

L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection:
1. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

F. Clean Up: Remove construction debris, waste materials, packaging material and the like from the work site daily. All dirt and mud which is tracked onto paved or surfaced roadways shall be cleaned away. Store within a fenced area all materials resulting from demolition activities which are salvageable. Neatly stack stored materials not in trailers, whether new or salvaged.

G. Mainternace of Storage Area: Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles; gravel gradation will be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
1. Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment; in addition, the Contractor will notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

1. Barricades: Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic, barricades shall be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

K. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
   a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

O. Building and Site Storm Protection: When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Owner's property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Owner's property.

P. Weather Protection of Temporary Facilities and Stored Materials: Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
    1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
    1. Restoration of Storage Area: Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore areas used by the Contractor for the storage of equipment or material, or other use, to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
    1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
    2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION

SECTION 015713 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Storm Water Pollution Prevention Plan shall be prepared in accordance with Technical Provision 01.17 of the White Mountain Apache Tribe IDIQ 2023 Modification of the 2019 PAO/SFC Technical Provisions, which have been included in the Project Documents for reference.

B. Temporary Erosion and Sediment Control shall conform to the requirements of the Flood Control District of Maricopa County Drainage Design Manual for Erosion Control, 2018 Revision to the 2012 Edition:
   1. Material and Installation of Stabilized Construction Entrance, per Chapter 5, EC-5.
   2. Material and Installation of Organic Filter Barrier, per Chapter 5, SPC-1.
   3. Material and Installation of Silt Fence, per Chapter 5, SPC-5.
   4. Material and Installation of Storm Drain Inlet Protection, per Chapter 5, SPC-7.
   5. Material and Installation of Designated Washdown Areas, per Chapter 5, GH-4.

1.2 RELATED SECTIONS

A. Section 312213 – Rough Grading

B. Section 312300 – Excavation and Fill

C. Section 312500 – Erosion and Sedimentation Controls

D. Construction Drawings

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 015731 - INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:
   1. Special requirements for Indoor Air Quality (IAQ) management during construction operations.
   2. Procedures for testing baseline IAQ or Building Flush-Out method. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

B. Related Sections:
   1. Section 01 32 33, “Photographic Documentation.”
   2. Section 01 33 00, “Submittal Procedures.”
   3. Section 01 50 00, “Temporary Facilities and Controls.”
   4. Section 01 57 31, “Indoor Air Quality Management.”
   5. Section 01 78 23, “Operation and Maintenance Data.”
   6. Section 01 81 13, “Sustainable Design Requirements.”

1.3 IAQ MANAGEMENT STRATEGY

A. The contractor shall prevent indoor air quality issues resulting from the construction process, to sustain long term installer and occupant health and comfort.

B. Protect the ventilation system components during construction and clean contaminated components after construction is complete.

C. Control sources of potential IAQ pollutants through selection of materials and processes used in Project construction.

1.4 DEFINITIONS – NOT USED

1.5 ADMINISTRATIVE REQUIREMENTS

A. LEED Kickoff Meeting: Within 30 days of Notice to Proceed, schedule and conduct meeting with Owner, Construction Manager, Architect, and LEED Consultant to discuss the proposed IAQ Management Plan and enforcement.

1.6 SUBMITTALS

A. Indoor Air Quality (IAQ) Management Plan: Submit the proposed indoor air quality management plan within 60 days of Notice to Proceed. The program shall meet the following requirements:
   1. Identification of Contractor’s staff responsible for enforcing indoor air quality management.
   2. Meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.

3. Protect absorptive materials stored on-site and installed from moisture damage.
4. Do not operate permanently installed air-handling equipment during construction unless filtration media with a minimum efficiency reporting value (MERV) of 8, as determined by ASHRAE 52.2–2017, with errata (or media with ISO coarse 90% or higher, as defined by ISO 16890-2016, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media.
5. Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer's recommendations.
6. Prohibit the use of smoking inside the building and on the property during construction. Smoking includes tobacco smoke, as well as smoke produced from the combustion of cannabis and controlled substances and the emissions produced by electronic smoking devices.

B. Cut sheets of filtration media used during construction with MERV values highlighted.

C. After building is enclosed, provide a minimum of six photos per month demonstrating compliant management strategies in accordance with the IAQ Management Plan.

D. Inspection and Test Reports:
1. Baseline Indoor Air Quality test report

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIAL CONDITIONS

A. Mold and Mildew: Materials that have evidence of growth of molds or mildew are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.

B. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.

2.2 AIR FILTRATION MEDIA

A. Minimum Efficiency Reporting Value (MERV) as determined by ASHRAE 52.2-2007:
1. MERV-8 for filtration media used at each return air grill, if used during construction.
2. MERV-13 for filtration media installed at the end of construction and prior to occupancy.

PART 3 - EXECUTION

3.1 IAQ MANAGEMENT PLAN REQUIREMENTS

A. HVAC Protection:
1. 1. Major HVAC equipment and ductwork should be sealed at the factory and wrapped completely in a non-porous covering. This covering shall be removed only when necessary and if removed, must be replaced prior to installation to prevent equipment and duct from being exposed to airborne contaminants, debris and moisture.
2. Prior to operation, all installed duct openings shall be covered with a non-porous material to prevent airborne contaminants, debris and moisture from entering the duct.

3. Prior to operation, a duct inspection shall be performed by the site superintendent and HVAC contractor to determine if the duct interiors require cleaning. 4.
4. During operation, return duct openings shall be covered with a “MERV 8” filter media that will be changed at regular intervals. Temporary “MERV 8” filter media shall be placed in the supply air stream prior to the main air handling unit filters to protect the main filters during operation. Filter media shall be changed weekly or when a visual inspection deems the filter inadequate. The goal is to complete filter changes more often than necessary to ensure the ductwork stays clean.
    a. Temporary filtration shall only be removed for system testing and balancing to ensure accurate readings.
    b. Prior to occupancy, all temporary filtration shall be removed and all permanent filtration media will be replaced with new product. The date of change and the replacement media should be logged with the Construction Manager.
5. Prior to occupancy, duct cleaning shall be done if the preventive measures listed above have not kept the ductwork clean.
6. A “Filter Log” shall be maintained for each of the filtered areas.

B. Source Control:
1. Combustion engine use is not allowed inside the building or within 25 feet of any building on site. Smoking is not allowed on the property.
    a. If combustion engine use is required for work inside the building, it must use propane or exhaust must be directly ducted to more than 25 feet from the exterior of the building.
2. Outside air used for ventilation should be filtered, kept free from airborne contaminants and construction debris (see HVAC protection).
3. To minimize the levels of Volatile Organic Compounds (VOCs) in the workspace, products with low VOC levels shall be used on this project. If any materials are determined to have high VOC levels and no alternate is available, a product and activity specific plan to reduce impact shall be prepared, implemented and documented.
4. Containers of materials, such as paints, coatings, adhesives and sealants must be closed when not in use, and either removed from the building or stored in sealed containers when not in use.

C. Pathway Interruption:
1. Use 100% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.
2. Erect barriers between work areas or between the inside and outside of the building to prevent unwanted airflow from dirty to clean areas.

D. Housekeeping:
1. The use of temporary air handling equipment and/or natural ventilation shall be maximized during working hours to supply fresh air to the space.
2. The use of exhaust fans and negative air machines shall be maximized during the working hours to remove dust and contaminants from the space, but should not jeopardize the building pressure and zone pressure controls.

3. Filter changes will be performed on an as-needed basis and shall be documented on the 'Filter Change Log' (see HVAC protection). An individual filter log shall be kept and attached to all equipment utilizing filters.
4. When a construction schedule is available, air handling units and exhaust fans in operation should be set for the work hours through the building automation system, if available, and local controls if a BAS is not connected.
5. Materials that contain VOCs shall be staged in an open air space for 24 hours before being brought into the building. If no open-air space is available on-site, these materials must be a stored in a negatively pressurized area, preferably with direct exhaust, operating 24/7.
6. To minimize the exposure to dust, humidity and VOCs, absorptive materials should be delivered to the site as close as possible to the time they are scheduled to be installed.
7. Drywall should have the prime coat of paint installed as soon as possible after installation.
8. Schedule construction activities such that materials containing VOCs, such as paints, shall be installed prior to absorbent materials whenever possible, or given proper drying time prior to the installation of additional absorptive materials.

E. Absorbent Material Protection:
1. All absorbent materials shall be covered on all six sides and elevated to prevent absorption, preferably stored in a container or inside the building.
2. In the event an absorbent material gets moist, it shall be replaced, even if already installed.
3. Unless required, installed drywall shall not touch the floor. This will limit absorption of liquids.

F. Scheduling:
1. The use of temporary air handling equipment and/or natural ventilation shall be maximized during working hours to supply fresh air to the space.
2. The use of exhaust fans and negative air machines shall be maximized during the working hours to remove dust and contaminants from the space, but should not jeopardize the building pressure and zone pressure controls.
3. Filter changes will be performed on an as-needed basis and shall be documented on the 'Filter Change Log' (see HVAC protection). An individual filter log shall be kept and attached to all equipment utilizing filters.

3.2 IAQ MANAGEMENT IMPLEMENTATION

A. On-Site Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing the IAQ Management Plan for the Project.

B. Progress Meetings: Construction related IAQ procedures shall be included in the pre-construction and construction progress meeting agendas.

C. Distribution: The Contractor shall distribute copies of the IAQ Management Plan to the Job Site Foreman, each Subcontractor, the Owner, the Architect, and the LEED Consultant.

D. Instruction: The Contractor shall provide on-site instruction of the IAQ procedures and ensure that all participants in the construction process understand the importance of the goals of the IAQ Management Plan.

E. Verification: Provide a minimum of six photos per month demonstrating compliant management strategies in accordance with the IAQ Management Plan.

3.3 INDOOR AIR QUALITY ASSESSMENT

After construction ends and before occupancy, but under ventilation conditions typical for occupancy, The Contractor will conduct Option 1: Flush Out or Option 2: Air testing. All interior finishes, such as millwork, doors, paint, carpet, acoustic tiles, furniture, and movable furnishings (e.g., workstations, partitions), must be installed, and major VOC punch list items must be finished. The options cannot be combined.

A. Flush Out
   1. Flush Out – Before Occupancy
      a. Install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4 267 140 liters of outdoor air per square meter) of gross floor area while maintaining an internal temperature of at least 60°F (15°C) and no higher than 80°F (27°C) and relative humidity no higher than 60%.

B. Air Testing
   1. After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing using protocols consistent with the methods listed in Table 1 for all occupied spaces. Use current versions of ASTM standard methods, EPA compendium methods, or ISO methods, as indicated. Laboratories that conduct the tests for chemical analysis of formaldehyde and volatile organic compounds must be accredited under ISO/IEC 17025 for the test methods they use. Retail projects may conduct the testing within 14 days of occupancy. Demonstrate that contaminants do not exceed the concentration levels listed in Table 1.

Table 1: Maximum concentration levels, by contaminant and testing method

Contaminant			Maximum concentration	ASTM and U.S. EPA methods	ISO method
Particulates	**PM10** (for all buildings)		50 µg/m^3 Healthcare only: 20 µg/m^3	EPA Compendium Method IP-10	ISO 7708
	PM2.5 (for buildings in EPA nonattainment areas for PM2.5, or local equivalent)		15 µg/m^3		
Ozone (for buildings in EPA nonattainment areas for Ozone, or local equivalent)			0.075 ppm	ASTM D5149 - 02	ISO 13964
Carbon monoxide (CO)			9 ppm; no more than 2 ppm above outdoor levels	EPA Compendium Method IP-3	ISO 4224
Total volatile organic compounds (TVOCs)			500 µg/m^3 Healthcare only: 200 µg/m^3	EPA TO-1, TO-17, or EPA Compendium Method IP-1	ISO 16000-6
Formaldehyde			27 ppb Healthcare only: 16.3 ppb	ASTM D5197, EPA TO-11, or EPA Compendium Method IP-6	ISO 16000-3
Target volatile organic compounds*	1	Acetaldehyde	140 µg/m^3		
	2	Benzene	3 µg/m^3	ASTM D5197; EPA TO-1, TO-17, or EPA Compendium Method IP-1	ISO 16000-3, ISO 16000-6
	3	Carbon disulfide	800 µg/m^3		
	4	Carbon tetrachloride	40 µg/m^3		
	5	Chlorobenzene	1000 µg/m^3		
	6	Chloroform	300 µg/m^3		
	7	Dichlorobenzene (1,4-)	800µg/m^3		
	8	Dichloroethylene (1,1)	70 µg/m^3		
	9	Dimethylformamide (N,N-)	80 µg/m^3		
	10	Dioxane (1,4-)	3000 µg/m^3		
	11	Epichlorohydrin	3 µg/m^3		
	12	Ethylbenzene	2000 µg/m^3		
	13	Ethylene glycol	400 µg/m^3		
	14	Ethylene glycol monoethyl ether	70 µg/m^3		
	15	Ethylene glycol monoethyl ether acetate	300 µg/m^3		
	16	Ethylene glycol monomethyl ether	60 µg/m^3		
	17	Ethylene glycol monomethyl ether acetate	90 µg/m^3		
	19	Hexane (n-)	7000 µg/m^3		
	20	Isophorone	2000 µg/m^3		
	21	Isopropanol	7000 µg/m^3		
	22	Methyl chloroform	1000 µg/m^3		
	23	Methylene chloride	400 µg/m^3		
	24	Methyl *t*-butyl ether	8000 µg/m^3		
	25	Naphthalene	9 µg/m^3		
	26	Phenol	200 µg/m^3		
	27	Propylene glycol monomethyl ether	7000 µg/m^3		
	28	Styrene	900 µg/m^3		
	29	Tetrachloroethylene (Perchloroethylene)	35 µg/m^3		
	30	Toluene	300 µg/m^3		
	31	Trichloroethylene	600 µg/m^3		
	32	Vinyl acetate	200 µg/m^3		
	33-35	Xylenes, technical mixture (m-, o-, p-xylene combined)	700 µg/m^3		

ppb = parts per billion; ppm = parts per million; µg/m^3 = micrograms per cubic meter

*The target volatile organic compounds are from CDPH Standard Method v1.1, Table 4-1. The Maximum concentration limits for these target compounds are the full CREL adopted by Cal/EPA OEHHA in effect on June 2014 http://oehha.ca.gov/air/allrels.html.

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
   3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design (Product Standard) Specification: Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. A specification in which a single manufacturer's product is named and may be accompanied by the words "basis-of-design," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
   2. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
   1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
   2. Data indicating compliance with the requirements specified in "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Resolution of Compatibility Disputes between Multiple Contractors:
      a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
      b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:
   1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
   2. Store products to allow for inspection and measurement of quantity or counting of units.
   3. Store materials in a manner that will not endanger Project structure.
   4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
   5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   7. Protect stored products from damage and liquids from freezing.
   8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," or "or approved comparable product," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
   a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
   a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
   a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
   a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
   a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
8. Reference Standards: Where Specifications describe a product by referring to a reference standard without listing product/manufacturer, propose a product that meets the standard. Where additional product description modifies the reference standard, propose a product that meets the standard as modified.

C. Product Uniformity: It is the intent of the documents that the completed construction be uniform through-out the Project. For each type of product, the manufacturer and model shall not vary. After a particular product has been identified and approved for an application, that product shall be used for that application across all the subcontracts and other Work related contracts held by the Contractor. This provision applies equally to accepted substitutions.

D. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

E. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

F. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
   1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
   1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

6. By proposing a product that is not listed, for consideration as a comparable product, the Contractor affirms that it meets requirements, except where clearly indicated otherwise. Approval, if granted, will be contingent upon the product meeting requirements as a comparable product. In the absence of clear indication of non-compliance in product submittal, approval of the comparable product by Architect will be based on Contractor's affirmation, whether explicit or implicit.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   1. Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp. See Section 013300 "Submittal Procedures."
   2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering.
   3. Installation.
   4. Cutting and patching.
   5. Coordination of Owner's portion of the Work.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.
   9. Correction of the Work.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.
   1. Prior to submitting cutting and patching plan, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
      a. Contractor's superintendent.
      b. Trade supervisor responsible for cutting operations.
      c. Trade supervisor(s) responsible for patching of each type of substrate.
      d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
   2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at Project site.
   1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
      a. Contractor's superintendent.
      b. Professional engineer responsible for performing Project surveying and layout.

c. Professional engineer responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Certified Surveys: Submit two copies signed by professional engineer.

C. Certificates: Submit certificate signed by professional engineer, certifying that location and elevation of improvements comply with requirements.

D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

A. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Conveying systems.
    k. Electrical wiring systems.
    l. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a professional engineer experienced in laying out the Work, using the following accepted surveying practices:
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb, and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.
1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.
a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for waste reduction and for the recycling of non-hazardous, recyclable, construction and demolition debris.
   1. Reduce waste by minimizing factors that contribute to waste.
   2. Use reasonable and legal means to divert a minimum of 75% of construction and demolition debris from landfills and incinerators through at least 4 waste diversion streams by facilitating their recycling or reuse through a Contractor developed, and Owner reviewed, construction waste management program.

B. Related Sections
   1. Division 1 Section 01 81 13 “Sustainable Design Requirements” for LEED credit requirements.

1.2 DEFINITIONS

A. Waste Reduction: Construction practices that achieve the most efficient use of resources and materials; uses water efficiently; avoids practices such as over- packaging, improper storage, ordering errors, poor planning, breakage, mishandling and contamination.

B. Construction and Demolition Debris: Solid wastes arising from demolition or removal, excess or unusable construction materials, packing materials for construction products, and other materials generated on site during the construction process but not incorporated into the Work.

C. Recyclable Materials: Construction and demolition debris that can be recovered and processed into new products or materials. Recyclable materials include, but are not limited to, the following:
   1. Metals: Ferrous (iron, steel, stainless steel, galvanized steel) and non-ferrous (copper, brass, bronze, aluminum) types and containers made from metals such as pails, buckets, and beverage cans.
   2. Asphaltic concrete paving.
   3. Concrete.
   4. Gypsum wallboard.
   5. Paper products such as generated from field office activities and clean corrugated packaging cardboard.
   6. Wood products, including untreated dimensional lumber, plywood, oriented strand board, hardboard, particleboard, and crates and pallets made from wood products.
   7. Brick and stone masonry.
   8. Carpet and padding.
   9. Plastics and containers made from plastics such as pails, buckets, and beverage bottles.
   10. Copper wiring.
   11. Glass: Glass beverages containers, window and mirror glass.

NOTE: Alternative Daily Cover does not qualify.

D. Non- Recyclable Materials: Construction and demolition debris not capable of being reused or reprocessed, exclusive of the recyclable materials listed above.

E. Hazardous Materials: Construction and demolition debris that are regulated for disposal by local, city, county, state, or Federal authorities.

F. Waste Diversion Stream: A waste stream is a distinct end use that has diverted material from disposal. Refer to the LEED reference manual Materials and Resources Construction and Demolition Waste Management for further guidance.

G. Source Separated Method: Construction and demolition debris, that is reusable and recyclable, are separated from non-recyclable debris and sorted into appropriately marked separated containers or bins and then transported to the designated recycling facility for further processing. Non-recyclable debris is transported to a landfill or incinerator.

H. Commingled Method: All construction and demolition debris is placed into containers or bins and then transported to a recycling facility where recyclable and salvageable materials are removed, sorted, and processed and the remaining waste is transported to a landfill or incinerator.

1.3 SUBMITTALS

A. Construction Waste Management Plan: Submit the proposed waste management program within 60 days of Notice to Proceed. The program shall include the following:
   1. Identification of Contractor's staff responsible for enforcing construction waste management.
   2. Actions that will be taken to reduce solid waste generation.
   3. Description of the specific methods to be used in recycling/reuse of the various construction and demolition debris generated, including the areas and equipment, to be used for processing, sorting, and temporary storage of debris.
   4. Characterization, including estimated types and quantities of the construction and demolition debris to be generated. Include percentage of recyclable and non-recyclable debris.
   5. List of specific construction and demolition debris materials that will be salvaged for resale, salvaged, and reused, or recycled.
   6. Name(s) of landfill and recycling facilities to be used.
   7. Identification of local and regional reuse programs as applicable, including non-profit organizations such as schools, local housing agencies, and organizations that accept used and excess construction materials such as materials exchange networks and Habitat for Humanity.
   8. Identification of constructions and demolition debris that cannot be recycled/reused with an explanation or justification.

B. Waste Management Reports: With each Application for Payment, submit a Waste Management Report in a form that is compliant with LEED requirements. Attach manifests, weight tickets, receipts and invoices, as applicable. Organize and maintain records to document the following:
   1. The quantity of debris generated, for each material recycled, reused, or salvaged.
   2. The quantity of debris diverted through sale, reuse, or recycling, in tons or cubic yards.
   3. Quantity of debris disposed by landfill or incineration.
   4. Name and location of each firm accepting the debris, including:
      a. Types of debris accepted.
      b. Date of acceptance.

C. Project Closeout: Upon project completion submit the Waste Management Reports to the owner and LEED Consultant.
   1. Submit final waste haul summary report documenting that non-hazardous construction and demolition has been recycled and salvaged. Calculations can be done by weight or volume but must be consistent throughout.

1.4 QUALITY ASSURANCE

A. Construction Waste Management Plan: Within 60 days of Notice to Proceed, prepare a plan to minimize waste and divert construction and demolition debris from landfills and incinerators by facilitating their reuse or recycling. Name the waste material processors who will accept the construction and demolition debris, the condition of the construction and demolition debris required by the waste material processors, the method proposed to provide the construction and demolition debris in suitable condition and in a quantity acceptable to the disposal sites and waste material processors whom will receive them, and the impact on the project schedule.

B. Disposal Sites and Waste Material Processors: Use only facilities with valid legal permits for disposal, recycling and waste processing issued by the jurisdictions in which they are located.

C. Pre-Construction Waste Management Meeting: Prior to beginning site preparation, schedule and conduct a meeting to review the waste management plan. The meeting shall include the Contractor, the Architect, the LEED Consultant and any of the Contractor's subcontractors or suppliers whose work will interface with the program. The agenda shall include a discussion of procedures, schedules and specific requirements for construction and demolition debris, sale, reuse, recycling, and disposal. Make any revisions to the plan agreed to as a part of the meeting and submit the revised program and minutes to the Architect, Owner, and LEED Consultant for their records.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Provide covered containers for deposit of construction waste/recycling materials, debris, and rubbish.

PART 3 - EXECUTION

3.1 CLEANING

A. During construction, maintain buildings, premises and property free from waste materials and rubbish. Dispose of such waste and debris at reasonable intervals of the project property.

B. Maintain areas under Contractor’s control free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

C. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to closing the space.

D. Periodically clean interior areas to provide suitable conditions for work. Remove debris from areas of work on a daily basis at a minimum, or more often as required to provide suitable conditions for work.

E. Broom clean interior areas prior to start of surface finishing, and continue cleaning on an as needed basis.

F. Control cleaning operations so that dust and other particles will not adhere to wet of newly coated surfaces.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Do not burn or bury rubbish or waste materials on the project premises.

B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner, architect, and LEED Consultant.

C. General: For the duration of the project implement and maintain construction waste management plan. During the execution of the work encourage the practice of efficient waste reduction when sizing, cutting, and installing products and materials.

D. Transportation: Arrange for the regular collection, transport from the site, and delivery of the construction waste and debris to the designated recyclers, and waste material processors and disposal sites.

E. Separation Facilities: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at the appropriate stages of the Project. Provide and designate an on-site area for the separation of construction and demolition debris for reuse and recycling. Locate the area so that non-recyclable debris will not contaminate materials to be reused or recycled. Provide containers and bins in the designated area to facilitate separation, storage and handling which are clearly and appropriately marked. Cut all items to lengths and sizes to fit within the containers or bins provided. Where there is enough recyclable debris (for example, salvaged metal doors and frames or duct work), arrange for items to be bundled, banded or tied, and stack in a designated location for a special pick-up. Maintain the separation facilities in an orderly condition to prevent contamination of materials placed therein and to maximize reuse and recyclability of debris. Separate construction and demolition debris at the project site by Source Separation and/or Commingled Method.

3.3 HAZARDOUS WASTE

A. Separate hazardous waste. Store and dispose of according to local regulations.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Substantial Completion procedures.
   3. Final Completion procedures.
   4. List of incomplete items.
   5. Submittal of Project warranties.
   6. Final cleaning.

1.2 DEFINITIONS

A. List of Incomplete Items (Punch List): Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
    a. If Contractor prematurely submits a request for reinspection, and Architect determines that Project is not substantially complete after second inspection, Owner may charge the Contractor for the cost of additional inspections.

2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
   1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report.
   5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architectwill either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
      a. If Contractor prematurely submits a request for reinspection, and Architect determines that Project is not complete after second inspection, Owner may charge the Contractor for the cost of additional inspections.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems
   3. Submit list of incomplete items in the following format:
      a. PDF Electronic File: Architectwill return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
   1. Submit on digital media acceptable to Architect.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's recommendations.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's recommendations if visible soil or stains remain.
k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
l. Remove labels that are not permanent.
m. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
n. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils.
r. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
s. Clean strainers.
t. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully

E. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Emergency manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.
   6. O&M database.

B. Related Requirements:
   1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
      a. The Owner's Commissioning Authority will review the commissioned systems and equipment submittals for completeness and applicability, and verify that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The Commissioning Authority will communicate deficiencies to the Owner. Upon a successful review of the corrections, the Commissioning Authority will recommend approval and acceptance of these O&M manuals to the Owner.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Submit Operation and Maintenance (O&M) Data specifically applicable to this Contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. Compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 013300 "Submittal Procedures".
   1. Include systems manuals in the O&M data in accordance with ASHRAE Guideline 0-219, Informative Appendix O.

C. O&M Database: Develop a database from the O&M manuals that contains the information required to start a preventative maintenance program.

D. Format: Submit operation and maintenance manuals in the following format:
   1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.
   2. Documents shall be fully legible.

E. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

F. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
   1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

G. Changes to Submitals: Manufacturer-originated changes or revisions to submitted material shall be furnished if a component of an item is so affected subsequent to acceptance of the O&M Manuals. Submit changes, additions, and revisions for final acceptance of submitted material within 30 calendar days of the notification of this change requirement.

H. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Architect.
   7. Name and contact information for Commissioning Authority.
   8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation in accordance with to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

F. Product Submittal Data: Provide a copy of all Product Data submittals required in the applicable technical sections.

G. Manufacturer's Instructions: Provide a copy of all Manufacturer's Instructions submittals required in the applicable technical sections.

H. O&M Submittal Data: Provide a copy of all Operation and Maintenance Data submittals required in the applicable technical sections.

I. Operating Instructions: Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:
   1. Safety Precautions: List personnel hazards and equipment or product safety precautions for all operating conditions.
   2. Operator Prestart: Include procedures required to install, set up, and prepare each system for use.
   3. Startup, Shutdown, and Post-Shutdown Procedures: Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.
   4. Normal Operations:Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment

J. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
   1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
   2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
   3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
   1. Emergency Operations: Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

B. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

F. Operator Service Requirements: Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

G. Environmental Conditions: Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each equipment should not be allowed to run.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.
   4. Regulation and control procedures.
   5. Instructions on stopping.
   6. Normal shutdown instructions.
   7. Seasonal and weekend operating instructions.
   8. Required sequences for electric or electronic systems.
   9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
   1. Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
      a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.

4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

1. Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
2. List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.11 PREVENTIVE MAINTENANCE

A. Preventative Maintenance: Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

B. Lubrication Data: Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":
1. A table showing recommended lubricants for specific temperature ranges and applications.
2. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
3. A Lubrication Schedule showing service interval frequency.

C. Preventive Maintenance Plan and Schedule: Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufactures' specified frequency and procedures for each separate operation.

D. Corrective Maintenance (Repair): Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

E. Troubleshooting Guides and Diagnostic Techniques: Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

F. Wiring Diagrams and Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

G. Maintenance and Repair Procedures: Include instructions and a list of tools required to repair or restore the product, component or system. Describe conditions under which the item equipment should not be allowed to run.

H. Removal and Replacement Instructions: Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

I. Spare Parts and Supply Lists: Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

J. Corrective Maintenance Work-Hours: Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

K. Personnel Training Requirements: Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

L. Testing Equipment and Special Tool Information: Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

M. Testing and Performance Data: Include completed pre-functional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.

c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architectfor resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Format: Annotated PDF electronic file with comment function enabled.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.
1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect'sreference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.
   2. Demonstration and training video recordings.
   3. Additional requirements are indicated in technical specifications Sections for specific systems and equipment.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator, instructor, and videographer.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date of video recording.
   2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
   3. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.

c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Systems and equipment operation manuals.
   c. Systems and equipment maintenance manuals.
   d. Product maintenance manuals.
   e. Project Record Documents.
   f. Identification systems.
   g. Warranties and bonds.
   h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.

d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
   1. Submit video recordings by uploading to web-based Project software site.
   2. File Hierarchy: Organize folder structure and file locations in accordance with Project Manual table of contents. Provide complete screen-based menu.
   3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
   4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged in accordance with Project Manual table of contents:
      a. Name of Contractor/Installer.
      b. Business address.
      c. Business phone number.
      d. Point of contact.
      e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
   1. Film training session(s) in segments not to exceed 15 minutes.
      a. Produce segments to present a single significant piece of equipment per segment.
      b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
      c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
   1. Furnish additional portable lighting as required.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 018113 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C: Healthcare) Certification.
   1. Specific requirements for LEED are also included in other Sections.
   2. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
   3. A copy of the LEED Project scorecard is attached at the end of this Section for information only.
      a. Not all requirements for LEED prerequisites and credits targeted in the scorecard are identified in the specifications.
      b. The LEED scorecard indicates compliance under either v4 or v4.1 paths for each credit.
   4. Definitions included in the “LEED Version 4 for the Building Design and Construction” (LEED v4 BD+C) Reference Guide and online amendments apply to this Section.

B. Related Requirements:
   1. Section 01 32 33, “Photographic Documentation.”
   2. Section 01 33 00, “Submittal Procedures.”
   3. Section 01 50 00, “Temporary Facilities and Controls.”
   4. Section 01 57 31, “Indoor Air Quality Management.”
   5. Section 01 74 19, “Construction & Demolition Waste Management and Disposal.”
   6. Section 01 78 23, “Operation and Maintenance Data.”
   7. Section 01 91 13, “General Commissioning Requirements.”
   8. Divisions 02 through 48 may or may not include references to LEED.

1.3 DEFINITIONS

A. Adhesives and Sealants: The adhesives and sealants category includes all interior adhesives and sealants wet-applied on site and used inside the weather barrier.

B. Bio-Based Materials: Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials. For the purposes of LEED, this excludes leather and other animal hides.

C. CDPH Standard Method v1.2: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.2–2017, for the emissions testing and requirements of products and materials.

D. Ceilings: The ceilings category includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems (including canopies and clouds), and glazed skylights. Exclude overhead structural elements.

E. Certified Wood: Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products

F. Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stages of processing, transformation, manufacturing, and distribution.

G. Chain-of-Custody Certificates: Certificates signed by manufacturers and fabricators certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC Chain of Custody Standard 40-004.

H. Composite Wood: The composite wood category includes all particleboard, medium density fiberboard (both medium density and thin), hardwood plywood with veneer, composite or combination core, and wood structural panels or structural wood products. Exclude finished products that are covered by the flooring, ceiling, wall panels, or furniture categories.

I. Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer's product and the product's supply chain.

J. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.
   1. Product-Specific Declaration: A product with a publicly available, critically reviewed life- cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
   2. Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
   3. Product-Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicated recognized by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

K. Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life.

L. Flooring: The flooring category includes all types of hard and soft flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), raised flooring, wall base, underlayment, and other floor coverings. Exclude subflooring and wet-applied products applied on the floor.

M. Furniture: The furniture category includes all seating, desks and tables, filing/storage, free-standing cabinetry, workspaces, and furnishing items within the project scope.

N. Health Product Declaration Open Standard (HPD): A standard format for reporting product content and associated health information for building products and materials.

O. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National association (SMACNA) “IAQ Guidelines for Occupied Buildings Under Construction.”

P. Insulation: The insulation category includes all thermal and acoustic boards, batts, rolls, blankets, sound attenuation fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation. Exclude insulation for HVAC ducts and plumbing piping.

Q. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.

R. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

S. Materials Reuse: Reuse includes salvaged, refurbished, or reused products.

T. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.

U. Paints and Coatings: The paints and coatings category includes all interior paints and coatings wet-applied onsite and used inside the weather barrier.

V. Recycled Content: Recycled content is the sum of post-consumer recycled content plus one-half the pre-consumer recycled content, based on cost.
   1. "Post-consumer" material is defined as waste material generated by household or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
   2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

W. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site.

X. Sustainability Attributes Documentation: Product documentation that supports the achievement of the following LEED credits: Environmental Product Declarations, Sourcing of Raw Materials, Material Ingredients, and Low Emitting Materials credits.

Y. Volatile Organic Compounds (VOC) Emissions Evaluation: Refer to CDPH Standard Method v1.2 or later definition.

Z. Volatile Organic Compounds (VOC) Content Evaluation: Refer to CARB SCM, SCAQMD Rule 1113 and/or SCAQMD Rule 1168.

AA. Wall Panels: The wall panels category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, interior and exterior doors, wall frames, interior and

exterior windows, and window treatments. Exclude cabinetry and vertical structural elements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. The scope of this project includes an awarded LEED certification. Work is not complete until Owner has accepted USGBC's final review of LEED certification.

B. Provide materials and procedures necessary to obtain LEED prerequisites and credits required in this Section. Other Sections may specify requirements that contribute to LEED prerequisites and credits. Refer to other sections for additional materials and procedures necessary to obtain LEED prerequisites and credits.

C. Respond to questions and requests for additional information from Architect, LEED Consultant, and USGBC regarding LEED credits until USGBC until the final LEED Certification has been awarded.

D. LEED Kickoff Meeting: Schedule and conduct a meeting with the Owner, Architect, Owner's Commissioning Authority, and LEED Consultant within 30 days of Notice to Proceed.
   1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect; Contractor including superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting.
   2. Agenda: LEED goals for the project, Contractor's action plans, and discussion of targeted LEED Prerequisites and Credits.
   3. Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED Credits and timeline for execution.

1.5 ACTION SUBMITTALS

A. Construction and Demolition Waste Management: Comply with submittal requirements of Section 01 74 19 "Construction Waste Management and Disposal."

B. Indoor Air Quality: Comply with submittal requirements of Section 01 57 31, "Indoor Air Quality Management."

C. Plumbing Fixtures & Appliances: Submit plumbing fixtures and appliances for information only.

D. LEED Sustainability Attribute Documentation: Submit LEED Submittal Coversheet and sustainability attribute documentation in addition to all product data submittals required by other Specification Sections.
   1. General, LEED Submittal Coversheet: Project submittals must be accompanied by a completed LEED Submittal Coversheet. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the LEED Submittal Coversheet. The LEED Submittal Coversheet is provided at the end of this section.
      a. For each product in a submittal, provide the following information on the LEED Submittal Coversheet:
         1) Product manufacturer.
         2) Product name.
         3) Product cost.
         4) Product volume (wet applied products).
   2. As applicable, provide the following Sustainability Attribute Documents to verify claims made on the LEED Submittal Coversheet:

a. Environmental Product Declarations.
b. Product Life Cycle Assessment (LCA).
c. Embodied Carbon Optimization Reports or Action Plans.
d. Extended Producer Responsibility Policies.
e. Recycled Content.
f. Manufacturer Inventory.
g. Health Product Declarations.
h. Cradle to Cradle certifications.
i. Declare product labels.
j. Material Ingredient Optimization Action Plan.
k. Green Seal in compliance with GS-11.
l. Other material ingredient reporting documentation with reporting at 1000 ppm.
m. VOC Emissions evaluation in compliance with CDPH v1.2 (2017) or inherently non-emitting sources criteria for products in the following categories:
    1) Paints and Coatings
    2) Adhesives and Sealants
    3) Flooring
    4) Wall Panels
    5) Ceilings
    6) Insulation
    7) Furniture
    n. VOC Content evaluation for products in the following categories:
    1) Paints and Coatings
    2) Adhesives and Sealants

1.6 INFORMATIONAL SUBMITTALS

A. LEED Plan Components: Provide preliminary submittals indicating how the following requirements will be met:
    1. Waste Management Plan, complying with Section 01 74 19 “Construction Waste Management and Disposal.”
    2. Indoor Air Quality Management Plan, complying with Section 01 57 31, “Indoor Air Quality Management.”

B. Monthly LEED Reports: Provide monthly reports for the following:
    1. Waste reduction progress reports complying with Section 01 74 19 “Construction Waste Management and Disposal.”
    2. Indoor air quality, during construction photo report, complying with Section 01 57 31, “Indoor Air Quality Management.”
        a. Provide a minimum of six photos per month demonstrating compliant management strategies when applicable.
    3. Erosion and Sediment Control Photo report complying with Section 01 50 00, “Temporary Facilities and Controls.”
        a. Provide a minimum of six photos per month demonstrating compliant management strategies.

1.7 QUALITY ASSURANCE

A. Contractor and Subcontractor Qualifications: Contractors and subcontractors who are familiar, or who are willing to become familiar with LEED Green Building Rating System credit and documentation requirements and processes, and who will provide the required documentation for LEED credits.
   1. Preconstruction Meeting: After award of Contract and prior to commencement of Work, schedule and conduct meeting with COR/Architect/Engineer to discuss the Project Sustainable Action Plan content as it applies to submittals, project delivery, required Construction Indoor Air Quality (IAQ) Management Plan, and other Sustainability Certifications Project Requirements. The purpose of this meeting is to develop a mutual understanding of the Sustainability Certifications Project Requirements, the IHS A/E Design Guide Chapter 5 requirements, and coordination of contractor's management of these requirements with the COR/Architect/Engineer and the Construction Quality Manager.
   2. Construction Job Conferences: Status of compliance with Sustainability Certifications Project Requirements of these specifications will be an agenda item at regular job meetings conducted during (and after with specific items) the course of work at the site.

B. LEED Coordinator: Designate a LEED Coordinator on the construction team to serve as the Primary Point of Contact for the LEED Consultant and provide all required documentation.

C. LEED References
   1. Review and be familiar with the LEED BD+C for New Construction Reference Guide, 2013 Edition, which includes guidelines and tools for documentations LEED credits.
   2. Review and be familiar with the LEED 2013 for Healthcare: New Construction Reference Guide.
   3. Obtain and bring to the Pre-construction meeting the Contractor's copy of the above Reference Guides.
   4. Keep a copy of the LEED Green Building Rating System Reference Guides on site at all times.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated. Contractor to determine a combination of credit options best suited for achieving credits required.
   1. Furniture and Medical Furnishings: Ensure 40% by cost of all freestanding furniture and medical furnishings (e.g., mattresses, foams, panel fabrics, cubicle curtains, window coverings, other textiles), including built-in casework and built-in millwork meet at least one of the criteria outlined in Section 2.2 Materials & Resources.
   2. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.

2.2 MATERIALS & RESOURCES

A. Environmental Product Declarations (EPD): Option 1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the following disclosure criteria:
   1. Life-cycle Assessment
   2. Industry-wide Type III EPD
   3. Product-specific Type III EPD

B. Environmental Product Declarations (EPD): Option 2. Provide compliant Embodied Carbon Optimization Reports or Action Plans for 5 products from at least 3 different manufacturers that meet LEED requirements according to LEED embodied carbon disclosure requirements.

C. Sourcing of Raw Materials: Provide products that meet at least one of the responsible extraction criteria below for at least 30%, by cost, of the total value of permanently installed building products in the project:
   1. Extended Producer Responsibility
   2. Bio-Based Materials
   3. Certified Wood
   4. Materials Reuse
   5. Recycled Content
   6. Materials Reuse.

D. Material Ingredients: Option 1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000ppm):
   1. Manufacturer Inventory.
   2. Health Product Declarations (HPDs).
   3. Cradle to Cradle (C2C) certifications.
   4. Declare product labels.
   5. FACTS
   6. Product Lens

E. Material Ingredients: Option 2. Provide Material Ingredient Optimization Reports or Action Plans for 5 products from at least 3 different manufacturers that comply with LEED requirements, including but not limited to the following:
   1. Action Plan.
   2. Manufacturer Inventory that is third party verified.
   3. Health Product Declaration that is third party verified.
   4. Cradle to Cradle certifications at Bronze level or higher.
   5. Declare labels designated as Red List Free.
   6. Green Seal in compliance with GS-11.

2.3 LOW-EMITTING MATERIALS

A. Low-Emitting Materials, General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.2-2017 or later, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.2 as follows:
   1. 0.5 mg/m3 or less,

2. Between 0.5 and 5.0 mg/m3 or,
3. 5.0 mg/m3 or more.

B. Low-Emitting Materials, Paints and Coatings: For field applications use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

Product Type	Allowable VOC Content (g/L)
Bond breakers	350
Colorant - Architectural coatings, excluding IM coatings	50
Colorant - Solvent-based IM	600
Colorant - Waterborne IM	50
Concrete - Curing compounds	100
Concrete - Curing compounds for roadways and bridges	350
Concrete surface retarder	50
Driveway sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100
Faux finishing coatings - Decorative coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings - Trowel applied coatings	50
Fire-proofing coatings	150
Flats	50
Floor coatings	50
Form release compound	100
Graphic arts (sign) coatings	200
Industrial maintenance coatings	100
Industrial maintenance coatings - color indicating saftey coatings	480
Industrial maintenance coatings - High temperature IM coatings	420
Industrial maintenance coatings - Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings - Zinc-rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-Color coatings	250
Nonflat coatings	50

Pre-treatment wash primers	420
Primers, sealers, and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Sacrificial anti-graffiti coatings	50
Shellac - Clear	730
Shellac - Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Stone consolidants	450
Swimming pool coatings - Repair	340
Swimming pool coatings - Other	340
Tile and stone sealers	100
Traffic coatings	100
Tub and tile refinish coatings	420
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood coatings - varnish	275
Wood coatings - sanding sealers	275
Wood coatings - lacquer	275
Wood conditioners	100
Wood preservatives	350
Low solids coatings	120

C. Low-Emitting Materials, Adhesives and Sealants: For field applications use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1168, effective October 6, 2017.

Product Type	Allowable VOC Content (g/L)
Building envelope membrane adhesive	250
Carpet pad adhesives	50
Ceramic glass, porcelain, & stone tile adhesive	65
Cove base adhesives	50

Dry wall and panel adhesives	50
Multi-purpose construction adhesives	70
Roofing- single ply roof membrane adhesive	250
Roofing- all other roof adhesives	250
Rubber floor adhesives	60
Structural glazing adhesives	100
Structural wood member adhesive	140
Subfloor adhesive	50
VCT and asphalt tile adhesives	50
Wood flooring adhesive	100
All other indoor floor covering adhesives	50
All other outdoor floor covering adhesives	50
Computer diskette manufacturing adhesive	350
Contact adhesive	80
Edge glue adhesive	250
ABS welding cement	325
ABS to PVC transition cement	510
CPVC welding cement	490
PVC welding cement	510
All other plastic cement welding cements	100
Rubber Vulcanization Adhesive	250
Special purpose contact adhesive	250
Thin metal laminating adhesive	780
Tire tread adhesive	100
Top and trim adhesive	250
Waterproof resorcinol glue	170
All other adhesives	250
Metal substrate-specific adhesives	30
Plastic foam substrate-specific adhesives	50
Porous material (except wood) substrate-specific adhesives	50
Wood substrate-specific adhesives	30

Fiberglass substrate-specific adhesives	80
Reinforced plastic composite substrate-specific adhesives	200
Clear, paintable, and immediately water-resistant sealant	250
Foam insulation	250
Grout	250
Roadway sealant	250
Non-staining plumbing putty	250
Potable water sealant	250
Roofing - single ply roof membrane sealant	450
Roofing - all other roof sealants	300
All other architectural sealants	50
Marine deck sealant	760
All other sealants	420
Plastic adhesive primers	550
Pressure sensitive adhesive primers	250
Traffic marking tape adhesive primers	150
Vehicle glass adhesive primers	250
All other adhesive primers	250
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
All other sealant primers	750

D. Low-Emitting Materials, Flooring: Flooring shall comply with the requirements of the California Department of Public Health, (CDPH), Standard Method v1.2-2017 or later, using the applicable exposure scenario.

E. Low-Emitting Materials, Wall Panels: Wall panels including all finish wall treatments, wall paneling, wall tile, surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments shall comply with California Department of Public Health, (CDPH), Standard Method v1.2-2017 or later, using the applicable exposure scenario.

F. Low-Emitting Materials, Ceilings: Ceilings including ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems including canopies and

clouds, and glazed skylights shall comply with California Department of Public Health, (CDPH), Standard Method v1.2-2017 or later, using the applicable exposure scenario.

G. Low-Emitting Materials, Insulation: Insulation including all thermal and acoustic boards, batts, rolls, blankets, sound attenuation fire blankets, foamed in place, loose fill, blown, and sprayed insulation shall comply with California Department of Public Health, (CDPH), Standard Method v1.2-2017 or later, using the applicable exposure scenario.

H. Low-Emitting Materials, Composite Wood: Composite wood, agrifiber products and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emission from Composite Wood Products" in compliance with one of the following programs:
   1. Certified as ultra-low-emitting formaldehyde (ULEF) product under EPA Toxic Substances Control Act, Formaldehyde Emission Standards for Composite Wood Products (TSCA, Title VI) (EPA TSCA Title VI)or California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM)
   2. Certified as no added formaldehyde resins (NAF) product under EPA TSCA Title VI or CARB ATCM
   3. Wood structural panel manufactured according to PS 1-09 or PS 2-10 (or one of the standards considered by CARB to be equivalent to PS 1 or PS 2) and labeled bond classification Exposure 1 or Exterior
   4. Structural wood product manufactured according to ASTM D 5456 (for structural composite lumber), ANSI A190.1 (for glued laminated timber), ASTM D 5055 (for I-joists), ANSI PRG 320 (for cross laminated timber), or PS 20-15 (for finger jointed lumber).

Category	Emissions Compliance	VOC Content Compliance
Paints and Coatings	75% by volume or surface area	100%
Adhesives and Sealants	75% by volume or surface area	100%
Flooring	90% by cost or surface area	N/A
Wall Panels	75% by cost or surface area	N/A
Ceilings	90% by cost or surface area	N/A
Insulation	75% by cost or surface area	N/A
Furniture	75% by cost	N/A
Composite Wood	75% by cost or surface area	N/A

I. Additional Low-Emitting Requirements:
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; ISO 11890-2.

3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

2.4 PBT SOURCE REDUCTION

A. Mercury, General: To the greatest extent possible procure and install LED lights. Applicable mercury-containing products and devices include, but are not limited to lamps and dental waste.
   1. Specify and install amalgam separation devices that meet or exceed the ISO-11143 standard. Comply with the mercury elimination requirements outlined below, from the 2010 FGI Guidelines for Design and Construction of Health Care Facilities, Section A1.3- 4b, Mercury Elimination.
      a. 4.2.1.1. New construction: Do not procure mercury-containing equipment, including thermostats, switching devices, and other building system sources. Lamps are excluded.
   2. Do not procure or install preheat, T-9, T-10, or T-12 fluorescents or mercury vapor high-intensity discharge (HID) lamps
   3. Do not procure or install probe-start metal halide HID lamps in any interior spaces.
   4. Procure and install illuminated exit signs that do not contain mercury and use less than 5 watts of electricity.

B. Lead, General: Procure and install materials manufactured with lead to the following standards:
   1. For water intended for human consumption, use solder and flux to connect plumbing pipe on site that meets the California AB1953 standard, which specifies that solder not contain more than 0.2% lead, and flux not more than a weighted average of 0.25% lead for wetted surfaces.
   2. For water intended for human consumption, use pipes, pipe fittings, plumbing fittings, and faucets that meet the California law AB1953 of a weighted average lead content of the wetted surface area of not more than 0.25% lead.
   3. Use lead-free roofing and flashing.
   4. Use electrical wire and cable with lead content less than 300 parts per million.
   5. Do not use interior or exterior paints containing lead.

C. Cadmium, General: Do not use interior or exterior paints containing intentionally added cadmium.

D. Copper, General: For copper pipe applications, reduce or eliminate joint-related sources of copper corrosion through either mechanically crimped copper joint systems or ensure all solder joints comply with ASTM B828 200 and use ASTM B813 2010 for flux.

2.5 PERFORMANCE CRITERIA

A. EPA WaterSense Labeled: Materials, products and equipment being installed which fall into a category covered by the WaterSense program must be WaterSense-labeled or meet or exceed WaterSense program performance requirements, unless disallowed for infection control reasons.
   1. Bathroom faucets.
   2. Commercial toilets.
   3. Irrigation controllers.
   4. Pre-rinse spray valves.
   5. Residential toilets.
   6. Showerheads.

7. Spray sprinkler bodies.
8. Urinals.

B. EPA Energy Star Labeled: Materials, products and equipment being installed which fall into any product category covered by the Energy Star program must be Energy Star-labeled.
1. Appliances
2. Electronics and Information Technology
3. Food Service Equipment (Commercial)
4. Heating and Cooling Equipment
5. Other
a. Decorative string lights.
b. Electric vehicle supply equipment.
c. Laboratory-grade refrigerators and freezers.
d. Light bulbs.
e. Light fixtures.
f. Pool pumps.
g. Roof products.
h. Water coolers.
i. Windows, doors, and skylights.

PART 3 - EXECUTION

3.1 EROSION & SEDIMENT CONTROL

A. Construction Activity Pollution Prevention: Comply with Section 01 50 00 “Temporary Facilities and Controls” and Section 01 57 13 “Temporary Erosion and Sediment Controls”.

3.2 NON-SMOKING BUILDING

A. Environmental Tobacco Smoke Control: Smoking is not permitted within the building or on the property.
1. Refer to Section 01 57 31, “Indoor Air Quality Management.”

3.3 CONSTRUCTION WASTE MANAGEMENT

A. Construction and Demolition Waste Management: Comply with Section 01 74 19 “Construction Waste Management and Disposal.”

3.4 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Construction Indoor Air Quality Management Plan: Comply with Section 01 57 31, “Indoor Air Quality Management.”

END OF SECTION

SECTION 018900 - SITE CONSTRUCTION PERFORMANCE REQUIREMENTS

1.1 WMAT STANDARDS

A. This Section and its attachments are part of the Contract Documents. They are not authored by SmithGroup:

1. MODIFIED TECHNICAL PROVISIONS #10, 2023 WMAT IDIQ (EA 17-23)

2. WMAT MODIFIED TECHNICAL DETAILS

END OF SECTION

INCORPORATED INTO THE CONTRACT

MODIFIED TECHNICAL PROVISIONS #10
2023 WMAT IDIQ (EA 17-23)

Previous 2022 EA 20-22
2021 IDIQ EA 28-21
2020 IDIQ EA 17-20
2019 IDIQ EA 02-19

SECTION 04 WATER TRANSMISSION & DISTRIBUTION MAIN

A. Technical Provisions 4 Section (TP-04.06 SETTING BLOW-OFF HYDRANT ASSEMBLIES AND VAULTS)

(REFLECTED IN Change Order #19)

See the following ***Updates*** to section **TP-04.06 SETTING BLOW-OFF HYDRANT ASSEMBLIES AND VAULTS**:

TP - 04.06 SETTING BLOW-OFF HYDRANT/***FLUSHING*** ASSEMBLIES AND VAULTS:

Blow-off hydrants ***(Flushing Assemblies)*** shall be installed in accordance with the manufacturer's printed specifications and instructions. The vault shall be installed in accordance with the applicable sections of TP-01.

A. ***Below Grade Blow-Off Hydrant and Vault***

1. General:

a) The hydrant shall meet the requirements of TP 04.03.H.

b) Install blow-off hydrants and auxiliary gate valves at the locations indicated on the plans and as shown on the detail drawing.

c) Utility marker shall be installed as shown on the detail drawing and in accordance with TP-01.

d) The hydrant and auxiliary gate valve shall be tested upon completion.

e) The portable discharge riser shall be constructed per TP 04.03.H.2 and shall be provided to the Owner.

2. Auxiliary Gate Valve and Valve Box:

a) The auxiliary gate valve and valve box shall be installed in accordance with TP 04.07. The concrete collar around the auxiliary gate valve and valve box shall be installed in accordance with TP 04.07.C and the drawings.

b) The auxiliary gate valve and valve box shall be located adjacent to the blow-off hydrant per the detail.

c) The pipe length and material type between the blow-off hydrant and the auxiliary gate valve and between the auxiliary gate valve and the water main shall be as designated on the plans and details.

d) Fully restraint joints between the water main tee and the auxiliary gate valve, and between the auxiliary gate valve and the blow-off hydrant.

e) Under no condition shall the diameter of the auxiliary pipe and auxiliary gate valve be less than 4-inches for blow-off hydrants. The pipe and auxiliary valve size shall match that of the blow-off hydrant inlet, as shown on the drawings.

f) Tracer wire and tracer wire access box shall be installed in accordance with the detail drawing and the provisions of TP 01.

g) Rip rap consisting of a minimum 4-inch to 6-inch angular diameter shall be compacted around concrete collar. The rip rap shall be placed around the collar at the required distance and thickness provided in applicable detail. Filter fabric shall be installed between rip rap and native soil as shown in details.

3. Installing Blow-off Hydrant:

a) Blow-off Hydrants shall stand plumb and shall have their nozzles pointed vertically upwards. The hydrant shall be set centered within the concrete vault.

b) Hydrant shall be restrained to the auxiliary pipe according to the manufacturer's recommendation. Contractor shall provide the required bolts, nuts and gaskets for the mechanical joint connection (MJ DI Transition Accessory Pack with Gland) and shall torque the bolts according to manufacturer's recommendation.

c) The hydrants shall be set so that the top of the discharge riser is 12-inches max from the top of the vault cover.

d) The hydrant interior shall be free of all dirt or foreign matter before installation.

4. Hydrant Base:

a) Set hydrant on compacted gravel base and on solid concrete blocks as shown in the detail drawing.

b) A gravel seepage area (drain pit) shall be provided around the weep hole near the hydrant. Gravel shall be installed as per the detail drawing.

c) A suitable concrete thrust block shall be constructed at the base of the hydrant in accordance with the detail drawings. Once the hydrant is set, concrete shall be poured against undisturbed earth in such a manner that the weep hole is kept free from all concrete or mortar. If the weep hole is covered either partially or wholly, the hydrant shall be cleaned in place and the gravel and concrete removed and replaced with new gravel and concrete.

d) Filter fabric shall be placed 4-inches below the top of the gravel drain pit as shown on the detail drawing.

5. Setting Vault:

a) Vault shall be set plumb and level on solid concrete masonry blocks and gravel base as shown on the detail drawings. Gravel from the drain pit shall extend into the vault to the depth shown in the detail.

b) Penetrations in the vault walls (if depicted in the plans) shall be made as shown in the detail drawings. All vault penetrations shall be sealed with approved grout material.

c) Backfill shall be placed and compacted around the vault. The vault shall be maintained plumb during backfilling and compaction.

6. Concrete Collar:

a) After installing the concrete vault, the Contractor shall compact the area around the vault prior to installing the concrete collar to ensure that there is no settlement.

b) A 6-inch wide by 6–inch thick (minimum) reinforced circular concrete pad shall be poured around the blow-off vault as shown on the plan and detail drawings or instructed by the Owner or Owner's Representative.

c) The concrete collar shall have a minimum slope of 1/12 away from the vault.

d) The cast iron frame and cover shall be anchored to the concrete collar and installed per the manufacturer's recommendations. The base of the frame shall be set 2-inches above finished grade.

e) Rip rap consisting of a minimum 4-inch to 6-inch angular diameter shall be compacted around concrete collar. The rip rap shall be placed around the collar at the required distance and thickness provided in applicable detail. Filter fabric shall be installed between rip rap and native soil as shown in details.

7. Drain Pipe:

a) The drain pipe shall only be installed if depicted on the plans (where the vault can drain to daylight).

b) The drain pipe shall be constructed to the alignment and length shown on the plans. The drain pipe shall be constructed as shown in the detail drawings.

c) Excavation, backfilling and compaction for the installation of the drain pipe shall meet the requirement of TP 01.

d) The inlet invert of the drain pipe shall be set at the top of the gravel in the vault. The drain pipe inlet edge shall be flush with the interior wall of the vault.

e) The outlet shall be screened per the detail drawings. The outlet screen shall be secured to the end of the drain pipe using the appropriate ductile iron fittings specified in TP 04.03.H.5. The outlet screen shall be wire brushed, sprayed with rust neutralizer and then coated with epoxy paint to protect the screen against corrosion.

f) Rip rap shall be installed for erosion protection around the drain pipe outlet.

B. ***Above Grade Flushing Assembly***

1. General:

a) The flushing assembly shall meet the requirements of Detail Drawing WMAT 4D-3 Modified 2-inch Flushing Assembly.

b) 2-inch Flushing Assembly shall only be installed on 2-inch water mains.

c) 4-inch Flushing Assembly can be installed on 4-inch thru 12-inch water mains, or as shown on the design drawings.

d) Flushing assemblies typically installed next to wells, at water main/system dead ends, water system ends, locations for strategic flushing, etc.

a) Install flushing assembly, including auxiliary piping and auxiliary gate valve at the locations indicated on the plans and as shown on the detail drawing.

b) Location and orientation of flush outlet to installed as shown in the plan drawings or as determined in the field by Owner or Owners Representative. Avoid flooding areas and erosion. Obtain approval of discharge location from Tribal Utility.

e) Utility markers and bollards shall be installed as shown on the detail drawings and in accordance with TP-01. Concrete shall be in accordance with TP 02. Locations and quantity shall be in accordance with the plans or as directed in the field by the Owner.

f) The flushing assembly and auxiliary gate valve (flush valve) shall be tested upon completion.

2. Auxiliary Piping and Auxiliary Gate Valve (Flush Valve):

a) The pipe length and material type between the water main and the auxiliary gate valve (auxiliary pipe) and between the auxiliary gate valve and the 45 degree elbow (flush line pipe) shall be as designated on the plans and details.

b) The pipe length of the auxiliary pipe and the flush line pipe shall be a minimum of 3ft or as shown in the design drawings.

c) All joints, from the water main tee/saddle to the auxiliary gate valve and to the flushing assembly, shall be fully restrained.

d) The auxiliary gate valve and valve box shall be installed in accordance with TP 04.07. The concrete collar around the auxiliary gate valve and valve box shall be installed in accordance with TP 04.07.C and the drawings.

e) The auxiliary gate valve shall be anchored and restrained with rebar and concrete, over the concrete block.

f) Tracer wire access box and tracer wire shall only be installed if shown on the plan drawings and shall be installed in accordance with the detail drawing and the provisions of TP 01.07.A.2.

3. Installing Flushing Assembly:

a) Flushing Assembly shall be constructed of galvanized iron schedule 40 for 2-inch flushing assemblies, as shown on the detail drawings.

b) All buried galvanized iron pipe shall be thoroughly wrapped in 10 mil pipe wrap tape.

c) The flush piping shall have a 45 degree GI fitting that directs the flush piping above ground at a 45 degree angle. (angled flush piping)

d) The 45 degree GI fitting shall have a weep hole drilled into the outer (bottom) face of the fitting as shown on the detail drawings. The weep hole shall be 1/8" for the 2-inch flushing assembly. Under no circumstances should the weep hole be covered or obstructed from flow by polywrap, polytape, concrete, etc.

e) A min of 18 cubic feet of gravel seepage area (drain pit) shall be provided around the weep hole near the hydrant. Extend filter rock of drain pit on 18-inches of either side of pipe. The size of the gravel and the dimensions of the drain pit shall be installed in accordance with the respective detail drawings.

f) For the 2-inch Flushing Assembly, the 2-inch GI angled flush piping shall extend 2.5 feet long (minimum) above ground. The piping shall have a threaded end to attach a threaded end cap to seal the outlet. A 1/8" vent hole shall be drilled into the 2-inch GI cap.

g) For the 2-inch Flush Valve Assembly, a 1.5 cubic foot concrete thrust block shall be placed on the 2-inch 45 degree angled flush piping, at half way between the elbow and the ground surface, as shown on the detail drawing.

h) All flush piping exposed above ground shall be painted with a BLUE epoxy paint. The paint shall extend about 6-inches below grade. All flush assembly outlet fittings shall also be painted BLUE.

4. <u>Concrete Collar & Gravel Pad</u>:

a) After installing the angled flush piping, the Contractor shall compact the area around the piping prior to installing the concrete collar to ensure that there is no settlement.

b) A 2-feet by 2-feet by 4–inch thick (minimum) reinforced rectangular concrete collar (radially scored at each corner) shall be poured around the flush piping as shown on the plan and detail drawings.

c) The concrete collar shall slope down 1-inch from the pipe to the edge of the collar.

d) A 4-feet by 4-feet by 4-inch gravel pad shall be placed around the concrete collar and flush piping, laid out in accordance with the detail drawings. Weed barrier filter fabric shall be placed under the gravel pad.

e) Up to (4) bollards shall be installed around the flush piping. The layout and number of bollards shall follow the orientation shown on the detail drawings or as directed by the Owner or Owners. Bollards shall be installed in accordance with TP 01.07.B.2.

5. <u>Measurement & Payment</u>:

a) <u>2-inch Flushing Assembly</u>: This bid item shall include all items past the auxiliary gate valve (flush valve) which includes - the 2" galvanized iron schedule 40 flush piping, 45° GI elbow with weep hole, 2" GI threaded end piping, drain pit, thrust block, 2" GI cap, concrete collar, gravel cover and utility markers.

b) The interconection tie-in to the existing/new water main with thrust blocking, bollards, 2" SDR21 PVC auxilary piping and 2" gate valve and valve box shall be paid for separately and individually, in accordance with previous approved bid prices for these respective items.

INCORPORATED INTO THE CONTRACT

MODIFIED TECHNICAL PROVISIONS #9
2022 WMAT IDIQ (EA 20-22)

Previous 2021 IDIQ EA 28-21
2020 IDIQ EA 17-20
2019 IDIQ EA 02-19

SECTION 04 WATER TRANSMISSION & DISTRIBUTION MAIN

A. Technical Provisions 4 Section (TP-04.06 SETTING BLOW-OFF HYDRANT ASSEMBLIES AND VAULTS)

(REFLECTED IN Change Order #20)

See the following ***Updates*** to section **TP-04.06 SETTING BLOW-OFF HYDRANT ASSEMBLIES AND VAULTS**:

TP - 04.06 SETTING BLOW-OFF HYDRANT/***FLUSHING*** ASSEMBLIES AND VAULTS:

Blow-off hydrants ***(Flushing Assemblies)*** shall be installed in accordance with the manufacturer's printed specifications and instructions. The vault shall be installed in accordance with the applicable sections of TP-01.

A. ***Below Grade Blow-Off Hydrant and Vault***

1. General:

a) The hydrant shall meet the requirements of TP 04.03.H.

b) Install blow-off hydrants and auxiliary gate valves at the locations indicated on the plans and as shown on the detail drawing.

c) Utility marker shall be installed as shown on the detail drawing and in accordance with TP-01.

d) The hydrant and auxiliary gate valve shall be tested upon completion.

e) The portable discharge riser shall be constructed per TP 04.03.H.2 and shall be provided to the Owner.

2. Auxiliary Gate Valve and Valve Box:

a) The auxiliary gate valve and valve box shall be installed in accordance with TP 04.07. The concrete collar around the auxiliary gate valve and valve box shall be installed in accordance with TP 04.07.C and the drawings.

b) The auxiliary gate valve and valve box shall be located adjacent to the blow-off hydrant per the detail.

c) The pipe length and material type between the blow-off hydrant and the auxiliary gate valve and between the auxiliary gate valve and the water main shall be as designated on the plans and details.

d) Fully restraint joints between the water main tee and the auxiliary gate valve, and between the auxiliary gate valve and the blow-off hydrant.

e) Under no condition shall the diameter of the auxiliary pipe and auxiliary gate valve be less than 4-inches for blow-off hydrants. The pipe and auxiliary valve size shall match that of the blow-off hydrant inlet, as shown on the drawings.

f) Tracer wire and tracer wire access box shall be installed in accordance with the detail drawing and the provisions of TP 01.

g) Rip rap consisting of a minimum 4-inch to 6-inch angular diameter shall be compacted around concrete collar. The rip rap shall be placed around the collar at the required distance and thickness provided in applicable detail. Filter fabric shall be installed between rip rap and native soil as shown in details.

3. Installing Blow-off Hydrant:

a) Blow-off Hydrants shall stand plumb and shall have their nozzles pointed vertically upwards. The hydrant shall be set centered within the concrete vault.

b) Hydrant shall be restrained to the auxiliary pipe according to the manufacturer's recommendation. Contractor shall provide the required bolts, nuts and gaskets for the mechanical joint connection (MJ DI Transition Accessory Pack with Gland) and shall torque the bolts according to manufacturer's recommendation.

c) The hydrants shall be set so that the top of the discharge riser is 12-inches max from the top of the vault cover.

d) The hydrant interior shall be free of all dirt or foreign matter before installation.

4. Hydrant Base:

a) Set hydrant on compacted gravel base and on solid concrete blocks as shown in the detail drawing.

b) A gravel seepage area (drain pit) shall be provided around the weep hole near the hydrant. Gravel shall be installed as per the detail drawing.

c) A suitable concrete thrust block shall be constructed at the base of the hydrant in accordance with the detail drawings. Once the hydrant is set, concrete shall be poured against undisturbed earth in such a manner that the weep hole is kept free from all concrete or mortar. If the weep hole is covered either partially or wholly, the hydrant shall be cleaned in place and the gravel and concrete removed and replaced with new gravel and concrete.

d) Filter fabric shall be placed 4-inches below the top of the gravel drain pit as shown on the detail drawing.

5. Setting Vault:

a) Vault shall be set plumb and level on solid concrete masonry blocks and gravel base as shown on the detail drawings. Gravel from the drain pit shall extend into the vault to the depth shown in the detail.

b) Penetrations in the vault walls (if depicted in the plans) shall be made as shown in the detail drawings. All vault penetrations shall be sealed with approved grout material.

c) Backfill shall be placed and compacted around the vault. The vault shall be maintained plumb during backfilling and compaction.

INCORPORATED INTO THE CONTRACT

6. Concrete Collar:

a) After installing the concrete vault, the Contractor shall compact the area around the vault prior to installing the concrete collar to ensure that there is no settlement.

b) A 6-inch wide by 6–inch thick (minimum) reinforced circular concrete pad shall be poured around the blow-off vault as shown on the plan and detail drawings or instructed by the Owner or Owner's Representative.

c) The concrete collar shall have a minimum slope of 1/12 away from the vault.

d) The cast iron frame and cover shall be anchored to the concrete collar and installed per the manufacturer's recommendations. The base of the frame shall be set 2-inches above finished grade.

e) Rip rap consisting of a minimum 4-inch to 6-inch angular diameter shall be compacted around concrete collar. The rip rap shall be placed around the collar at the required distance and thickness provided in applicable detail. Filter fabric shall be installed between rip rap and native soil as shown in details.

7. Drain Pipe:

a) The drain pipe shall only be installed if depicted on the plans (where the vault can drain to daylight).

b) The drain pipe shall be constructed to the alignment and length shown on the plans. The drain pipe shall be constructed as shown in the detail drawings.

c) Excavation, backfilling and compaction for the installation of the drain pipe shall meet the requirement of TP 01.

d) The inlet invert of the drain pipe shall be set at the top of the gravel in the vault. The drain pipe inlet edge shall be flush with the interior wall of the vault.

e) The outlet shall be screened per the detail drawings. The outlet screen shall be secured to the end of the drain pipe using the appropriate ductile iron fittings specified in TP 04.03.H.5. The outlet screen shall be wire brushed, sprayed with rust neutralizer and then coated with epoxy paint to protect the screen against corrosion.

f) Rip rap shall be installed for erosion protection around the drain pipe outlet.

INCORPORATED INTO THE CONTRACT

B. ***Above Grade Blow-Off Hydrant***

1. ***General:***

   a) ***2-inch Flushing Assembly shall only be installed on 2-inch water mains.***

   b) ***4-inch Flushing Assembly can be installed on 4-inch thru 12-inch water mains, or as shown on the design drawings.***

   c) ***Under no condition shall the diameter of the auxiliary pipe and auxiliary gate valve be less than 2-inches, for 2-inch Flushing Assemblies or less than 4-inches, for 4-inch Flushing Assemblies***

   d) ***Flushing assemblies are typically installed near wells, at water main/system dead ends, water system ends, locations for strategic flushing, etc.***

   a) ***Install flushing assembly, including auxiliary piping and auxiliary gate valve at the locations indicated on the plans and as shown on the detail drawing.***

   b) ***Location and orientation of outlet nozzle(s) to be installed as shown in the plan drawings or as determined in the field by Owner or Owners Representative.***

   c) ***Avoid flooding areas and avoid causing erosion. Obtain approval of flush water discharge location from Tribal Utility. Use erosion protection measures as needed, such as concrete splash pads or gravel.***

   e) ***Utility markers and bollards shall be installed as shown on the detail drawings and in accordance with TP-01. Concrete shall be in accordance with TP 02.***

   f) ***The flushing assembly and auxiliary gate valve shall be tested for operation, pressure and leaks upon completion.***

2. ***Post Flush Hydrant:***

   a) ***The Post Flush Hydrant shall meet the requirements of Detail Drawing WMAT 4D-2 Flush Post Hydrant Assembly.***

   b) ***The Flush Post Hydrant shall be a Kupferle #2 Eclipse Post Hydrant or approved equal.***

   c) ***The post hydrant shall be self-draining and non-freezing.***

   d) ***The portions of the flush hydrant in contact with water shall either be composed of corrosion resistant materials and/or shall be protected against corrosion, including the internal and external portions of the stand pipe.***

   e) ***All working parts shall be serviceable from above ground with no digging or replacement needed.***

   f) ***The depth of bury shall be 3 feet. (below frost line)***

   g) ***The inlet shall be a 2" FIP or 2" MJ inlet and shall use non-corrosive fittings as needed to be compatible to connect to 2" corrosion resistant metallic pipe, such as brass or galvanized iron. (as shown on the drawings)***

   h) ***The outlet shall have either one or two nozzles, as shown on the drawings. The outlet nozzles shall be 2.5" NST.***

i) The top stock shall have a Single Nozzle. The nozzle shall be compatible with standard fire hydrant accessories. (i.e. hoses, adapter, gauges, diffusers, etc.)

j) The operating rod shall be made of stainless steel pipe.

k) The flush hydrant shall have a vandal proof mechanism, if shown on the drawings.

3. Auxiliary Piping and Auxiliary Gate Valve:

a) The pipe length and material type between the water main and the auxiliary gate valve (auxiliary pipe) and between the auxiliary gate valve and the flush hydrant (flush line pipe) shall be as designated on the plans and details.

b) The auxiliary pipe shall be 2" SDR 21 PVC. The pipe shall use solvent weld Schedule 80 type fittings to secure watertight between the pipe and all connections.

c) The flush line pipe shall be 2" high pressure rated corrosion resistant metallic pipe such as brass or galvanized iron. The pipe shall be factory threaded MIP to thread into the FIP of the hydrant and gate valve. The connections shall be secure watertight.

d) The pipe length of the auxiliary pipe and the flush line pipe shall be a minimum of 3ft or as shown in the design drawings.

e) The auxiliary piping and gate valve shall be buried below the frost line at 3ft deep.

f) All joints, from the water main tee/saddle to the auxiliary gate valve and to the flush hydrant, shall be fully restrained, and thrust blocked, if shown on the drawings.

g) The auxiliary gate valve and valve box shall be installed in accordance with TP 04.07. The concrete collar around the auxiliary gate valve and valve box shall be installed in accordance with TP 04.07.C and the drawings.

h) Tracer wire access box and tracer wire shall only be installed if shown on the plan drawings and shall be installed in accordance with the detail drawing and the provisions of TP 01.07.A.2.

i) Warning tape shall be installed in accordance with TP 01.

4. Installing Post Flush Hydrant:

a) The post flush hydrant shall be installed in accordance with the manufacturer's recommendation.

b) The flush hydrant shall be installed at the locations shown on the drawings or staked in the field, as instructed by the Owner.

c) The inlet valve body of the flush hydrant shall be buried below the frost line at 3ft deep.

l) The flush hydrant shall be set in 4 cubic feet of crushed stone (¾" to 2") to allow for proper drainage of the hydrant.

d) Concrete blocks shall be used to set, level and stabilize the flush hydrant, as shown on the drawings.

e) The stand pipe shall be set plumb and level.

f) The base of the Top Stock shall be set at final grade.

g) The outlet nozzle shall be oriented toward the concrete splash pad as shown on the drawings or as directed in the field by the Owner.

h) A min of 4 cubic feet of gravel seepage area (drain pit) shall be provided around the weep hole near the hydrant. The size of the gravel and the dimensions of the drain pit shall be installed in accordance with the respective detail drawings.

5. ***Concrete Collar & Concrete Splash Pad:***

a) After installing the flush hydrant, the Contractor shall compact the area around the hydrant stand pipe prior to installing the concrete collar, to ensure that there is no settlement.

b) A 2-feet by 2-feet by 4–inch thick (minimum) reinforced rectangular concrete collar (radially scored at each corner) shall be poured around the flush hydrant stand pipe, as shown on the plan and detail drawings.

c) The concrete collar shall slope down 1-inch from the pipe to the edge of the collar.

d) A Concrete Splash Pad shall also be constructed as shown in the drawings. The Contractor shall compact the area of the splash pad to ensure that there is no settlement.

e) The concrete pad shall be 4ft x 10ft x 4in and shall be reinforced with a 6x6 wire steel mesh or steel rebar. Control joints shall be installed every 5ft. The surface of the pad shall be sloped away from the flush hydrant to allow for proper drainage.

f) Bollards shall be installed around the flush hydrant, if shown on the drawings. The layout and number of bollards shall follow the orientation shown on the detail drawings or as directed by the Owner or Owners. Bollards shall be installed in accordance with TP 01.07.B.2.

6. ***Measurement & Payment:***

a) Post Flush Hydrant: This bid item shall include the materials, equipment and labor necessary to install the flush hydrant. This shall include the assembly and installation of the flush hydrant including excavation, crushed stone, concrete blocks, leveling, compaction and concrete collar.

b) Other Items: The interconnection tie-in to the existing/new water main with thrust blocking, 2" Brass flush line piping, 2" SDR21 PVC auxiliary piping, 2" gate valve and valve box, bollards and concrete splash pads shall be paid for separately and individually, in accordance with previous approved bid prices for these respective items.

INCORPORATED INTO THE CONTRACT

MODIFIED TECHNICAL PROVISIONS #8
2022 WMAT IDIQ (EA 20-22)

Previous 2021 IDIQ EA 28-21
2020 IDIQ EA 17-20
2019 IDIQ EA 02-19

SECTION 04 WATER TRANSMISSION & DISTRIBUTION MAIN

A. Technical Provisions 4 Section (TP-04.03.O. Well Electrical Utility Service)

(REFLECTED IN Change Order #19)

Add New section **P. Well Head Concrete Pad** after Section O. Well Electrical Utility Service:

P. Well Head Concrete Pad: A concrete pad shall be set around the well head (pitless unit upper casing). Contractor shall provide all labor, tools, equipment & materials necessary to install the Well Head Concrete Pad at both New Corduroy Wells, CRD 20-1 Upper Corduroy and CRD 20-2 Community Well, at the location shown on the design drawings and/or as agreed upon in the field with the Owner or Owner's Representative. This item shall include the installation of all items including: concrete, steel reinforcement, corrosion protection, etc. in accordance with the Pitless Unit and Well Head Detail Drawing, and all contract technical provisions related to excavation and concrete.

1. ***After the pitless unit has been installed and all work electrical work has been completed, a 36-inch diameter by 6-inch thick reinforced, concrete pad shall be constructed around the pitless unit upper casing.***
2. ***The concrete pad shall be set so that the concrete surface is a minimum of 18" from the top of upper casing of pitless unit.***
3. ***The area around the well shall be graded and compacted, and sloped to drain water away from the well.***
4. ***The concrete pad shall be circular spanning 36 inches from edge of steel casing to the edge of concrete.***
5. ***The concrete pad shall be reinforced with No. 4 rebar, 12-inches O.C.E.W, centered on the pitless unit.***
6. ***The concrete shall be poured around the well casing pitless unit and the electrical conduits.***
7. ***The concrete pad surface shall have a 2% slope away from the pitless unit.***
8. ***The pitless unit outer casing and electrical conduit shall be wrapped with 20 mil PVC wrap tape (or other approved corrosion protection) before the concrete pad is poured to protect the piping from direct contact with the concrete.***
9. ***Concrete and steel reinforcement shall meet the requirements of T02.***

INCORPORATED INTO THE CONTRACT

B. Technical Provisions 4 Section (TP-04.03.P. Well Head Concrete Pad)

(REFLECTED IN Change Order #19)

Add New section **Q. Temporary Well Control Panel** after Section P. Well Head Concrete Pad:

Q. Temporary Well Control Panel: A temporary well control panel shall be set up for a shallow low producing well. Contractor shall provide all labor, tools, equipment & materials necessary to install the Temporary Control Panel at the CRD 20-2 Community Well, at the location shown on the design drawings and/or as agreed upon in the field with the Owner or Owner's Representative. This item shall include the installation of the Main Circuit Breaker, Pump Power Cable, Pump Power Cable Conduit, Pressure Transducer Signal Cable Conduit and Junction Boxes. This also includes moving the Pump Well Control Box & Pump Saver to the Panel Rack for CRD 20-2 Community Well, in accordance with Detail Drawing 4J Well Control Panel.

1. General

a) The Main Circuit Breaker, Pump Well Control Box and Pump Saver Box shall be set up, wired and tested in accordance with the manufacturer's recommendations

b) Any gaps or holes in panels shall be sealed, as needed, with duct seal putty compound that is non-toxic, non-corrosive and non-staining.

2. Conduit

a) (2) different electrical conduits (pump power cable & transducer signal cable) shall be installed from the well head to the Well Control Panel, as shown in the drawings.

b) The (2) conduits shall be attached to (2) standard compatible electrical junction boxes, just below the well cap, as shown in the drawings.

c) The conduit for the pump power cable shall be 2" conduit and shall be installed 18" below grade. No other wires, other than the pump power cable, shall be placed in this conduit.

d) A 1" conduit shall also be installed for a future well pressure transducer signal cable. Pull tape (fish string) shall be left installed in this conduit for future pulling of the transducer cable.

e) All above ground conduit shall be rigid metal conduit. Any buried rigid metal conduit shall be wrapped in 20 mil PVC tape. All buried conduit shall be rigid PVC conduit.

f) An 18" horizontal separation distance shall be maintained between the 2" conduit (pump power cable) and the 1" conduit (pressure transducer signal cable). All bends in conduit shall be wide sweep.

g) Warning tape shall be placed above each conduit.

INCORPORATED INTO
THE CONTRACT

3. *Main Circuit Breaker*

   a) *The Main Circuit Breaker shall be installed in Pump & Controls Panel, as shown in Detail Drawing 4J Well Control Panel and the supporting drawings.*

   b) *It shall be anchored securely to the welded wire mesh of the Panel Rack (Control Panel Support Structure).*

   c) *The Main Circuit Breaker shall be an Eaton Cutler EHD 3060, or approved equal.*

4. *Pump Well Control Box & the Pump Saver Box*

   a) *The Pump Well Control Box & the Pump Saver Box shall be moved from their current location, next to the well head, and into the Pump & Controls Panel on the Panel Rack Support Structure, as shown in Detail Drawing 4J.*

   b) *Both of these boxes shall be anchored securely, preserving the NEMA rating integrity of the Pump & Controls Panel*

R. *42" x 30" Control Panel: Contractor shall provide all labor, tools, equipment & materials necessary to install a 42" x 30" Control Panel (Pump & Controls Panel), at the location shown on the design drawings or as agreed upon in the field with the Owner or Owner's Representative.*

1. *General*

   a) *This Pump & Controls Panel shall be installed next to the Circuit Breaker Panel, as shown on the design drawings and shall be anchored securely, preserving the NEMA rating integrity of the Pump & Controls Panel.*

   b) *This Pump & Controls Panel shall be Pentair A42R3012HCR, or approved equal.*

   c) *This item shall be installed in accordance with the Delivery Order, Design Drawings, Electrical Details and Local, National and NEC Electrical Codes.*

   d) *All materials shall be installed in accordance with the manufacturer's recommendations.*

   e) *All contract requirements from the original EA 02-19 IDIQ contract and current EA 20-22 IDIQ contract, relating to materials, installation and inspection, apply, as applicable, to this bid item*

S. *SPD Level 1 Surge Protector: Contractor shall provide all labor, tools, equipment & materials necessary to install an SPD Level 1 Surge Protector, at the locations shown on the design drawings or as agreed upon in the field with the Owner or Owner's Representative. This SPD Level 1 Surge Protector shall be installed in the Electrical Meter Panel, as shown in the Detail Drawing. This SPD Level 1 Surge Protector shall be a Delta LA303, or approved equal.*

T. *SPD Level 2 Surge Protector: Contractor shall provide all labor, tools, equipment & materials necessary to install an SPD Level 2 Surge Protector, at the locations shown on the design drawings or as agreed upon in the field with the Owner or Owner's Representative. This SPD Level 2 Surge Protector shall be installed in the Circuit Breaker Panel, as shown in the Detail Drawing. This SPD Level 2 Surge Protector shall be a D QO2175SB, or approved equal.*

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MODIFIED TECHNICAL PROVISIONS #7
2019 WMAT IDIQ (EA 02-19)
2021 WMAT IDIQ (EA 28-21)
2022 WMAT IDIQ (EA 20-22)

SECTION 04 WATER TRANSMISSION & DISTRIBUTION MAIN

A. Technical Provisions 4 Section (TP-04.03.N. Well Meter & Vault)

(REFLECTED IN Change Order #13 & Change Order #17)

See the following ***Updates*** to section **N. Well Water Meter & Vault**:

N. Well Water Meter & Vault: The well water meter shall be a Krohne Waterflux 3000 electromagnetic flow sensor/meter. The meter package shall also include the Krohne IFC 100 Signal Converter for electromagnetic flow meters and the related power/signal cable, or approved equal.

1. Meter & Signal Converter

a) The water meter, signal converter and power/signal cable shall all be installed in accordance with the manufacturer's recommendation and shall only be installed at the locations shown on the design drawings or as specified in the field by the Owner.

b) Typically, the water meter size shall be either 3-inch or 4-inch or as shown in the design drawings.

c) Water meter cabling shall be sized to have sufficient slack between the meter location in the meter vault and the signal converter location in the control panel. All excess cabling shall be coiled up and zip-tied/taped inside of the vault, off to the side, so it does not get stepped on or damaged.

d) Install copper grounding rod for meter, adjacent to vault, per N.E.C. The penetrations of the ground rod through the vault need to be properly sealed and grouted.

e) Ground rod shall be copper bonded end threaded rod with a high carbon steel core and tip. The ground rod shall be coated for corrosion protection. (1) 5/8" diameter 8ft long ground rod shall be driven vertically and completely into the ground, next to the meter vault, per local electric code. If the 8ft rod can't be driven vertically, then it can be driven at an angle (not more than 45 degrees), but the ground rod shall not be cut.

f) The ground wire from the meter shall be connected to this ground rod. The ground wire shall be formed/positioned along the vault floor and wall, away from ingress/egress. Ground wire shall be solid bare copper wire and shall be a mimimum size of 4 AWG, per local electric code.

g) Electrical conduit shall be installed from the meter vault to the control panel box, which will house the signal converter. The meter cabling shall be routed through the electrical conduit.

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h) Electrical conduit shall be rigid, non-metallic, water tight, heat and corrosion resistant, Schedule 40 PVC, appropriate for running electrical wiring above and below ground.
i) This shall also include the proper end seal connections between the electrical conduit and the vault wall/control panel box. These connections shall be water proof seals.
j) Cord grips shall be installed as needed to provide a water-tight seal where the cabling connects with the meter and with the signal converter.

2. Control Panel Box

a) The control panel box shall be a wall mounted enclosure, NEMA Type 4 outdoor rating, with a single door.
b) Material construction shall be 14 gauge carbon steel, type 304/316 stainless steel or equal.
c) Door shall be secured with heavy duty continuous hinge pin and stainless steel clamps. The door shall have a padlocking hasp and staple.
d) The control panel box shall be a Millbank Type 4 Wall Mount Enclosure, ***Austin NEMA 4 Single Door Enclosure,*** or approved equal.
e) The control panel box shall be properly anchored to the existing well control/power panel Unistrut frame, at the location shown on the design drawings or as specified in the field by the Owner or Owner's Representative.
f) Unitstruts shall be used, as needed. Unistruts shall be installed per the manufacturer's recommendation.
g) The control panel box shall have fabricated welded brackets to anchor directly to unistrut braces. DO NOT DRILL HOLES in NEMA rated Control Panel Boxes. This may negate the NEMA rating. If approved to drill holes by Owner, then ensure that water proof seals / rubber gasketed washers are used at penetrations.
h) Water tight seals shall be used, as needed, at the connection points between the signal converter and the control panel box and also between the control panel box and the unistruts.
i) The signal converter shall be installed inside of the control panel box to allow for ease of access to the signal converter and the wiring to the converter.
j) TUA will provide new padlocks for the new control panel boxes.

3. Vault

a) Vault shall be composed of precast steel reinforced concrete and shall have a 28-day compressive strength of at least 3,000 psi.
b) The vault shall be watertight and be constructed of precast, reinforced concrete of sufficient strength to withstand hauling and handling stresses, and shall meet all state and local regulations for the state and localities for which it is installed.
c) Concrete shall conform to Section 02 of the Technical Provisions and reinforcing steel shall conform to Section 03 of the Technical Provisions.
d) Grout for jointing shall be as specified in Section 02 of the Technical Provisions.
e) Chipped and honey combed vaults shall not be approved and will be rejected if delivered and installed. The vault shall be free of excessive cracking. Cracks in the concrete which, in the opinion of the Owner or Owner's Representative could lead to

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leakage and/or premature failure, shall be sealed by the Contractor, at no extra cost, using approved materials. Vaults with cracks visible on both sides or cracks where metal or synthetic fiber reinforcement is visible, shall be rejected.

f) The vault shall typically be 84” long by 54” high by 48” wide, or as shown on the design drawings.
g) The wall thickness shall be a minimum of 6” thick.
h) The joints between the base and top sections shall be sealed with “Ram Nek” bituminous rope type sealer, or equal.
i) The depth of the vault from interior floor to the underside of the access hatch shall not exceed 48 inches, in order to avoid confined space requirements.
j) The vault base shall be sloped 1/8” per foot (3/4” total from end to end), toward drain outlet end of vault.
k) A small, aluminum ladder shall be provided, in the vault to facilitate ingress/egress for the water operators, without stepping on any of the piping, meter, valves or other appurtenances. ***Securely anchor the base of the ladder to the floor, to restrict movement, as needed.***
l) Fill in any anchor holes left in concrete vault with waterproof silicone.
m) Utility marker shall conform to Section 01 of the Technical Provisions.

4. Vault Access Door

a) The access door shall be made of aluminum or other approved non-corrodible metal and shall have a minimum load rating of 300 lbs. per square foot.
b) The dimensions shall be 36" x 72", full top opening, per the design drawings.
c) The access door shall have a non-corrosive lifting handle and a padlock bar.
d) The access door shall have an auto lock hold open arm with a release handle.
e) The hinges and hardware shall be 316 stainless steel.
f) The access door shall be cast into the concrete vault lid with the hinges on the vault side farthest from the water main pipe.
g) The frame edge for the vault lid shall be coated with bituminous coating where in contact with the concrete vault for proper sealing.
h) The underside of the lid shall be insulated in cold climates, as shown on the design plans or directed by the Owner or Owner’s Representative.
i) The insulation can be field installed or can be factory installed by the manufacturer.
j) Field installed insulation shall be completed using 2-inch polystyrene insulation board with appropriate compatible adhesive or an approved securing mechanism, as directed by the Owner’s Representative.
k) Galvanized/non-corrosive wire shall be used to anchor the insulation board to the underside of the vault lid (3 strands minimum). Drill holes on inside metal edge/lip of the vault lid, as needed.
l) The vault access door shall be a Halliday Series S1R3672 Access Door, or approved equal.

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5. Vault Penetrations
    a) Wall penetrations shall be pre-cast into the vault walls as shown on the design drawings.
    b) These penetrations shall match the location, distances and sizes shown on the design drawings.
    c) The penetrations shall be sleeved with an appropriately sized pvc pipe sleeve.
    d) These wall penetrations shall be for the water main piping, the ARV vent tubing, meter cable/electrical conduit and the drain line.
    e) A drain line penetration shall be cast into both ends of the concrete vault. Unused outlet shall be plugged.
    f) All connections between piping and vault walls (around penetrations) shall be sealed with non-shrinking grout.

6. Vault Installation
    a) The vault shall be installed at the location and elevation shown in the plans and detail drawings.
    b) Install vault in accordance with the manufacturer's recommendations.
    c) Excavation shall be the minimum required to provide proper bedding and placement of the vault to the established elevations.
    d) Prior to setting the vault, all rocks and other foreign material which might damage the vault upon placement, shall be removed from the excavation.
    e) The Contractor shall set the vault on a 6-inch thick, minimum, bed of sand or gravel to facilitate leveling the vault. The base bedding shall be compacted to 95% Modified Proctor Density
    f) The base bedding shall present a smooth, uniform and level surface.
    g) Prior to backfilling, the vault elevation shall be checked at all corners to assure that placement is level and is set at the appropriate depth.
    h) Backfill in 12 inch layers and thoroughly compact in a manner that will not produce undue strain on the vault.
    i) Final grade shall be a minimum of 8" below the top of the vault. (i.e. Top of vault needs to be kept at a minimum of 8" above existing ground to protect against surface runoff) or higher, as determined in the field by the Owner and Owner's Representative.
    j) Slope final grade away from vault for proper drainage.
    k) If groundwater is present, dewater in accordance with TP 01, as needed.
    l) All work in setting the vault shall be done under dry conditions.

7. Drain Line ***to Daylight***
    a) The drain pipe shall only be installed if depicted on the plans (where the vault can drain to daylight).
    b) The drain pipe shall be 4-inch PVC SDR 35 pipe.
    c) The pipe material shall transition to a 4-inch ductile iron pipe at the outlet end (10-foot minimum length) and where bury depth is less than 1-foot.

d) The drain pipe shall be constructed to the alignment and length shown on the plans or as directed in the field by the Owner or Owner's Representative.
e) The drain pipe shall be constructed as shown in the detail drawings.
f) Excavation, backfilling and compaction for the installation of the drain pipe shall meet the requirement of Technical Provision Section 01.
g) Warning tape shall be installed in accordance with Technical Provision Section 01.
h) The inlet invert of the drain pipe shall be set at the base of vault floor (to existing drain outlet penetration in the vault).
i) The drain pipe shall have a proper, water-tight connection to the selected drain outlet penetration on the vault wall.
j) The other unused drain outlet shall be plugged/grouted.
k) The drain pipe inlet edge shall be flush with the interior wall of the vault.
l) The outlet penetration shall be screened at the inlet to the drain pipe from the vault and at the exit of the drain pipe, where it drains to daylight.
m) The outlet screen shall be secured to the end of the drain pipe using the appropriate ductile iron fittings (Vault Drain End Assembly).
n) Install #8 steel mesh at outlet end anchored with a 4-inch DI uni-flange adapter, MJ gland pack, MJ gasket and T-head bolts as the Vault Drain End Assembly.
o) The outlet screen shall be wire brushed, sprayed with rust neutralizer and then coated with epoxy paint to protect the screen against corrosion.
p) Support vault drain assembly and end of DI drain pipe with proper compaction.
q) Rip rap shall be installed for erosion protection around the drain pipe outlet and Vault Drain End Assembly.

8. ***Gravel Drain Pit: A gravel drain pit shall be constructed to drain vault when the vault can not be drained by gravity to daylight (due to flat surrounding natural ground or other ground terrain reasons, or as specified by the Owner or Owner's Representative). The gravel drain pit shall be constructed at the locations shown on the construction plans.***

a) The drain pit shall be constructed in accordance with Detail 4I (WMAT) Water Meter Vault.
b) The gravel used shall be clean and of size 1" to 1.5". The total volume shall be a minimum of 25 cf.
c) The drain pit shall be placed at a minimum of 10ft from the edge of the vault and/or at the locations shown on the construction plans.
d) Filter fabric shall be installed above the gravel, before it is backfilled.
e) The drain pipe to the gravel drain pit shall be 4-inch SDR 35 PVC and shall be sloped at a minimum of 1%.
f) If a backwater valve is specified in the construction plans, the valve shall meet the requirements of Detail 7D WMAT SSL Backwater Valve and Technical Provisions #3 for a Backwater Valve.

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9. Internal & External Piping & Restraints
   a) All internal and external water main (well supply line) piping shall be ductile iron pipe ***and shall be restrained***. ***The pipe and restraints*** shall meet the requirements of Technical Provision Section 04.
   b) All ductile iron ***restrained*** pipe shall be installed and secured in accordance with the manufacturer's recommendations.
   c) All mechanical joint restraints shall meet the requirements of Technical Provision Section 04.
   d) A Romac Alpha mechanical joint restraint shall be used in the interior piping to properly install and restrain all interior piping components.
   e) Pipe supports shall be used, as needed, to properly support the piping and appurtenances inside of the vault.
   f) Pipe supports shall be corrosion resistant and properly sized for the diameter of water main piping and required height support. Include hex adjustment nut and set screws for safety.
   g) Restrained DIP ~~flanged~~ adapters shall be used to connect to well supply piping on the outside of the vault, as per the design drawings.
   h) 45 degree DIP elbows shall be used on each side of the vault, as needed, to keep vault a minimum of 8" above final grade, as per the design drawings.
   i) Owner's Representative shall verify adequate pipe ***joint*** restraint (***and*** thrust block) for existing and new pipe, both on inlet and outlet sides of the vault.

9. Valves: ***Torque all bolts to manufacturer's recommendations***.
   a) Check Valve
      i. Shall be a swing check or flexible disc check valve with a 250 psi maximum working pressure rating.
      ii. The size shall match the size of the water main piping in the meter vault.
      iii. The body and the cover shall be ductile iron and shall have an epoxy coated interior and exterior for corrosion resistance.
      iv. Shall be certified ANSI/NSF 61
      v. Shall allow for horizontal installation
      vi. Shall be a Mueller flexible disc Model 851A, Flowmatic 745, or approved equal.
   b) Plug Valve
      i. The size shall match the size of the water main piping in the meter vault.
      ii. The body and the cover shall be ductile iron and shall have an epoxy coated interior and exterior for corrosion resistance.
      iii. Shall be certified ANSI/NSF 61
      i. Shall be a Val-Matic 5600R Full Port (FLxFL) with wormgear handle, or approved equal
   c) Air Release Valve
      i. No pipe, valve or fitting on the inlet or outlet line shall be smaller than the ARV inlet or outlet.
      ii. Flexible tubing, matching the size of the discharge end of the ARV, shall be used from the ARV to the union, before the wall penetration.

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iii. ½" galvanized pipe shall be used from the union, through the wall penetration, through the ground and above grade, with a screened end.
iv. The outlet end of the air relief discharge line shall be a minimum of 12" above final grade, or as shown on the design drawings.
v. Shall be certified ANSI/NSF 61
vi. Shall be an ARI D-040***-C (heavy duty cast iron)***, 1" diameter, or approved equal.

10. Sample Tee Assembly, Sample Tap, Pressure Gauge
    a) All components shall be certified ANSI/NSF 61.
    b) ¾" or 1" saddle shall be used to connect the sample tee assembly to the water main piping.
    c) ¾" or 1" brass cross or (2) tees shall be used for the tee assembly
    d) ¾" or 1" brass ball valve shall be used for isolating the tee.
    e) Sample tap shall be ¾" brass, non-threaded, ¼ turn boiler drain valve.
    f) A 4" pressure gauge, with individual psi readings, shall be installed. ***Pressure gauge shall be fluid filled with 5psi gradations.***

11. Testing
    a) Pressure Testing: All water main connection joints, ~~flanges~~, valves and appurtenances shall be pressure tested in accordance with Technical Provisions Section 04. Any observed leaks shall be corrected immediately.
    b) ***Disinfection and Flushing: All water main connection joints, valves and appurtenances shall be disinfected and flushed in accordance with Technical Provisions Section 04. A plan will need to developed, in conjunction and with approval from the tribal utility, to determine how to properly flush and dispose of disinfected water, for this piping and per specific site.***
    c) ***Install upstream and downstream corporation stops/saddles and gate valves, outside meter vault, as needed, to isolate meter and piping and to complete pressure testing, disinfection and flushing according to TP 04.***
    d) Signal converter shall be tested to ensure that it is accurately displaying output data such as flow, velocity, temperature, conductivity, etc.
    e) Control panel box door shall be tested to ensure is closes, seals and locks correctly.
    f) ARV shall be tested for air flow.
    g) Pressure gauge shall be tested to ensure that it is accurately displaying pressure data.
    h) Sample tap shall be tested to ensure flow and pressure for future water sampling.
    i) Plug valve shall be throttled to ensure that it is able to throttle flow.
    j) Access hatch shall be tested to ensure it opens, closes and locks correctly.
    k) Floor drain and drain line shall be tested with some water to ensure positive drainage from the floor of the vault to the drain line outlet.
    l) Tracer wire shall be tested in accordance with TP 01.
    m) Any tested items found to be deficient, shall be corrected at the contractor's expense.
    n) Provide gate valve key, tracer wire box, marker post and carsonite markers, as needed, per specific site/project.

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B. Technical Provisions 4 Section (TP-04.03.N. Well Meter & Vault)

(REFLECTED IN Change Order #17)

Add New section **O. Well Electrical Utility Service** after Section N. Well Water Meter & Vault:

O. Well Electrical Utility Service: An electrical utility service shall be constructed to provide electrical utility power to a constructed production well. The extended power to the well site shall be constructed as either overhead or underground electrical power, as shown on the construction plans. The electrical utility service shall be constructed at the locations shown on the construction plans. All materials, installation methods and clearances, for this electrical utility service shall be in accordance with Local Code (Navopache Electric Cooperative) (Nav EC) and the National Electric Code (NEC).

1. Electrical Service Drop Meter/Service Pole (OH Power)

a) The meter/service pole shall meet the requirements of the Nav EC Overhead Service specifications as shown in the Addendum.
b) The full length of the meter pole shall be manufactured of pressure treated wood or steel, in accordance with the Nav EC Overhead Service specification.
c) The meter pole shall be a minimum of 25ft long and shall be buried a minimum of 5ft and shall be stamped with code, year, species, class and height.
d) The meter pole shall be backfilled and compacted around the base of the pole, according to required specifications.
e) The meter pole shall include all required conductors, wiring, conduit, hardware and grounding including: weather head, service mast conduit, pipe strap supports, ground wire, ground rod, etc
f) The ground wire shall be #4 copper ground wire and the ground rod shall be 5/8" copper weld ground rod.
g) A minimum of 18ft of clearance shall be provided to the lowest point of the service drop sag to allow for passage of heavy equipment and trucks.
h) The meter pole and all components shall be approved by Nav EC.
i) All work shall be completed for Nav EC to complete the service drop connection to the weather head.

2. Electrical Service Meter Panel (Main Disconnect)

a) The meter panel shall meet the requirements of the Nav EC Overhead Service specifications as shown in the Addendum
b) The meter panel shall provide for single phase, 120/240 Volt, 100 Amps (minimum) power and shall have a test block by-pass.
c) The meter panel shall be installed at the specified height as shown in the Nav EC Overhead Service specifications, so that the meter is between 4ft and 6.25ft high.
j) The panel shall house the NEC electric meter and shall be approved by NEC.
k) All work shall be completed for Nav EC to install utility meter inside of the meter panel.

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MODIFIED TECHNICAL PROVISIONS #6
2019 WMAT IDIQ (EA 02-19)
2021 WMAT IDIQ (EA 28-21)

SECTION 04 WATER TRANSMISSION & DISTRIBUTION MAIN

A. Technical Provisions 4 Section (TP-04.03.M Fire Hydrants)

(REFLECTED IN Change Order #13)

Add New section **N. Well Water Meter & Vault** after Section M. Fire Hydrants:

N. Well Water Meter & Vault: The well water meter shall be a *Krohne Waterflux 3000* electromagnetic flow sensor/meter. The meter package shall also include the *Krohne IFC 100 Signal Converter* for electromagnetic flow meters and the related power/signal cable, or approved equal.

1. ***Meter & Signal Converter***
   - ***a) The water meter, signal converter and power/signal cable shall all be installed in accordance with the manufacturer's recommendation and shall only be installed at the locations shown on the design drawings or as specified in the field by the Owner.***
   - ***b) Typically, the water meter size shall be either 3-inch or 4-inch or as shown in the design drawings.***
   - ***c) Water meter cabling shall be sized to have sufficient slack between the meter location in the meter vault and the signal converter location in the control panel. All excess cabling shall be coiled up and zip-tied/taped inside of the vault, off to the side, so it does not get stepped on or damaged.***
   - ***d) Install copper grounding rod for meter, adjacent to vault, per N.E.C. The penetrations of the ground rod through the vault need to be properly sealed and grouted.***
   - ***e) Electrical conduit shall be installed from the meter vault to the control panel box, which will house the signal converter. The meter cabling shall be routed through the electrical conduit.***
   - ***f) Electrical conduit shall be rigid, non-metallic, water tight, heat and corrosion resistant, Schedule 40 PVC, appropriate for running electrical wiring above and below ground.***
   - ***g) This shall also include the proper end seal connections between the electrical conduit and the vault wall/control panel box. These connections shall be water proof seals.***
   - ***h) Cord grips shall be installed as needed to provide a water-tight seal where the cabling connects with the meter and with the signal converter.***

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2. Control Panel Box

- ***a) The control panel box shall be a wall mounted enclosure, NEMA Type 4 outdoor rating, with a single door.***
- ***b) Material construction shall be 14 gauge carbon steel, type 304/316 stainless steel or equal.***
- ***c) Door shall be secured with heavy duty continuous hinge pin and stainless steel clamps. The door shall have a padlocking hasp and staple.***
- ***d) The control panel box shall be a Millbank Type 4 Wall Mount Enclosure, or approved equal.***
- ***e) The control panel box shall be properly anchored to the existing well control/power panel Unistrut frame, at the location shown on the design drawings or as specified in the field by the Owner or Owner's Representative.***
- ***f) Unitstruts shall be used, as needed. Unistruts shall be installed per the manufacturer's recommendation.***
- ***g) The signal converter shall be installed inside of the control panel box to allow for ease of access to the signal converter and the wiring to the converter.***
- ***h) Water tight seals shall be used, as needed, at the connection points between the signal converter and the control panel box and also between the control panel box and the unistruts.***
- ***i) TUA will provide new padlocks for the new control panel boxes.***

3. Vault

- ***a) Vault shall be composed of precast steel reinforced concrete and shall have a 28-day compressive strength of at least 3,000 psi.***
- ***b) The vault shall be watertight and be constructed of precast, reinforced concrete of sufficient strength to withstand hauling and handling stresses, and shall meet all state and local regulations for the state and localities for which it is installed.***
- ***c) Concrete shall conform to Section 02 of the Technical Provisions and reinforcing steel shall conform to Section 03 of the Technical Provisions.***
- ***d) Grout for jointing shall be as specified in Section 02 of the Technical Provisions.***
- ***e) Chipped and honey combed vaults shall not be approved and will be rejected if delivered and installed. The vault shall be free of excessive cracking. Cracks in the concrete which, in the opinion of the Owner or Owner's Representative could lead to leakage and/or premature failure, shall be sealed by the Contractor, at no extra cost, using approved materials. Vaults with cracks visible on both sides or cracks where metal or synthetic fiber reinforcement is visible, shall be rejected.***
- ***f) The vault shall typically be 84" long by 54" high by 48" wide, or as shown on the design drawings.***
- ***g) The wall thickness shall be a minimum of 6" thick.***
- ***h) The joints between the base and top sections shall be sealed with "Ram Nek" bituminous rope type sealer, or equal.***
- ***i) The depth of the vault from interior floor to the underside of the access hatch shall not exceed 48 inches, in order to avoid confined space requirements.***
- ***j) The vault base shall be sloped 1/8" per foot (3/4" total from end to end), toward drain outlet end of vault.***

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k) A small, aluminum ladder shall be provided, in the vault to facilitate ingress/egress for the water operators, without stepping on any of the piping, meter, valves or other appurtenances.

l) Utility marker shall conform to Section 01 of the Technical Provisions.

4. <u>Vault Access Door</u>

a) The access door shall be made of aluminum or other approved non-corrodible metal and shall have a minimum load rating of 300 lbs. per square foot.

b) The dimensions shall be 36" x 72", full top opening, per the design drawings.

c) The access door shall have a non-corrosive lifting handle and a padlock bar.

d) The access door shall have an auto lock hold open arm with a release handle.

e) The hinges and hardware shall be 316 stainless steel.

f) The access door shall be cast into the concrete vault lid with the hinges on the vault side farthest from the water main pipe.

g) The frame edge for the vault lid shall be coated with bituminous coating where in contact with the concrete vault for proper sealing.

h) The underside of the lid shall be insulated in cold climates, as shown on the design plans or directed by the Owner or Owner's Representative.

i) The insulation can be field installed or can be factory installed by the manufacturer.

j) Field installed insulation shall be completed using 2-inch polystyrene insulation board with appropriate compatible adhesive or an approved securing mechanism, as directed by the Owner's Representative

k) The vault access door shall be a Halliday Series S1R3672 Access Door, or approved equal.

5. <u>Vault Penetrations</u>

a) Wall penetrations shall be pre-cast into the vault walls as shown on the design drawings.

b) These penetrations shall match the location, distances and sizes shown on the design drawings.

c) The penetrations shall be sleeved with an appropriately sized pvc pipe sleeve.

d) These wall penetrations shall be for the water main piping, the ARV vent tubing, meter cable/electrical conduit and the drain line.

e) A drain line penetration shall be cast into both ends of the concrete vault. Unused outlet shall be plugged.

f) All connections between piping and vault walls (around penetrations) shall be sealed with non-shrinking grout.

6. <u>Vault Installation</u>

a) The vault shall be installed at the location and elevation shown in the plans and detail drawings.

b) Install vault in accordance with the manufacturer's recommendations.

c) *Excavation shall be the minimum required to provide proper bedding and placement of the vault to the established elevations.*
d) *Prior to setting the vault, all rocks and other foreign material which might damage the vault upon placement, shall be removed from the excavation.*
e) *The Contractor shall set the vault on a 6-inch thick, minimum, bed of sand or gravel to facilitate leveling the vault. The base bedding shall be compacted to 95% Modified Proctor Density*
f) *The base bedding shall present a smooth, uniform and level surface.*
g) *Prior to backfilling, the vault elevation shall be checked at all corners to assure that placement is level and is set at the appropriate depth.*
h) *Backfill in 12 inch layers and thoroughly compact in a manner that will not produce undue strain on the vault.*
i) *Final grade shall be a minimum of 8" below the top of the vault. (i.e. Top of vault needs to be kept at a minimum of 8" above existing ground to protect against surface runoff) or higher, as determined in the field by the Owner and Owner's Representative.*
j) *Slope final grade away from vault for proper drainage.*
k) *If groundwater is present, dewater in accordance with TP 01, as needed.*
l) *All work in setting the vault shall be done under dry conditions.*

7. <u>Drain Line</u>

a) *The drain pipe shall only be installed if depicted on the plans (where the vault can drain to daylight).*
b) *The drain pipe shall be 4-inch PVC SDR 35 pipe.*
c) *The pipe material shall transition to a 4-inch ductile iron pipe at the outlet end (10-foot minimum length) and where bury depth is less than 1-foot.*
d) *The drain pipe shall be constructed to the alignment and length shown on the plans or as directed in the field by the Owner or Owner's Representative.*
e) *The drain pipe shall be constructed as shown in the detail drawings.*
f) *Excavation, backfilling and compaction for the installation of the drain pipe shall meet the requirement of Technical Provision Section 01.*
g) *Warning tape shall be installed in accordance with Technical Provision Section 01.*
h) *The inlet invert of the drain pipe shall be set at the base of vault floor (to existing drain outlet penetration in the vault).*
i) *The drain pipe shall have a proper, water-tight connection to the selected drain outlet penetration on the vault wall.*
j) *The other unused drain outlet shall be plugged/grouted.*
k) *The drain pipe inlet edge shall be flush with the interior wall of the vault.*
l) *The outlet penetration shall be screened at the inlet to the drain pipe from the vault and at the exit of the drain pipe, where it drains to daylight.*
m) *The outlet screen shall be secured to the end of the drain pipe using the appropriate ductile iron fittings (vault drain end assembly).*
n) *Install #8 steel mesh at outlet end anchored with a 4-inch DI uni-flange adapter, MJ gland pack, MJ gasket and T-head bolts as the vault drain end assembly.*

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o) *The outlet screen shall be wire brushed, sprayed with rust neutralizer and then coated with epoxy paint to protect the screen against corrosion.*
p) *Support vault drain assembly and end of DI drain pipe with proper compaction.*
q) *Rip rap shall be installed for erosion protection around the drain pipe outlet and vault drain end assembly.*

8. ***Internal & External Piping & Restraints***

a) *All internal and external water main (well supply line) piping shall be ductile iron flanged pipe and shall meet the requirements of Technical Provision Section 04.*
b) *All ductile iron flanged pipe shall be installed and secured in accordance with the manufacturer's recommendations.*
c) *All mechanical joint restraints shall meet the requirements of Technical Provision Section 04.*
d) *A Romac Alpha mechanical joint restraint shall be used in the interior piping to properly install and restrain all interior piping components.*
e) *Pipe supports shall be used, as needed, to properly support the piping and appurtenances inside of the vault.*
f) *Restrained DIP flanged adapters shall be used to connect to well supply piping on the outside of the vault, as per the design drawings.*
g) *45 degree DIP elbows shall be used on each side of the vault, as needed, to keep vault a minimum of 8" above final grade, as per the design drawings.*
h) *Owner's Representative shall verify adequate pipe restraint (thrust block or restraint joint) for existing and new pipe, both on inlet and outlet sides of the vault.*

9. ***Valves***

a) *Check Valve*
   i. *Shall be a swing check or flexible disc check valve with a 250 psi maximum working pressure rating.*
   ii. *The size shall match the size of the water main piping in the meter vault.*
   iii. *The body and the cover shall be ductile iron and shall have an epoxy coated interior and exterior for corrosion resistance.*
   iv. *Shall be certified ANSI/NSF 61*
   v. *Shall allow for horizontal installation*
   vi. *Shall be a Mueller flexible disc Model 851A, Flowmatic 745, or approved equal.*
b) *Plug Valve*
   i. *The size shall match the size of the water main piping in the meter vault.*
   ii. *The body and the cover shall be ductile iron and shall have an epoxy coated interior and exterior for corrosion resistance.*
   iii. *Shall be certified ANSI/NSF 61*
   i. *Shall be a Val-Matic 5600R Full Port (FLxFL) with wormgear handle, or approved equal*

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c) *Air Release Valve*
   i. *No pipe, valve or fitting on the inlet or outlet line shall be smaller than the ARV inlet or outlet.*
   ii. *Flexible tubing, matching the size of the discharge end of the ARV, shall be used from the ARV to the union, before the wall penetration.*
   iii. *½" galvanized pipe shall be used from the union, through the wall penetration, through the ground and above grade, with a screened end.*
   iv. *The outlet end of the air relief discharge line shall be a minimum of 12" above final grade, or as shown on the design drawings.*
   v. *Shall be certified ANSI/NSF 61*
   vi. *Shall be an ARI D-040, 1" diameter, or approved equal.*

10. ***Sample Tee Assembly, Sample Tap, Pressure Gauge***
   a) *All components shall be certified ANSI/NSF 61*
   b) *¾" saddle shall be used to connect the sample tee assembly to the water main piping.*
   c) *¾" brass ball valve shall be used for isolating the tee.*
   d) *¾" brass cross or (2) ¾" tees shall be used for the tee assembly.*
   e) *Sample tap shall be ¾" brass, non-threaded, ¼ turn boiler drain valve.*
   f) *A 4" pressure gauge, with individual psi readings, shall be installed.*

11. ***Testing***
   a) *Pressure Testing: All water main connection joints, flanges, valves and appurtenances shall be pressure tested in accordance with Technical Provisions Section 04. Any observed leaks shall be corrected immediately.*
   b) *Signal converter shall be tested to ensure that it is accurately displaying output data such as flow, velocity, temperature, conductivity, etc.*
   c) *Control panel box door shall be tested to ensure is closes, seals and locks correctly.*
   d) *ARV shall be tested for air flow.*
   e) *Pressure gauge shall be tested to ensure that it is accurately displaying pressure data.*
   f) *Sample tap shall be tested to ensure flow and pressure for future water sampling.*
   g) *Plug valve shall be throttled to ensure that it is able to throttle flow.*
   h) *Access hatch shall be tested to ensure it opens, closes and locks correctly.*
   i) *Floor drain and drain line shall be tested with some water to ensure positive drainage from the floor of the vault to the drain line outlet.*
   j) *Any tested items found to be deficient, shall be corrected at the contractor's expense.*

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MODIFIED TECHNICAL PROVISIONS 5
2019 WMAT IDIQ (EA 02-19)

SECTION 05 WATER SERVICE LINES

A. Technical Provisions 5 Section (TP-05.03.J WATER SERVICE LINES MATERIALS/Pipe Insulation)

(REFLECTED IN Change Order #7)

Add New section **K. Freeze-Proof Yard Hydrant** after Section J. Pipe Insulation:

K. Freeze-Proof Yard Hydrant:

1. Hydrant:

a) A freeze-proof yard hydrant shall ONLY be installed when shown on the drawings and agreed upon by the Owner or Owner's Representative, for specific sites only. These installations will typically be to replace old existing yard hydrants with new yard hydrants. All other installations, for houses that do not currently have a yard hydrant, will be determined by the Owner or Owner's Representative.

b) The hydrant shall have a shutoff valve and weep (drain) hole which allows for the water in the standpipe riser casing to drain out of the weep hole in the valve body, below the frost line.

c) The valve body and seat shall be brass.

d) The hydrant shall have a plunger that seals the drain hole during open (flowing) conditions and opens the drain hole during closed (non-flowing) conditions, to allow for draining of the hydrant when it is shutoff.

e) The hydrant valve body and weep hole shall be installed at a 3-foot bury depth, in order to be set below the frost line. The appropriate hydrant shall be selected to meet this bury depth requirement.

f) The hydrant head, handle and standpipe casing shall be made of high quality metal, with any applicable coatings, to prevent corrosion.

g) The hydrant operating rod shall be a steel material. The nozzle shall be a 3/4" brass male hose thread nozzle.

h) The hydrant shall have a high flow double check backflow preventer installed on the nozzle end. The backflow preventer shall be brass and allow for the hydrant to automatically drain when an attached hose is removed.

i) The operating handle should be able to rotate 90 degrees to open at full pressure.

j) The maximum pressure rating shall be 125 psi.

k) The yard hydrant shall be a Woodford Model R34 or approved equal. The backflow preventer shall be a Nidel Model 50H or approved equal.

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2. Water supply line, fittings, curb stop & concrete pad

- *a) All brass compression fittings shall meet the requirements of TP 05.03.B.*
- *b) Water service line material shall meet the requirements of TP 05.03.A*
- *c) Curb stops and boxes shall meet the requirements of TP 05.03.F.*
- *l) Concrete and steel reinforcement shall meet the requirements of TP 02 & TP 03.*

B. Technical Provision Section 5 (TP-05.05.C WATER SERVICE LINE INSTALLATION/Water Meter and Box)

Add New section **D. Freeze-Proof Yard Hydrant** after Section C. Water Meter and Box:

D. Freeze-Proof Yard Hydrant:

1. General:

- *a) The yard hydrant shall be installed per the manufacturer's recommendations and in accordance with the detail drawing.*
- *b) The hydrant shall be located as shown on the drawings or specified by the Owner or Owner's Representative.*
- *c) The yard hydrant shall be installed facing away from the house and shall be installed vertically plumb.*
- *d) Ensure that the hydrant is not installed in low areas where surface water can pond around the hydrant.*
- *e) The backflow preventer shall be securely installed on the nozzle end, as shown on the detail drawing and tested according to manufacturer's recommendations.*

2. Supply Line:

- *a) The supply line for the yard hydrant shall be connected to the individual home water service line.*
- *b) The connection between the supply line and the water service line shall be made with a compatible brass compression tee fitting. This tee fitting shall be installed between the home and the water meter.*
- *c) The supply line shall have a minimum of 3 feet of cover for frost protection.*

3. Curb Stop and Box:

- *a) A curb stop and box shall be installed on the supply line, between the tee fitting and the yard hydrant.*
- *b) The curb stop and box shall be located as shown in the drawing or as determined by the Owner or Owner's Representative.*
- *c) The curb stop and box shall be installed in accordance with TP 05.05.B and the related detail drawings.*

4. Yard Hydrant:

- *a) The supply line shall be flushed out before connecting the yard hydrant to remove any dirt, gravel or debris in the supply line.*
- *b) The hydrant shall be connected to the supply line with compatible fittings. All connections shall be secure and sealed watertight.*

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c) If needed, a support such as a concrete block or an 8-inch piece of No. 4 steel rebar shall be placed below the elbow fitting of the hydrant to be used to support the yard hydrant assembly.
d) 4-inches of gravel shall be used below the elbow fitting as shown on the detail.

5. Gravel Seepage Pit & Testing:
a) A gravel seepage pit shall be used to allow for proper drainage of the yard hydrant.
b) After secure compacted gravel (and additional support if needed) is placed below the hydrant elbow, the hydrant and backflow preventer shall be tested.
c) The hydrant shall be tested prior to covering connections or weep hole with gravel.
d) The hydrant shall be opened up to full pressure. All connections shall be checked for leaks. The weep hole shall be observed for draining properly.
e) The yard hydrant's brass valve body shall be covered with a minimum of 1 cubic foot of 1/2" to 1" gravel, as shown in the detail drawing. The gravel shall be filled to a minimum of 3-inches above the brass drain valve body and 4-inches below the elbow fitting to ensure adequate drainage.
f) After gravel is placed around the valve body, the hydrant shall be backfilled with native soil and mounded up to 2" to 4" above the ground surface, in accordance with the detail drawing.
g) Backfill material shall be properly compacted around the hydrant standpipe riser casing to maintain plumb and secure installation.

6. Concrete Collar:
a) Concrete collar shall be placed on top of 2" to 4" raised mound.
b) An 18" x 18" x 4" reinforced concrete collar pad shall be placed around the hydrant, on the raised ground level, per the detail drawings.
c) Concrete surface shall have a gradual slope away from the casing pipe.
d) A PVC sleeve (casing) shall be used between the concrete and the standpipe riser. The sleeve shall fit snug around the standpipe riser.
e) Wrap PVC tape around the standpipe riser casing where penetrating through concrete collar. The PVC tape shall be 1/8" thick to protect standpipe riser pipe, as shown in the detail drawing.
f) In locations where it is known that the soil is corrosive, the outside of the standpipe riser shall be completely wrapped with PVC tape below the bury depth.

C. Technical Provisions 5 Section (TP-05.03.F WATER SERVICE LINES MATERIALS/Curb Stops and Boxes)

Add:

For shallow installations, a telescoping curb stop box without a stationary rod may be approved by the Owner or Owner's Representative. The shallow curb stop and box shall be installed in accordance with TP 05.05.B. Contractor shall provide (1) pentagon head key to remove the curb stop box cover and (1) compatible curb stop shutoff key to the Owner for every type of curb stop installed. The keys shall be new and tested in front of Owner or Owner's Representative to ensure proper fit and operability.

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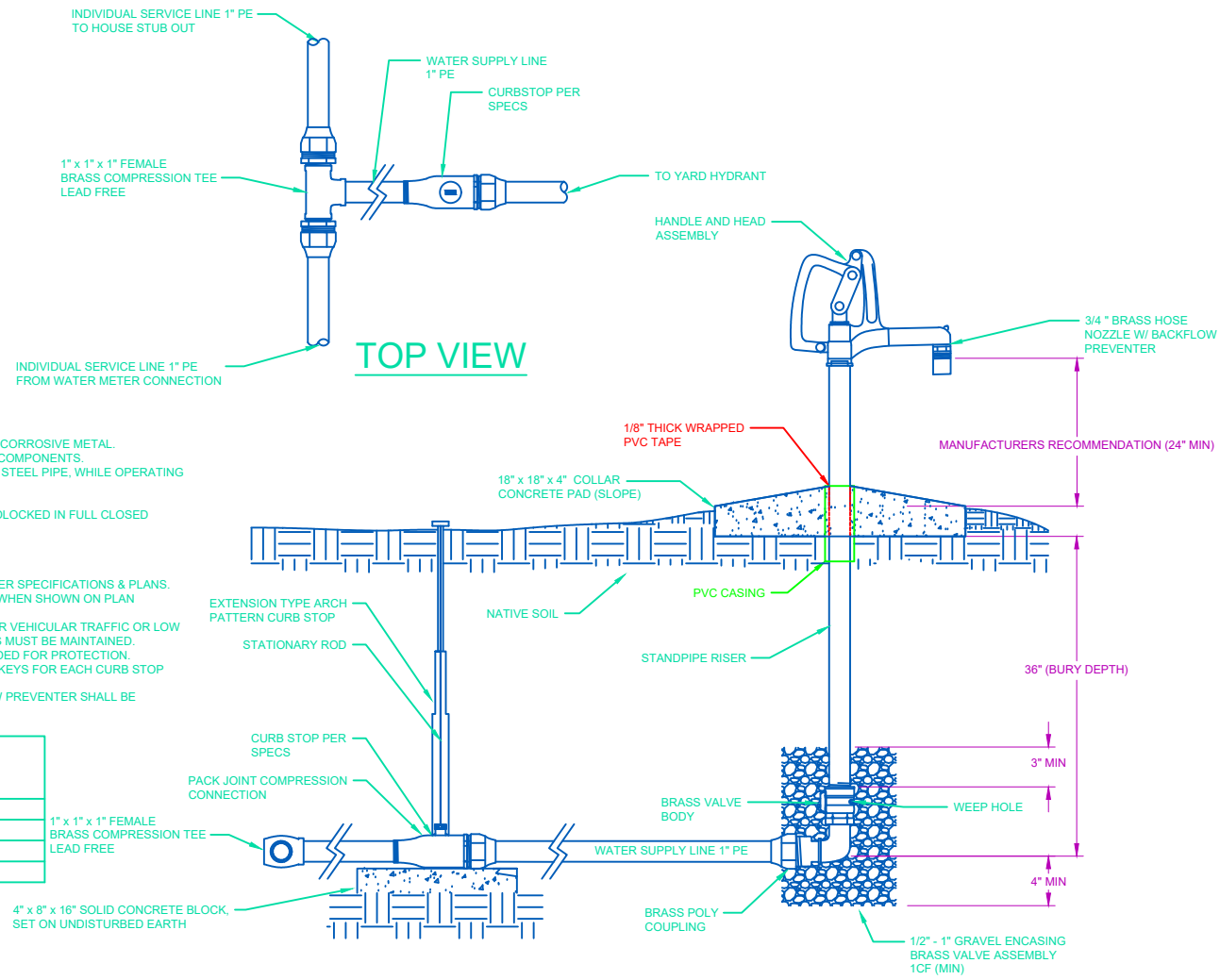

NOTES:
1) HEAD & HANDLE ARE HIGH QUALITY, NON-CORROSIVE METAL.
2) ALL METAL CONSTRUCTION; NO PLASTIC COMPONENTS.
3) CASING IS CONSISTED OF 1" GALVANIZED STEEL PIPE, WHILE OPERATING ROD IS 3/8" STEEL ROD, OR EQUAL.
4) DRAIN HOLE: TAPPED - 1/8" N.P.T.
5) TAMPERPROOF LOCK, WHICH CAN BE PADLOCKED IN FULL CLOSED POSITION.
6) 3/4" BRASS HOSE NOZZLE.
7) MAX PRESSURE - 125 PSI
8) MAX TEMPERATURE - 120° F
9) CURBSTOP AND BOX TO BE INSTALLED PER SPECIFICATIONS & PLANS.
10) YARD HYDRANT ONLY TO BE INSTALLED WHEN SHOWN ON PLAN DRAWINGS.
11) HYDRANT SHALL NOT BE INSTALLED NEAR VEHICULAR TRAFFIC OR LOW AREAS, PROPER SEPARATION DISTANCES MUST BE MAINTAINED.
12) BOLLARDS SHALL BE INSTALLED AS NEEDED FOR PROTECTION.
13) CONTRACTOR SHALL PROVIDE 1 SET OF KEYS FOR EACH CURB STOP INSTALLED.
14) A HIGH FLOW DOUBLE CHECK BACKFLOW PREVENTER SHALL BE INSTALLED ON THE NOZZLE END.

SEPERATION DISTANCE FROM	FEET
SEPTIC TANK	50
DRAINFIELD	100
SEWER LINES	50
STREAM OR LAKE	25

5D

FREEZE-PROOF YARD HYDRANT

Scale: NOT TO SCALE

DATE	REVISIONS	INITIALS
1/23/2020	UPDATED	RB

INDIAN HEALTH SERVICE
OFFICE OF ENVIRONMENTAL HEALTH & ENGINEERING

PHOENIX AREA OFFICE
40 N. CENTRAL AVE, SUITE 720
PHOENIX, AZ 85004
(602) 364-5088

WRSU REVISED DETAILS
FREEZE-PROOF YARD HYDRANT

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED WATER DRAWINGS WMAT2020
LAYOUT NAME: 5D
PROJ ENG: RB

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MODIFIED TECHNICAL PROVISIONS 4
2019 WMAT IDIQ (EA 02-19)

SECTION 01 TRENCH EXCAVATION & BACKFILL FOR PIPELINES AND APPURTENANT STRUCTURES

A. Technical Provisions Section 1 (TP-01.07.B.1 LOCATING FACILITIES FOR INSTALLED SANITATION FACILITIES/Utility Line Markers, Bollards, and Metal Marker Posts/Utility Line Marker)

Add to end of text:
Utility line marker shall be made of composite fiberglass, shall be UV and impact resistant and shall be flexible in most weather conditions.

SECTION 04 WATER TRANSMISSION & DISTRIBUTION MAIN

A. **Modified Technical Provisions 1** Section 4 (TP-04.13.D.6 FLUSHING AND DISINFECTION OF MAINS/Flushing after Disinfection)

Change:
Flushing shall continue until all visible debris has been removed and the chlorine concentration ***is*** between 0.4 and 0.8 mg/l in a new or unchlorinated system.

To:
Flushing shall continue until all visible debris has been removed and the chlorine concentration ***is*** between 0.4 and 0.8 mg/l in a new or unchlorinated system. ***The results shall be shown to the Owner's Representative.***

B. **Modified Technical Provisions 1** Section 4 (TP-04.16.I METHOD OF MEASUREMENT AND BASIS FOR PAYMENT/Testing)

Change:
Vault Drain Assembly (without pipe): …Payment shall be full compensation for furnishing and installing the connection to the vault, steel mesh, flange adapter, rectangular accessory bolt pack kit, outlet erosion protection, compaction, water tight connections and appurtenances, including all incidentals, in conformance with the plans and specifications.

To:
Vault Drain Assembly (without pipe): …Payment shall be full compensation for furnishing and installing the connection to the vault, steel mesh, ***DI uni-flange adapter, MJ gland pack, MJ gasket, T-head bolts,*** outlet erosion protection, compaction, water tight connections and appurtenances, including all incidentals, in conformance with the plans and specifications…

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C. Technical Provisions Section 4 (TP-04.03.B MATERIALS/Pipe)

Add to end of text:
All pipe lubricants used for the joint installation on each type of pipe material shall meet the pipe manufacturer's recommendation. All metal pipe and fittings used shall be lead free.

D. Technical Provisions Section 4 (TP-04.03.G.2.h MATERIALS/Combinatio Air Valve/ARV Vault)

Change:
If depicted on the plans, the drain pipe shall be 4-inch SDR 35 pipe. The pipe material shall transition to 4-inch DI pipe at the outlet end (10-foot minimum length) and where bury depth is less than 1-foot. Install #8 steel mesh at outlet end anchored with a 4-inch DI flange adapter and 4-inch DI rectangular accessory bolt pack kit.

To:
If depicted on the plans, the drain pipe shall be 4-inch SDR 35 pipe. The pipe material shall transition to 4-inch DI pipe at the outlet end (10-foot minimum length) and where bury depth is less than 1-foot. Install #8 steel mesh at outlet end anchored with a 4-inch DI ***uni-flange adapter, MJ gland pack, MJ gasket and T-head bolts.***

E. Technical Provisions Section 4 (TP-04.03.G.4.e MATERIALS/Combination Air Valve/ARV Inlet (Riser) and Outlet (Discharge) Piping)

Add to end of subsection e) :
The ball valve can also be a full port threaded or sweated brass valve.

F. Technical Provisions Section 4 (TP-04.03.G.4.g MATERIALS/Combination Air Valve/ARV Inlet (Riser) and Outlet (Discharge) Piping)

Add to end of subsection g) :
…or stainless steel.

G. Technical Provisions Section 4 (TP-04.03.H.2 MATERIALS/Blow-Off Hydrant Assembly/ Portable Discharge Riser)

Change:
Portable Discharge Riser: 4-inch aluminum piping and fittings, 4-inch camlock male to female NPT (quick connect), dimensions and configuration shown on the detail drawings…

To:
Portable Discharge Riser: 4-inch aluminum or ***Schedule 80 PVC*** piping and fittings, 4-inch camlock male to female NPT (quick connect), dimensions and configuration shown on the detail drawings…

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H. Technical Provisions Section 4 (TP-04.03.H.3 MATERIALS/Blow-Off Hydrant Assembly/ Fire Hose and Quick Connect Adapter)

Change:
Fire Hose and Quick Connect Adapter: 4-inch single jacket fire hose, 50 feet, minimum, 125 psi service pressure. Adapter: stainless steel 4-inch male camlock to male NPT (quick connect). Hose to be provided by the Contractor to the Owner.

To:
Fire Hose and Quick Connect Adapter: 4-inch single jacket fire hose, 50 feet, minimum, 125 psi service pressure. Adapter: stainless steel ***or aluminum*** 4-inch male camlock to male NPT (quick connect). Hose to be provided by the Contractor to the Owner

I. Technical Provisions Section 4 (TP-04.03.H.5 MATERIALS/Blow-Off Hydrant Assembly/Drain Pipe)

Change:
Drain Pipe: …The DI pipe shall be a minimum of 10 feet long. Install #8 steel mesh at outlet end anchored with a 4-inch DI flange adapter and 4-inch DI rectangular accessory bolt pack kit.

To:
Drain Pipe: …The DI pipe shall be a minimum of 10 feet long. Install #8 steel mesh at outlet end anchored with a 4-inch DI ***uni-flange adapter, MJ gland pack, MJ gasket and T-head bolts.***

J. Technical Provisions Section 4 (TP-04.08.D.7 SETTING COMBINATION AIR VALVES AND VAULTS/Setting Valve and Piping)

Add to end of text:
9. #24 mesh shall be fastened to the outlet of the discharge line (air relief line).

K. Technical Provisions Section 4 (TP-04.08.E.5 SETTING COMBINATION AIR VALVES AND VAULTS/Drain Pipe)

Add to end of subsection 5) :
A minimum of (3) coats of black epoxy paint shall be applied per manufacturer's recommendation.

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SECTION 05 WATER SERVICE LINES

A. **Modified Technical Provisions 1** Section 5 (TP-05.03.E. WATER SERVICE LINE MATERIALS /Corporation Stops)

Change:
Ford FB 1101 Ballcorp, or equal, shall be allowed for ¾" and 1"diameter water main taps. Mueller H-15026 shall be allowed for 1" diameter water main taps and Ford FB 1001-7-IDR7, or equal for 2" diameter water main taps.

To:
Ford FB 1101 Ballcorp, or equal, shall be allowed for 1"diameter water main taps. Mueller H-15026 shall be allowed for 1" diameter water main taps and Ford FB 1001-7-IDR7, or equal for 2" diameter water main taps.

B. Technical Provisions Section 5 (TP-05.03 WATER SERVICE LINE MATERIALS)

Add to end of text:
All piping and fittings shall meet the requirements of National Sanitation Foundation (NSF) 61 and NSF 14, as applicable.

C. Technical Provisions Section 5 (TP-05.03.B WATER SERVICE LINE MATERIALS/PE Pipe Fittings)

Change:
…Fittings shall use a compression ring, or pack joint with stainless steel stiffeners, to make a watertight connection….

To:
…Fittings shall use a compression ring, ***grip joint*** or pack joint with stainless steel stiffeners, to make a watertight connection. ***All fittings must comply with the latest version of AWWA C800***.

D. Technical Provisions Section 5 (TP-05.03.D WATER SERVICE LINE MATERIALS/Service Saddles)

Change:
…Ford FS303 series stainless steel service saddles…

To:
…Ford ***FS313 or FSP313*** series stainless steel service saddles…

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E. Technical Provisions Section 5 (TP-05.03.F WATER SERVICE LINE MATERIALS/Curb Stops and Boxes)

Change:
Curb stops shall be brass, Mueller Mark II Oriseal….

To:
Curb stops shall be brass ***and lead free*** Mueller Mark II Oriseal….

SECTION 06 GRAVITY SANITARY SEWERS

A. **Modified Technical Provisions 1** Section 6 (TP-06.07.H INSTALLATION OF MANHOLES/Pipe to Manhole Connections)

Add to end of text under Section I. Beaver Slide Manholes :
5. Concrete used shall meet the requirements of TP 02.

B. Technical Provisions Section 6 (TP-06.03.A.3.b MATERIALS/Pipes, Joints and Fittings/Fittings)

Add to end of text:
b) ….Ductile Iron Fittings shall also meet the requirements of TP 04.03.C and AWWA C111.

C. Technical Provisions Section 6 (TP-06.03.B.4.a MANHOLES/Steps)

Add to end of text:
a) …Steps shall meet ASTM C478, 4101-07 and OSHA Std 1-19.

D. Technical Provisions Section 6 (TP-06.03.B.7.c MANHOLES/Standard Manholes)

Add to end of text:
c) …with cone opening over outlet of manhole.

E. Technical Provisions Section 6 (TP-06.07.E.2 INSTALLATION OF MANHOLES /Adjustment/Grade Rings)

Change:
…For concrete adjustment rings, grout in place on the inside and outside when the manhole is constructed.

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To:
…For concrete adjustment rings, ***install approved joint sealant in all joints between adjustment rings and then*** grout in place on the inside and outside when the manhole is constructed.

SECTION 07 SEWER SERVICE LINES

A. Technical Provisions Section 7 (TP-07.03.B MATERIALS/Cleanouts)

Change:
Cleanouts: Double service line (two-way) cleanout piping and fittings shall be 4-inch diameter PVC pipe matching the chosen septic drain piping material. The cleanout piping and cap shall be threaded.

To:
Cleanouts: Double service line (two-way) cleanout piping and fittings shall be 4-inch diameter ***SDR-35*** PVC pipe matching the ***sewer service line*** piping material. The cleanout piping and cap shall be threaded.

B. Technical Provisions Section 7 (TP-07.03.D MATERIALS/Pipe Hangers)

Add New Section ***E. PVC Tape*** after Section D. Pipe Hangers

E. PVC Tape:

1. Shall provide a moisture and corrosion barrier.
2. Shall provide UV and weathering protection.
3. Shall be made for exposed and direct burial applications.
4. Shall be a minimum of 10 mil thick.
5. Shall be compatible for use on a variety of piping materials including steel, galvanized, electrical conduit, cast and ductile iron.

SECTION 12 NON-AGGREGATE SEWAGE DISPOSAL SYSTEMS

A. Technical Provisions Section 12 (TP-12.03.A.2 MATERIALS/Pipe and Fittings)

Change:
Lubricants used for the joint installation shall meet the requirements of the pipe manufacturer.

To:
Lubricants ***and solvents*** used for the joint installation shall meet the requirements of the pipe manufacturer.

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B. Technical Provisions Section 12 (TP-12.04.M INSTALLATION/Drainfield Abandonment)

Add to end of text:
The Contractor and the Owner's Representative shall notify the Homeowner NOT to build any structures above the abandoned drainfield.

SECTION 16 SINGLE RESIDENCE EFFLUENT LIFT STATION

A. **Modified Technical Provisions 1** Section 16 (TP-16.03.I.3 MATERIALS/Controls/Alarm System)

Add to end of text under Section I.4 External Splice Box:
d) Splice box shall be engineered for sewage applications, watertight for prolonged submergence per UL Listing (Type 6P), resistant to cold and UV exposure, suitable for external applications, separate conduit hubs to maintain isolation of high and low voltage wires, minimum of (4) cord grips to accommodate power cords for floats and pump.

B. Technical Provisions Section 16 (TP-16.03.B.1 MATERIALS/Pipe and Fittings)

Change:
…Lubricants used for the joint installation shall meet the requirements of the pipe manufacturer.

To:
…Lubricants ***and solvents*** used for the joint installation shall meet the requirements of the pipe manufacturer. ***The standard pipe length shall be 20 feet.***

C. Technical Provisions Section 16 (TP-16.03.H.1.d MATERIALS/Effluent Pump/Effluent Pump)

Add to end of text:

e) The pump shall be designed to handle septic tank effluent and capable of passing a minimum of ¾" spherical solids.
f) *The impeller shall be cast iron non-clog style.*
g) The casing shall be made of corrosion resistant, high impact material and have a 1-inch to 2-inch discharge.
h) The rotor shaft and all fasteners shall be corrosion resistant stainless steel.
i) The pump motor shall be single phase submersible type.

D. Technical Provisions Section 16 (TP-16.03.K.3 MATERIALS/Effluent Discharge Line)

Add to end of text:
4. Sch 80 PVC pipe and fittings shall conform to ASTM D-1785 & ASTM D-1784, respectively.

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E. Technical Provisions Section 16 (TP-16.03.M.3 MATERIALS/Septic Tank & Pump Tank Risers)

Add to end of text:
…The safety screen shall provide a secondary layer of protection against entry into the tank. The safety screen shall be compatible with and match the inside diameter of the riser. The safety screen shall be made of strong, non-corrosive material shall be secured with a minimum of (4) stainless steel screws.

F. Technical Provisions Section 16 (TP-16.03.K MATERIALS/Effluent Discharge Line)

Change:
Effluent Discharge Line: (*Piping within Pump Tank*) …This includes the piping from the pump discharge outlet to the tank exterior.

To:
Effluent Discharge Line: (*Piping within Pump Tank*) …This includes the piping from the pump discharge outlet to the ***connection to the service force line.***

G. Technical Provisions Section 16 (TP-16.03.N.3 MATERIALS/Service Force Line)

Change:
PE to PE Joints shall be joined by proper compression fittings equal to A.Y. McDonald Series 4760 or shall be butt fused or flanged with back-up rings and SAE Grade 3 bolts, equal to Victaulic Style 995 with internal stainless steel stiffener.

To:
PE to PE Joints shall be joined by PE compression fittings compatible with the service force line material and size. The PE compression fittings shall be made of high performance thermoplastic materials that are corrosion resistant with a design life of 30 years or greater. The PE compression fittings shall have a pressure rating 1.5 times greater than maximum pressure generated by the effluent system. The PE compression fittings shall be Harco Philmac or approved equal.

H. Technical Provisions Section 16 (TP-16.03.N.4 MATERIALS/Service Force Line)

Change:
PE to PVC transitions shall use compression fittings manufactured by A.Y. McDonald, Ford Meter Box, Mueller or equal.

To:
PE to PVC transitions shall be joined by PE compression fittings compatible with pipe materials and size. The PE compression fittings shall meet the requirements listed above. If compatible PE compression fittings can't be obtained, then these transitions shall use compression fittings manufactured by A.Y. McDonald, Ford Meter Box, Mueller or equal.

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I. Technical Provisions Section 16 (TP-16.03.O.1.c MATERIALS/Saddles & Fittings/Connecting to Gravity Sewer Mains)

Add to text:
These shall include properly sized and compatible bushings and solvents/glues.

J. Technical Provisions Section 16 (TP-16.04.N INSTALLATION/Septic Tank Abandonment)

Add New Section ***O. Drainfield Abandonment*** *after Section N. Septic Tank Abandonment:*

O. ***Drainfield Abandonment: Drainfield chambers and piping shall be abandoned by removing the observation pipes and distribution boxes to a minimum of 12-inches below grade and filling the pipe and hole with suitable, compactible soil material. The remaining chambers and components of the system shall be abandoned in place. Septic lines must be cut and capped to prevent flow into the field once it is abandoned. The Contractor and the Owner's Representative shall notify the Homeowner NOT to build any structures above the abandoned drainfield.***

SECTION 28 HIGH DENSITY POLYETHYLENE (HDPE) MAIN & FITTINGS

A. Technical Provisions Section 28 (TP-28.03.A.2 MATERIALS/Pipe and Fitting Material)

Add to text:

2. …The dimension ration (DR) of the pipe shall be as specified in the Bid Schedule.

SECTION 43 SEWER FORCE MAIN

A. Technical Provisions Section 43 (TP-43.03.H.3 MATERIALS/Wastewater Combination Air and Vacuum Valve and Vault/Vault Concrete Collar and Vault Lid)

Add New Section ***4. Inlet (Riser) and Outlet (Discharge) Piping*** *after 3. Vault Concrete Collar and Vault Lid*

4. Inlet (Riser) and Outlet (Discharge) Piping

a) Material of the inlet and outlet pipe shall be rigid and non-corrodible. Joining of dissimilar metals should be avoided. If approved by the Owner and show in the plans, dielectric unions may be installed, if dissimilar metals are used. The material of the inlet and outlet pipe shall be as specified on the design plans and detail drawings.

b) The pipe material from the tee/saddle or compression fitting elbow at the bottom of the vault, to the pipe outlet shall be brass. For the Horizontal Offset Option, the pipe material from the water main to the bottom compression fitting elbow in the vault shall

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be PE 4710. Appropriate reducers shall be used for the outlet or inlet of the ARV piping, as shown on the design plans and detail drawings.

c) No pipe, valve or fitting on the inlet or outlet line shall be smaller than the ARV inlet or outlet.

d) Full port type ball valve and fittings shall match the material and size of the riser pipe. This ball valve can be a full port threaded or sweated brass valve.

e) The outlet pipe shall be affixed to the vault wall using a 2-inch stainless steel strap and a #12 stainless steel mesh shall be fastened over the opening of the outlet pipe.

f) When the ARV is located directly above the sewer force main connection, the connection shall be made with either a tee or a tapping saddle. The tee and reducer shall meet the requirements of TP 04.03.C. The saddle and corporation stop shall be meet the requirements of TP-05.

g) When the ARV is offset from the sewer force main connection, the corporation stop, saddle, PE pipe and fittings shall meet the requirements of TP-05

B. Technical Provisions Section 43 (TP-43.10.A.1WASTEWATER COMBINATION AIR/VACUUM VALVE AND MANHOLE INSTALLATION/General)

Change:
…TP 43.03.G.

To:
…TP 43.03.***H***.

SECTION 56 HORIZONTAL DIRECTIONAL DRILLING

A. Technical Provisions Section 56 (TP-56.03.F MATERIALS & JOINTING METHOD/Tracer Wire)

Add to text:
The tracer wire shall be securely bonded together with an approved underground waterproof splice kit at all wire joints to provide electrical continuity and it shall be accessible at all tracer wire access points. The underground waterproof splice kit shall be equal to 3M Direct Bury Splice Kit DBR/Y-6. When tracer wire is installed, the Contractor shall provide (2) extra Underground Waterproof Splice Kits to the operating utility.

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MODIFIED TECHNICAL PROVISIONS 3
2019 WMAT IDIQ (EA 02-19)

SECTION 07 SEWER SERVICE LINES

A. Technical Provisions 7 Section (TP-07.03.D SEWER SERVICE LINES/MATERIALS/Pipe Hangers)

(REFLECTED IN Change Order #4)

Add New section **E. Backwater Valve** after Section D. Pipe Hangers:

E. Backwater Valve:

1. ***Valve:***
   - ***a) A backwater valve shall ONLY be used when shown on the drawings and agreed upon by the Owner or Owner's Representative, for specific sites, to protect low areas from backflow of wastewater.***
   - ***b) The valve shall be 4-inch diameter and only allow flow in one direction (downstream - exiting the building sewer drain).***
   - ***c) The valve shall be made of durable, corrosion resistant material and shall be compatible to connect to the sewer service line piping material.***
   - ***d) The valve shall have a flapper check valve with a watertight seal, when closed and when a back water flow condition occurs. The flapper check valve shall be normally closed under normal operating conditions and shall only open to allow wastewater to exit the building drain to the sewer service line.***
   - ***e) The valve shall have a threaded access cap, with a watertight seal, to allow for cleaning and maintenance of the valve and flapper.***
   - ***f) A durable, non-corrosive pipe (handle) shall be secured to the threaded access cap of the valve to allow for removal of the cap.***
   - ***g) The backwater valve shall be a Canplas, Oatey or approved equal.***

2. ***Access Sleeve Riser:***
   - ***a) The valve shall have an access sleeve riser made of material that is compatible with the backwater valve.***
   - ***b) The access sleeve shall have a removable lid to access the threaded access cap of the backwater valve.***
   - ***c) The access sleeve shall be of a minimum diameter to allow for removal of the backwater valve threaded access cap with the attached pipe handle.***
   - ***d) The access sleeve riser shall be a Canplas Access Sleeve Kit, or piping and lid material that is approved equal.***

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e) If the access sleeve riser needs to be extended in height, it shall be done so with compatible material and connections that ensure secure and water tight seals at the joints and at the valve.

B. Technical Provision Section 7 (TP-07.04.C INSTALLATION OF GRAVITY SEWER LINES/Pipe Laying)

Add New section **D. Backwater Valve** after Section C. Sewer Main Connection:

D. Backwater Valve:

1. ***Concrete Pad/Collar:***
   - ***a) The two way cleanout sweeps shall be installed facing away from each other and at the specified distance, in accordance with the detail drawing.***
   - ***b) The two way cleanout and the access sleeve riser for the backwater valve shall be installed in a 20-inch x 40-inch x 4-inch concrete pad as shown in the detail drawing.***
   - ***c) The two way cleanout and concrete pad material and installation shall be in accordance with TP 07.***
2. ***Valve:***
   - ***a) The backwater valve shall be installed per the manufacturer's recommendations and in accordance with the detail drawing.***
   - ***b) The backwater valve shall be installed with the threaded access cap to the top and shall not exceed the maximum slope recommended by the manufacturer.***
   - ***c) The valve shall be installed so that the arrows on the side are in the direction of the flow.***
   - ***d) The connections between the backwater valve and the sewer service line piping and the access sleeve shall be secure and water tight.***
   - ***e) When connecting the valve to the sewer service line, ensure that solvent cement does not enter the body of the valve.***
3. ***Access Sleeve Riser:***
   - ***a) The access sleeve riser shall be installed according to the manufacturer's recommendations.***
   - ***b) The access sleeve shall be installed vertically plumb from the valve to the top of the concrete pad, as shown in the detail drawings.***
   - ***c) When connecting the access sleeve riser to backwater valve, ensure that solvent cement does not enter the body of the valve.***
   - ***d) A single layer of poly seal foam shall be wrapped around the access sleeve riser between the exterior of the sleeve and the concrete pad according to the detail drawing.***
   - ***e) A secure, watertight and removable lid shall be used at the top of the access sleeve riser.***
   - ***f) A pipe handle shall be secured to the threaded access cap of the backwater valve and extended to within reach of the access sleeve opening, in accordance with the detail drawing.***

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g) Any extension in height to the access sleeve riser to reach to the top of the concrete pad shall be done so with approved and compatible piping and jointing materials that ensure secure and water tight seals at the joints and at the valve.

h) Prior to testing the system, remove the access sleeve riser lid and the backwater valve cap to check the valve flapper for freedom of movement.

INCORPORATED INTO THE CONTRACT

MODIFIED TECHNICAL PROVISIONS 2
2019 WMAT IDIQ (EA 02-19)

SECTION 01 TRENCH EXCAVATION & BACKFILL FOR PIPELINES AND APPURTENANT STRUCTURES

A. WMAT Modified Technical Details

(REFLECTED IN Change Order #1)

Change:
Add in Details **1J – Concrete Pavement Patch (CO Item C20)** and **1K – ABC Patch (CO Item C21)**

B. Technical Provisions 1 Section (TP-01.13.B ROADWAY RESTORATION AND PATCHING)

(REFLECTED IN Change Order #1)

Change:

1. Reinforced Concrete Patch: Compacted aggregate base course, six inches in depth, shall be placed in the roadway immediately beneath the concrete patching. The cut shall be filled with a six inch thick reinforced concrete patch. Concrete shall meet the requirements of Section 02-Concrete. The reinforcement shall be #6 welded wire reinforcement mesh (6-inch by 6-inch). The concrete patch shall be a minimum of four feet wider than the top of the trench and centered over the trench. The Contractor shall notify the Owner at least 48 hours before concrete is poured to allow the Owner or Owner's Representative to inspect patch preparation.
2. Asphalt Patch: Compacted aggregate base course, six inches in depth, shall be placed in the roadway immediately below a bituminous wear course. Asphalt mix surfacing conforming to ASTM D-3515 (Hot-Mixed, Hot Laid Bituminous Paving Mixtures) shall be placed and compacted in accordance with the detail to make the crossing level with the existing roadway. Cold mix is not permitted as a permanent asphalt patch.
3. Regraveling: Where regraveling is required after crossing of the existing roads or driveways, the Contractor shall remove existing gravel surfacing, stockpile the material, and restore the road surface after installation of the pipe. The stockpiled material shall be used for backfilling to within two inches of finished level. The final two (2) inches of gravel surfacing shall conform to the requirements of gravel for re-graveling as listed above in TP 01.13.A. This material shall be placed only in the amount and at the locations designated by the Owner or Owner's Representative. All quantities shall be verified by the Owner or Owner's Representative during placement of the gravel.

INCORPORATED INTO THE CONTRACT

To:

1. Reinforced Concrete Patch ***(Detail 1J)*****: *Reinforced concrete patches shall be used on all main routes with heavy traffic (large vehicles/equipment) with asphalt pavement that is 6-inches thick or greater. T-cuts that are 12-inches deep (below the road pavement) and 2-feet wider (min) than the excavated trench shall be used on all main routes. Concrete slurry shall be placed in the excavated trench from the top of the pipe to immediately beneath the new reinforced concrete patch. The concrete slurry shall meet the requirements set forth in TP 01.11.D.3.B, TP 02.12 and TP 11.A.2 and shall be in accordance with FHWA FP-14, Section 614 Lean Concrete Backfill. The pavement cut shall be filled with a 6-inch thick reinforced concrete patch. Concrete shall meet the requirements of Section 02 and shall have a 28-day compressive strength of 3,000 psi. The surface of the reinforced concrete patch shall be recessed 1/8" to ¼" from the existing asphalt pavement surface on both sides.*** The reinforcement shall be #6 welded wire reinforcement mesh (6-inch by 6-inch). The concrete patch shall be a minimum of four feet wider than the top of the trench and centered over the trench. The Contractor shall notify the Owner at least 48 hours before concrete is poured to allow the Owner or Owner's Representative to inspect patch preparation.

2. Asphalt Patch ***(Detail 1G)*****: *Asphalt patches shall be used on all non-main routes without heavy traffic and with asphalt pavement that is less than 6-inches thick. T-cuts that are 12-inches deep (below the road pavement) and 1-foot wider (min) than the excavated trench shall be used on all non-main routes. Concrete slurry shall be placed along the excavated trench from 6-inches above the top of the pipe to immediately beneath the new asphalt patch. The concrete slurry shall meet the requirements set forth in TP 01.11.D.3.B, TP 02.12 and TP 11.A.2 and shall be in accordance with FHWA FP-14, Section 614 Lean Concrete Backfill. Approved bedding material, six inches in depth, shall be placed above the pipe immediately below the concrete slurry.*** Asphalt mix surfacing conforming to ASTM D-3515 (Hot-Mixed, Hot Laid Bituminous Paving Mixtures) shall be placed and compacted in accordance with the detail to make the crossing level with the existing roadway. Cold mix is not permitted as a permanent asphalt patch.

3. ABC Patch ***(Detail 1K)*****: *ABC (aggregate base course) patches shall be used on all gravel or dirt roads. T-cuts are not required for gravel or dirt road crossings. Concrete slurry shall be placed in the excavated trench from the top of the pipe to a minimum of 12-inches below the existing road surface. The concrete slurry shall meet the requirements set forth in TP 01.11.D.3.B, TP 02.12 and TP 11.A.2 and shall be in accordance with FHWA FP-14, Section 614 Lean Concrete Backfill. The road cut shall be filled with a minimum 12-inch thick layer of ABC compacted in accordance with TP-01 and compaction results shall be submitted to the Owner. The ABC material*** shall conform to the requirements of gravel for re-graveling as listed above in TP 01.13.A. This material shall be placed only in the amount and at the locations designated by the Owner or Owner's Representative. All quantities shall be verified by the Owner or Owner's Representative during placement of the gravel.

INCORPORATED INTO THE CONTRACT

SECTION 05 WATER SERVICE LINES

A. Modified Technical Provisions 1 Section 5 (TP-05.03.G.4 WATER SERVICE LINE MATERIALS/Water Meter and Box Combination/Meter Box and Cover)

(REFLECTED IN Change Order #2)

Change:

The coppersetter and meter shall be enclosed within a standard sized meter box as shown on the detail drawings. All meter boxes shall be wire reinforced concrete boxes. Lids for boxes in residential areas shall be of polymer material with a touch read or I-Tron Slot. Lids for boxes in traffic areas shall be traffic rated steel diamond plate lids with stainless steel bolts. All sections of all boxes shall be nested or otherwise interlocked to prevent lateral movement. Sufficient sections shall be installed to provide a walled enclosure for a minimum depth of 6 inches below the angle valve. Minimum cover opening dimensions shall be 14 1/8-inches by 21 3/4-inches. The box shall be an Old Castle Precast High Density Concrete Box conforming to Mag Spec 320 #2 Meter Box, or approved equal. Pea gravel or 3/4 inch crushed rock shall be placed inside the meter can below the water meter to a minimum depth of three (3) inches as shown on the drawings. The meter box shall be installed on bricks or masonry block on top of the prepared subsurface.

To:

The coppersetter and meter shall be enclosed within a standard sized meter box as shown on the detail drawings. All meter boxes in ***traffic areas*** shall be wire reinforced ***traffic rated*** concrete boxes. ***All meter boxes in residential (non-traffic) areas can be non-reinforced concrete boxes***. Lids for boxes in residential areas shall be of polymer material with a touch read or I-Tron Slot. Lids for boxes in traffic areas shall be traffic rated steel diamond plate lids with stainless steel bolts. All sections of all boxes shall be nested or otherwise interlocked to prevent lateral movement. Sufficient sections shall be installed to provide a walled enclosure for a minimum depth of 6 inches below the angle valve. Minimum cover opening dimensions shall be 14 1/8-inches by 21 3/4-inches. The box shall be an Old Castle Precast High Density Concrete Box conforming to Mag Spec 320 #2 Meter Box, or approved equal. Pea gravel or 3/4 inch crushed rock shall be placed inside the meter can below the water meter to a minimum depth of three (3) inches as shown on the drawings. The meter box shall be installed on bricks or masonry block on top of the prepared subsurface

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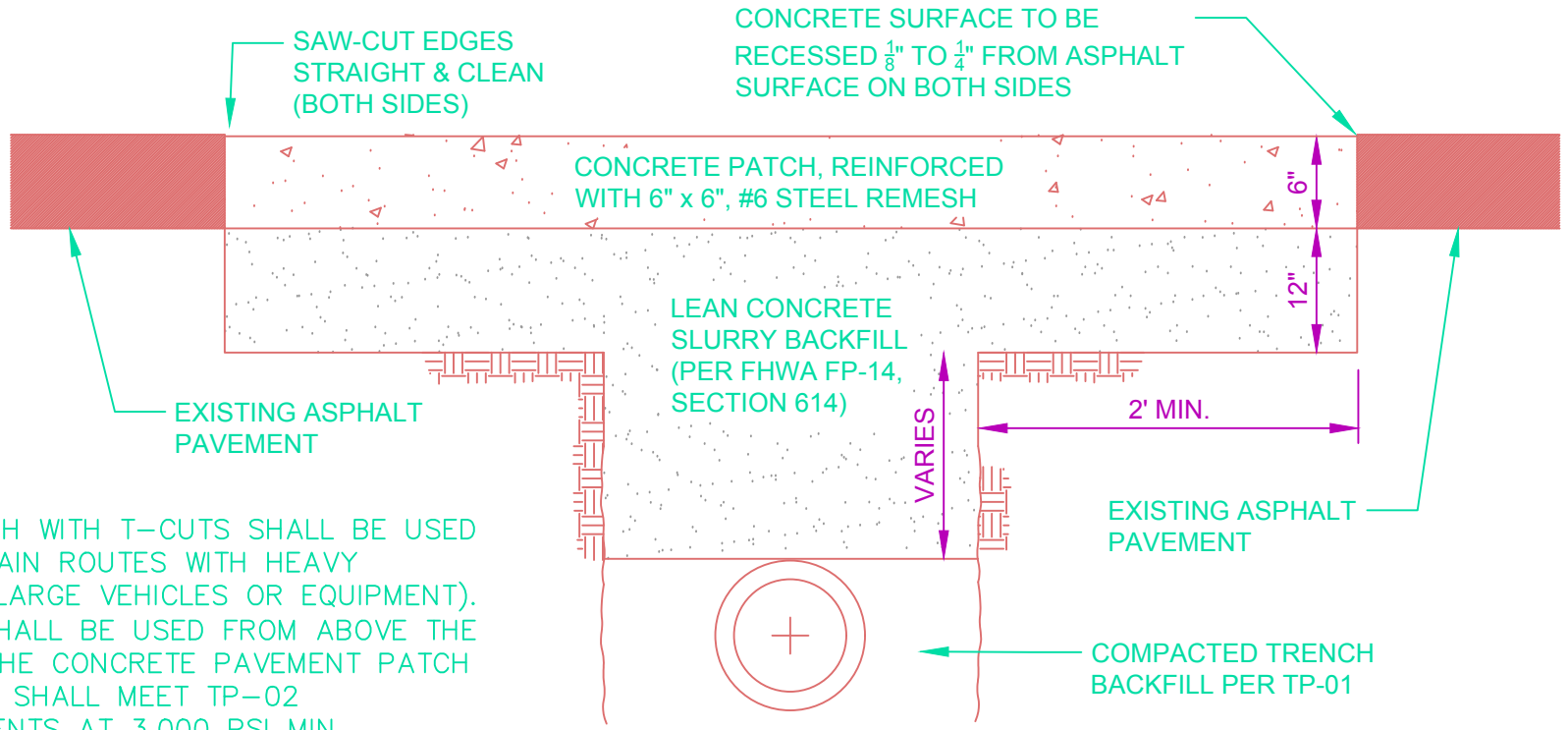


NOTES:

1) THIS PATCH WITH T-CUTS SHALL BE USED ON ALL MAIN ROUTES WITH HEAVY TRAFFIC (LARGE VEHICLES OR EQUIPMENT).
2) SLURRY SHALL BE USED FROM ABOVE THE PIPE TO THE CONCRETE PAVEMENT PATCH
3) CONCRETE SHALL MEET TP-02 REQUIREMENTS AT 3,000 PSI MIN.

1J (WMAT)

CONCRETE PAVEMENT PATCH

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA
04-18	UPDATED MARCH REVISION	LB
08-19	REVISED PER WMAT DOT	LTS

INDIAN HEALTH SERVICE
OFFICE OF ENVIRONMENTAL HEALTH & ENGINEERING

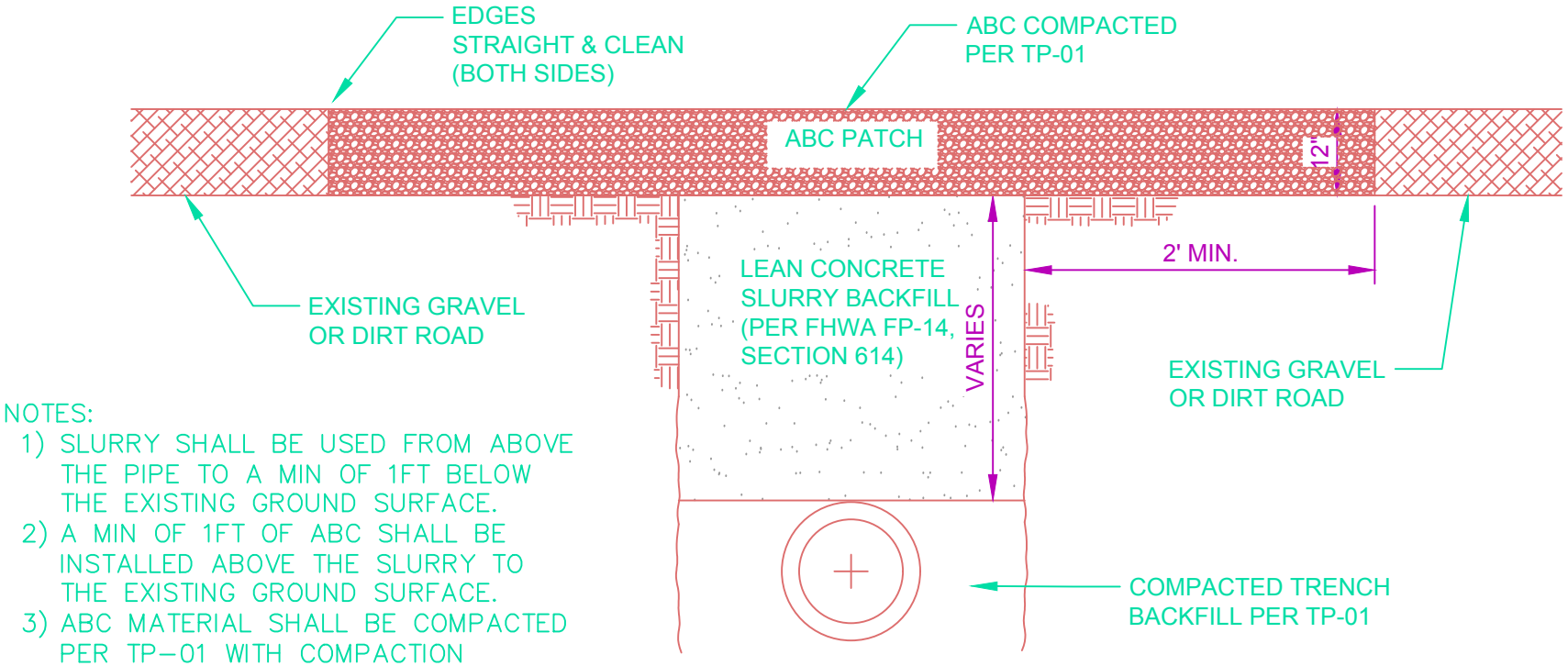
PHOENIX AREA OFFICE
40 N. CENTRAL AVE, SUITE 720
PHOENIX, AZ 85004
(602) 364-5088

PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
CONCRETE PAVEMENT PATCH

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED MISC DRAWINGS WMAT
LAYOUT NAME: 1J WMAT EADO
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



NOTES:

1) SLURRY SHALL BE USED FROM ABOVE THE PIPE TO A MIN OF 1FT BELOW THE EXISTING GROUND SURFACE.
2) A MIN OF 1FT OF ABC SHALL BE INSTALLED ABOVE THE SLURRY TO THE EXISTING GROUND SURFACE.
3) ABC MATERIAL SHALL BE COMPACTED PER TP-01 WITH COMPACTION RESULTS SUBMITTED TO OWNER.

1K (WMAT)

ABC PATCH

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA
04-18	UPDATED MARCH REVISION	LB
08-19	REVISED PER WMAT DOT	LTS

INDIAN HEALTH SERVICE
OFFICE OF ENVIRONMENTAL HEALTH & ENGINEERING

PHOENIX AREA OFFICE
40 N. CENTRAL AVE, SUITE 720
PHOENIX, AZ 85004
(602) 364-5088

PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
ABC PATCH

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED MISC DRAWINGS WMAT
LAYOUT NAME: 1K WMAT EADO
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT

MODIFIED TECHNICAL PROVISIONS
2019 WMAT IDIQ

SECTION 01 TRENCH EXCAVATION & BACKFILL FOR PIPELINES AND APPURTENANT STRUCTURES

A. Technical Provision Section 1 (TP-01.03 WORK WITHING RIGHT OF WAYS AND TRAFFIC CONTROL)

Add after second to last paragraph:
Contractor shall submit request to Owner or Owner's Representative for any proposed road or lane closures. Notifications shall be made to the proper tribal departments and traffic control plan shall include traffic re-routing plans.

B. Technical Provision Section 1 (TP-01.06 PROTECTION OF UTILITIES)

Add after the end of the first paragraph:
Contractor shall complete all repairs to mains or service lines in accordance with the WMAT TUA Standard Operating Procedures for Utility Repairs.

C. Technical Provision Section 1 (TP-01.06 PROTECTION OF UTILITIES)

Add after the end of the second paragraph:
Contractor shall document pre-construction site conditions by video or photograph.

D. Technical Provision Section 1 (TP-01.07.A.2.a LOCATING FACILITIES FOR INSTALLED SANITATION FACILITIES/Warning Tape and Tracer Wire/Tracer Wire)

Add to the end of the paragraph:

- ***The Contractor shall not over strip the jacket off the wire when connecting to access box or to connectors/splice kits. Bare wire shall not be allowed to touch the soil.***
- ***Uninsulated tracer wire shall not be allowed.***
- ***Connectors/splice kits shall be used as needed at piping tee (3-way) and cross (4-way) configurations.***
- ***All mainline and service line tracer wires shall be interconnected at intersections, such as pipeline tees and crosses.***
- ***Connectors shall provide a water proof and corrosion-proof connection. Copperhead Connectors shall be approved as equals.***

- ***Tracer wire connections shall not be made by only taping the end wires together. Only approved connectors will be allowed for all tracer wire connections.***
- ***Match connector to the size of the wire.***
- ***Non-locking friction fit or taped connectors are not allowed. Spray coating shall not be allowed.***
- ***Tracer wire shall not be doubled up at the wire at any point in the connection process.***
- ***Di-electric anti-corrosion wax/gel shall be used to protect the wires at the access box connection points.***
- ***The tracer wire shall be attached to the pipe on the bottom half of the pipe. (just below the vertical centerline of the pipe).***
- ***2-feet of excess/slack wire is required to be curled up inside all tracer wire access boxes after meeting final elevation.***
- ***Duct tape, mastic, electrical tape or plastic ties shall be used to attach the tracer wire to the pipe.***
- ***Install tracer wire boxes at all points of connections to existing systems and directly above the pipe.***

E. Technical Provision Section 1 (TP-01.07.A.2.c LOCATING FACILITIES FOR INSTALLED SANITATION FACILITIES/Warning Tape and Tracer Wire/Tracer Wire)

Change:
All tracer wire shall be tested for continuity after installation in the presence of the Owner's Representative. Tracer wire shall be repaired or replaced, as necessary, until continuity is achieved, at no additional cost to the Owner.

To:
All tracer wire shall be tested for ***proper functioning using a conductive/inductive type locator in the presence of the Owner or Owner' Representative. This verification shall be performed after final backfill and prior to final acceptance of the project.*** Tracer wire shall be repaired or replaced, as necessary, until ***proper functioning/traceability*** is achieved, at no additional cost to the Owner.

F. Technical Provision Section 1 (TP-01.08.F EXCAVATION/Underground obstructions)

Add after the 2nd paragraph.
Price of any needed rerouting will be negotiated between the Contractor and the Owner.

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G. Technical Provision Section 1 (TP-01.08.J EXCAVATION)

Add New Section ***J. Dust Control*** after Section I. Removal of Nuisance Water:

J. Dust Control: ***The Contractor shall spray the construction areas and access roads with water to mitigate dust migration as directed by the Owner's Representative, at the Contractor's expense, including the cost of obtaining water for dust control.***

H. Technical Provision Section 1 (TP-01.10.F SEPARATION OF WATER AND SEWER PIPELINES/Extra Protection)

Add after existing text:
Payment for extra protection relating to ductile iron pipe or concrete pipe encasement shall be paid for as specified in the bid schedule and these specifications.

Concrete Pipe Encasement: ***Shall meet the requirements set forth in TP 01.10.F as well as the provisions and requirements set forth in the detail drawing for encasement of the pipe line in reinforced concrete.***

I. Technical Provision Section 1 (TP-01.11.D.3 BACKFILLING/Placement/Backfill for Road Subgrade)

Add into last sentence:
"Tribal" to list of road authorities.

J. Technical Provision Section 1 (TP-01.11.D.3.a BACKFILLING/Placement/Backfill for Road Subgrade)

Add after existing text:
The subgrade shall be tested and approved prior to placement of any base material.

K. Technical Provision Section 1 (TP-01.12.A COMPACTION REQUIREMENTS, METHODS AND TESTING/Minimum Density)

Add after existing text:
The Contractor shall be responsible for meeting the necessary moisture content. Contractor shall provide the equipment necessary (water truck, water wagon, etc.) to obtain water for the project site.

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L. Technical Provision Section 1 (TP-01.12.B COMPACTION REQUIREMENTS, METHODS AND TESTING/Reference Densities/Baseline Testing)

Change 2nd sentence in 2nd paragraph:
The Contractor shall submit for approval a testing plan identifying proposed testing locations prior to the start of any excavation work.

To:
The Contractor shall ***work with the Owner's Representative to select the testing locations*** prior to the start of any excavation work.

M. Technical Provision Section 1 (TP-01.13 ROADWAY RESTORATION AND PATCHING)

Add into second to last sentence:
"Tribal" to list of road authorities.

N. Technical Provision Section 1 (TP-01.13.B.2 ROADWAY RESTORATION AND PATCHING/Asphalt Patch)

Add before second to last sentence:
The asphalt mix shall be placed directly over the hardened slurry backfill. If the slurry backfill has been placed to the existing road surface, a 3-inch depth shall be excavated and leveled prior to installation of asphalt.

O. Technical Provision Section 1 (TP-01.13.B.2 ROADWAY RESTORATION AND PATCHING/Asphalt Patch))

Add to end of paragraph:
Cold mix may be allowed to be placed temporarily with approval from the Owner or Owner's Representative. Cold mix will only be allowed to be placed temporarily until hot mix is available. At that point, then the cold mix shall be removed/disposed of and the hot mix shall be applied. Contractor shall coordinate the schedule for this work with the Owner.

P. Technical Provision Section 1 (TP-01.17 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

Add after the existing text:
The Contractor and Owner shall negotiate a price for each SWPPP that is required on a per project basis.

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Q. Technical Provision Section 1 (TP-01.21 SEEDING)

Add to end of the paragraph.
Where a grass lawn is disturbed, the Contractor shall place a generous amount of grass seed on the disturbed area following Final Grading. If there is risk that the seeds will not take root due to cold seasonal temperatures, a bag of grass seed can be given to the homeowner for them to apply at their own discretion, if the homeowner, Owner and Owner's Representative agree to this.

R. Technical Provision Section 1 (TP-01.22 RECORD DRAWINGS)

Add to the end of the last paragraph.
The record drawings completed by the Contractor and submitted to the Owner shall be clear and legible drawings.

S. Technical Provision Section 1 (TP-01.23.A MEASUREMENT AND PAYMENT/Solid Rock Excavation)

Add to the end of paragraph.
Payment for solid rock removal shall include the use of drilling, blasting, rippers or other specialized equipment. Payment shall be based on the depth of solid rock excavation from 0 feet to 8 feet and from greater than 8 feet to 12 feet, as shown in the Bid Schedule.

T. Technical Provision Section 1 (TP-01.23.G MEASUREMENT AND PAYMENT/Seeding)

Add to the end of the last paragraph.
Change unit of payment from "Lump Sum" to "Pounds".

U. Technical Provision Section 1 (TP-01.23.H MEASUREMENT AND PAYMENT/Exploratory Time)

Add to the end of the last paragraph.
In addition to locating existing utility lines for the current project, this may also be for specifically requested circumstances such as locating a buried item for a future design or excavating soil pits for soil analysis. In these situations, payment shall be made by the unit price per hour of exploratory time (backhoe excavation) specifically requested by the Owner or Owner's Representative for a special situation and compensation will be made only for the time needed on site to complete the work in accordance with the project documents. The start time and end time shall be recorded and concurred upon by the Contractor and Owner's Representative.

INCORPORATED INTO THE CONTRACT

Payment for Exploratory Time shall be at the contract unit price shown in the Bid Schedule for 1) without a laborer or 2) with a laborer, depending on if a laborer is actively needed for the duration of the exploratory time, in addition to the operator that is operating the equipment.

V. Technical Provision Section 1 (TP-01.23.I MEASUREMENT AND PAYMENT/Record Drawings)

Add the following Sections after Section I. Record Drawings.

J. Concrete Utility Encasement

Payment shall be made by the unit price per actual linear feet installed in accordance with the project documents. Payment shall be full compensation for furnishing all labor, tools, equipment, compaction, and material, and performing all operations including excavation, reinforcement, concrete and all incidentals. Compensation shall be made only for that volume necessary to complete the work in accordance with the plans and specifications.

K. Road Crossing

Payment for road crossings shall be made by the unit price for the type of crossing specified per linear foot excavated and measured horizontally along the center line of the trench (between edges/width of existing pavement) in accordance with the project documents. Payment shall be full compensation for furnishing all labor, tools, equipment, compaction, and material, and performing all operations (saw cutting, excavation, debris removal, delivery & placement of backfill, subgrade, concrete, reinforcement and/or asphalt) in connection with the installation of road crossings across roads as shown on the drawings and in accordance with the details and specifications. The cost of the pipe itself shall be covered under the respective unit price for each pipe type.

L. Aggregate Resurfacing

Payment for aggregate resurfacing/regraveling shall be made by the unit price per cubic yard installed in accordance with the project documents. Payment shall full compensation for placing the aggregate and other materials needed, including compacted subgrade and restoration to original condition. Compensation will only be made for the area necessary to complete the work in accordance with the plans and specifications.

M. Temporary Cold Mix Asphalt Patch

Payment for temporary cold mix asphalt patch shall be made by the unit price per cubic yard of material in accordance with the specifications. Payment shall be full compensation for placing the cold mix asphalt patch and other materials needed, including compacted subgrade and also for the removal and disposal of the temporary cold mix when hot mix becomes available. Compensation shall be made only for that area necessary to complete the work in accordance with the plans and specifications.

N. Remove and Replace Sidewalk

Payment shall be made by the unit price per square foot of sidewalk replaced. Compensation will be made only for that sidewalk replacement necessary to complete the work in accordance with the

project documents. Contractor shall match the thickness of the existing sidewalk. If the Owner determines the Contractor has performed sidewalk replacement unnecessary for the proper completion of the work, no payment will be made for that portion of the replacement. Payment shall be full compensation for all materials for replacing the sidewalk. Payment shall include cost of concrete and forms; excavation; necessary compaction and disposal of old concrete.

O. Cibecue Mobilization
Payment shall be made by the unit price per each Delivery Order where a portion of the work is in Cibecue, AZ. If consecutive Delivery Orders have work in Cibecue, no mobilization fee will be added to the subsequent Delivery Order. Payment shall be full compensation for all work, time, and expenses necessary to mobilize the equipment, materials, and crew to Cibecue.

W. Technical Provision Section 1 (SUBMITTAL)

Change:
1.12 Density Testing Location Plan

To:
1.12 ***Density/Baseline*** Testing Location Plan

SECTION 02 CAST-IN-PLACE CONCRETE

A. Technical Provision Section 2 (TP-02.07 FIELD TESTING)

Remove from last paragraph:
…yard hydrant concrete pads….

SECTION 04 WATER TRANSMISSION AND DISTRIBUTION MAIN

A. Technical Provision Section 4 (TP-04.03.E.1.b MATERIALS/Gate Valves/General)

Add to end of existing text:
Contractor shall provide (1) gate valve wrench for every (10) gate valves installed.

INCORPORATED INTO THE CONTRACT

B. Technical Provision Section 4 (TP-04.13.D.6 FLUSHING AND DISINFECTION OF MAINS/ Flushing after Disinfection)

Change:
Flushing shall continue until all visible debris has been removed and the chlorine concentration is the same as in the existing system, or not more than 0.4 mg/l in a new or unchlorinated system.

To:
Flushing shall continue until all visible debris has been removed and the chlorine concentration ***is between 0.4 and 0.8*** mg/l in a new or unchlorinated system

C. Technical Provision Section 4 (TP-04.16.A METHOD OF MEASUREMENT AND BASIS FOR PAYMENT/Water Pipe)

Add to end of text:

…***and utility line marker, metal marker post, polywrap and board insulation, as needed.***

D. Technical Provision Section 4 (TP-04.16.F METHOD OF MEASUREMENT AND BASIS FOR PAYMENT/Combination Air Release and Vacuum Valve and Vault)

Remove from the body of text:

… drain pipe and screen, drain pipe outlet erosion protection…

Add to end of text:

…***and utility marker.***

E. Technical Provision Section 4 (TP-04.16.H METHOD OF MEASUREMENT AND BASIS FOR PAYMENT/Testing)

*Add New section **I. Vault Drain Asssembly (without pipe)** after Section H. Testing:*

I. ***Vault Drain Assembly (without pipe): Payment for the vault drains shall be at the unit bid price as stated in the Bid Schedule. Payment shall be full compensation for furnishing and installing the connection to the vault, steel mesh, flange adapter, rectangular accessory bolt pack kit, outlet erosion protection, compaction, water tight connections and appurtenances, including all incidentals, in conformance with the plans and specifications. The drain pipe shall not be included in this bid item but shall be paid for based on the type and size of pipe used at the unit bid price as stated in the Bid Schedule.***

INCORPORATED INTO THE CONTRACT

F. Technical Provision Section 4 (Submittals)

Add submittal:

04.06 Asbestos-Abatement Contractor Documentation

SECTION 05 WATER SERVICE LINES

A. Technical Provision Section 5 (TP-05.01 SCOPE)

Add the following after the existing text:

Per the 2017 Tribal Plan of Operations, the Residential New Connection Fee for water service is set at $300.00 for homes which are being served under active IHS/SFC projects. The Indian Health Service, has determined that this fee is authorized for payment by IHS, pending available funding. The Contractor is not responsible for paying this water service line connection fee.

B. Technical Provision Section 5 (TP-05.03.D. WATER SERVICE LINE MATERIALS/Service Saddles)

Add the following after the existing text:

Ford S71 Brass Style A Single Strap Saddle, or equal, shall be allowed for water main taps on standard PVC pipe. Ford S91 Brass Style A Single Strap Saddle, or equal, shall be allowed for water main taps on C900 pipe.

C. Technical Provision Section 5 (TP-05.03.E. WATER SERVICE LINE MATERIALS /Corporation Stops)

Add the following after the existing text:

Ford FB 1101 Ballcorp, or equal, shall be allowed for ¾" and 1"diameter water main taps. Mueller H-15026 shall be allowed for 1" diameter water main taps and Ford FB 1001-7-IDR7, or equal for 2" diameter water main taps.

D. Technical Provision Section 5 (TP-05.03.G.1 WATER SERVICE LINE MATERIALS/Water Meter and Box Combination/Coppersetter)

Add after first sentence:

Coppersetters shall have a tie-bar when they are above 15" in height. Copper setter shall be copper with a horizontal inlet and outlet and a locking angle stop. The coppersetter shall raise the meter above the normal service line bury depth so as to place the top of the meter and angle valve no less than 6 inches and no more than 12 inches below the top surface of the finished meter box.

INCORPORATED INTO THE CONTRACT

E. Technical Provision Section 5 (TP-05.03.G.3 WATER SERVICE LINE MATERIALS/Water Meter and Box Combination/Water Meter)

Change:
The water meter shall be a sealed register magnetic drive water meter with nutating disc, positive displacement, magnetic, or ultrasonic lead-free meter. The meter shall be Badgermeter Model 25, Sensus iPerl, Neptune T10 series, Kamstrup Ultrasonic water meter, or equal as indicated on the project plans and as approved by Owner and noted on the Bid Schedule.

To:
The water meter shall be a sealed register magnetic drive water meter with nutating disc, positive displacement, magnetic, or ultrasonic lead-free meter. The meter shall be ***a 5/8 x ¾" lead free Neptune T10 R900i AMR*** water meter, as indicated on the project plans and as approved by Owner and noted on the Bid Schedule. Unit of measurement shall be in U.S. gallons.

F. Technical Provision Section 5 (TP-05.03.G.4 WATER SERVICE LINE MATERIALS/Water Meter and Box Combination/Meter Box and Cover)

Change:
Boxes in traffic areas shall be wire reinforced concrete with steel diamond plate or cast iron covers with interlocked sections. Boxes and covers in non-traffic areas shall be wire reinforced concrete. All sections of all boxes shall be nested or otherwise interlocked to prevent lateral movement. Sufficient sections shall be installed to provide a walled enclosure for a minimum depth of 6 inches below the angle valve. Minimum cover opening dimensions shall be 9-inches by 14-inches. Pea gravel or 3/4 inch crushed rock shall be placed inside the meter can below the water meter to a minimum depth of three (3) inches as shown on the drawings. The meter box shall be installed on bricks or masonry block on top of the prepared subsurface.

To:
The coppersetter and meter shall be enclosed within a standard sized meter box as shown on the detail drawings. All meter boxes shall be wire reinforced concrete boxes. Lids for boxes in residential areas shall be of polymer material with a touch read or I-Tron Slot. Lids for boxes in traffic areas shall be traffic rated steel diamond plate lids with stainless steel bolts. All sections of all boxes shall be nested or otherwise interlocked to prevent lateral movement. Sufficient sections shall be installed to provide a walled enclosure for a minimum depth of 6 inches below the angle valve. ***Minimum cover opening dimensions shall be 14 1/8-inches by 21 3/4-inches. The box shall be an Old Castle Precast High Density Concrete Box conforming to Mag Spec 320 #2 Meter Box, or approved equal.*** Pea gravel or 3/4 inch crushed rock shall be placed inside the meter can below the water meter to a minimum depth of three (3) inches as shown on the drawings. The meter box shall be installed on bricks or masonry block on top of the prepared subsurface.

INCORPORATED INTO THE CONTRACT

G. Technical Provision Section 5 (TP-05.03.H WATER SERVICE LINE MATERIALS/Tracer Wire, Tracer Wire Access Point and Warning Tape)

Add the following after the existing text:
A tracer wire access point/box shall not be installed for water service line installations. The tracer wire shall just terminate inside the meter box with enough wire length (~ 2 ft excess slack) to reach from the meter box opening.

H. Technical Provision Section 5 (TP-05.05.A.1 WATER SERVICE LINE INSTALLATION/Water Service Lines)

Add the following after existing text:
Proper compaction shall be provided beneath the saddle and water service line connection to minimize or eliminate settlement from the resulting loading at this connection. If possible, excavation for the water service line shall be at the tap angle.

I. Technical Provision Section 5 (TP-05.05.A.2 WATER SERVICE LINE INSTALLATION/Water Service Lines)

Change:
PE Pipe shall be installed with sufficient slack for thermal expansion and contraction.

To:
PE Pipe shall be installed with sufficient slack for thermal expansion and contraction ***and to prevent pulling apart of the joints when the backfill is placed.***

J. Technical Provision Section 5 (TP-05.05.A.9 WATER SERVICE LINE INSTALLATION/Water Service Lines)

Change:
Install Tracer Wire and Warning Tape along the water service lines from the water main to the meter box and to the building, or as shown on the drawings. Tracer wire shall be installed and tested in accordance with TP 01.

To:
Install Warning Tape along the water service lines from the water main to the meter box and to the building, or as shown on the drawings. ***Tracer wire shall be installed in consultation with the Tribal Utility and the Owner's Representative and will only be installed on a case by case basis. Typical sites where tracer wire might be installed are where the distance from the water main to the meter/shut-off is greater than 30 feet and if the water service line alignment is not straight from the water main to the meter/shutoff.*** Tracer wire shall be installed and tested in accordance with TP-01**.**

INCORPORATED INTO THE CONTRACT

K. Technical Provision Section 5 (TP-05.05.C WATER SERVICE LINE INSTALLATION/Water Meter and Box)

Add the following after existing text:
The coppersetter shall be connected with water tight connections to the water service line. Use brace bar to maintain a vertical (plumb) alignment of the coppersetter. The meter shall be installed in accordance with the manufacturer's recommendations. The tracer wire shall be brought up along the coppersetter and shall terminate by the locking angle stop. The Contractor shall verify that the meter is functioning properly by observing the visual display in front of the Owner's Representative.

L. Technical Provision Section 5 (TP-05.07 PRESSURE TESTING AND FLUSHING)

Add the following after the second paragraph:
This value is typically 0.4 – 0.8 mg/L.

M. Technical Provision Section 5 (TP-05.09.A MEASUREMENT AND PAYMENT/Water Service Lines)

Add after existing text:
…and board/pipe insulation (as needed), pipe hangers, warning tape and tracer wire.

SECTION 06 GRAVITY SANITARY SEWERS

A. Technical Provision Section 6 (TP-06.03.B.2.a MATERIALS/Manholes/Lines and Grades)

Change:
Sewer line cut stakes shall be provided by the Contractor, at each manhole and at the midpoint between each manhole at a minimum.

To:
Sewer line cut stakes shall be provided by the Contractor, ***in consultation with the tribal utility and the Owner's Representative,*** at each manhole and at the midpoint between each manhole at a minimum.

B. Technical Provision Section 6 (TP-06.03.B.2.b MATERIALS/Manholes/Lines and Grades)

Add c) after b)
c) If schedule permits, the Owner's Representative can provide the sewer line cut stakes, but this will be on a case by case basis and shall be arranged by the Contractor and the Owner's Representative in advance of the needed staking.

INCORPORATED INTO THE CONTRACT

C. Technical Provision Section 6 (TP-06.03.B.4.c MATERIALS/Manholes/Steps)

Add d) after c)

d) Maximum spacing from the top of the cone to the first step shall be 16-inches. If shown on the drawings, another step can be added closer to the top of the cone. All steps shall be installed by the manhole manufacturer.

D. Technical Provision Section 6 (TP-06.03.B.5.b MATERIALS/Manholes/Adjustment/Grade Rings/Concrete)

Add iii) after ii)

Concrete grade rings will only be allowed on a case by case basis with prior approval from the Owner or Owner's Representative or as shown on the drawings.

E. Technical Provision Section 6 (TP-06.03.E MATERIALS/Markers and Bollards)

*Add New section **F. Steel Casing Piers** after Section E. Markers and Bollards:*

F. Steel Casing Piers:

1. ***Piers shall be composed of 8-inch diameter standard steel casing.***
2. ***Size of strap iron and steel channel shall be as shown on the detail drawing.***
3. ***Pier shall be set in a 3-feet diameter or square reinforced concrete base. Steel reinforcement size and layout shall be in accordance with the detail drawing.***
4. ***Concrete base shall be 2.5-feet deep, as shown in the detail drawing.***
5. ***Paint used for the exposed steel shall be an epoxy or enamel UV protectant paint that bonds well with steel and is tan in color.***
6. ***Concrete and steel reinforcement shall meet the requirements of TP 02 and TP 03, respectively.***

F. Technical Provision Section 6 (TP-06.06.B.7 INSTALLATION OF GRAVITY SEWER LINES/Pipe Laying)

Change:

All sewer main line stub-outs shall be plugged. A PVC cap shall be solvent welded to the main line stub out. A piece of No. 3 rebar, 1-foot in length shall be installed to mark the main line stub out. Bury the rebar 6 inches below ground surface. A PE marker painted green shall also be installed at this same location.

INCORPORATED INTO THE CONTRACT

To:

All sewer main line stub-outs shall be plugged. A PVC cap shall be solvent welded to the main line stub out. A piece of No. 3 rebar, 1-foot in length shall be installed to mark the main line stub out. Bury the rebar 6 inches below ground surface. ***A section of 8" SDR 35 pipe with a PVC cap, shall be installed to mark the stub-out terminus. The pipe shall extend from near the stub-out terminus to approximately 12" above finished grade.***

G. Technical Provision Section 6 (TP-06.06.B INSTALLATION OF GRAVITY SEWER LINES/Pipe Laying)

Add New section ***C. Pipe Supporting Piers*** *after Section B. Pipe Laying:*

C. Pipe Supporting Piers:

1. ***Piers shall be installed at the locations shown in the plans.***
2. ***Piers shall be set to maintain the slope and elevation of the gravity main as indicated in the plans or instructed by the Owner's Representative.***
3. ***Soil shall be properly compacted before concrete base is poured.***
4. ***All #4 reinforcement bars shall be tied together.***
5. ***Top of concrete base shall be 2-inches above finished grade.***
6. ***Channel and straps (top pipe support) shall be welded as shown on the detail drawing.***
7. ***Pier strap iron (pipe support placement) shall be set to restraint the sewer pipe at a maximum of 6-inches from the bell of the pipe.***
8. ***Contractor shall verify that sewer pipe is securely restrained to the steel piers and that the sewer pipe meets the required slope and elevation.***
9. ***All exposed steel casing, channel and strap shall be painted.***

H. Technical Provision Section 6 (TP-06.07.F.5 INSTALLATION OF MANHOLES/Frame Cover and Collar)

Add 6. after 5.

6. In unimproved areas, the collar can be rounded down or have a 90 degree edge. Consult with tribal utility and Owner's Representative.

INCORPORATED INTO THE CONTRACT

I. Technical Provision Section 6 (TP-06.07.H INSTALLATION OF MANHOLES/Pipe to Manhole Connections)

Add New section ***I. Beaver Slide Manhole*** *after Section H. Pipe to Manhole Connections:*

I. Beaver Slide Manhole:

1. On a case by case basis, beaver slide manhole may be allowed where the invert of the inlet pipe is above the crown of the outlet pipe. This would typically be for elevation drops in the manhole channel greater than 0.1 feet but less than 2 feet.

2. Beaver slides shall be constructed to provide a smooth and continuous channel directed into and with the flow of the receiving sanitary sewer in accordance with the detail drawing. This style of manhole channel (beaver slide) shall be filleted to prevent solids deposition.

3. Prior approval must be obtained from the Owner's Representative before this is constructed in the field.

4. No separate or additional payment shall be made for a beaver slide that is constructed in a manhole. Payment shall be based on the unit price in the Bid Schedule for the type of manhole for which it is used (i.e. standard, shallow, etc.).

J. Technical Provision Section 6 (TP-06.14.I MEASUREMENT AND PAYMENT/Sewer Video Inspection)

Add New sections ***J. Manhole Coating and K. Steel Casing Piers*** *after Section I. Sewer Video Inspection:*

J. Manhole Coating: Payment for manhole coating shall be at the unit bid price as stated in the Bid Schedule. Payment shall be full compensation for furnishing and applying the coating/lining system including but not limited to surface preparation, applying the prime coat and top coat, safety and includes all incidentals, in conformance with the plans and specifications.

K. Steel Casing Piers: Payment for the steel casing piers shall be at the unit bid price as stated in the Bid Schedule. Payment shall be full compensation for furnishing and installing the steel piers, reinforced concrete base, compaction, strap iron, steel channel, welding, restraining pipe and includes all incidentals, in conformance with the plans and specifications.

INCORPORATED INTO THE CONTRACT

SECTION 07 SEWER SERVICE LINES

A. Technical Provision Section 7 (TP-07.02 GENERAL)

Add after the third sentence in the first paragraph:
Contractor shall consult with the Tribal Utility and the Owner's Representative for the staking of the sewer service line and sewer main tap.

B. Technical Provision Section 7 (TP-07.02 GENERAL)

Add after the first sentence in second paragraph:
Currently the Tribal Utility is not charging a connection fee for sewer service lines. If connection fees are charged in the future, IHS will be paying for this cost. The Contractor is not responsible for paying this sewer service line connection fee.

C. Technical Provision Section 7 (TP-07.04.A.1.d INSTALLATION/Sewer Service Line/Connection to Building)

Add after existing text:
If the sewer service line needs to be buried with less than 12-inches of cover, consult with the Owner's Representative to determine if the pipe material needs to be changed to Schedule 40, SDR 21 PVC, DIP or other.

D. Technical Provision Section 7 (TP-07.04.A.2.b INSTALLATION/Sewer Service Line/Pipe Slope and Bends)

Add after existing text:
The Owner's Representative may permit a minimum slope of 1/8-inch per foot (1%) or steeper than ½-inch (4%) on a case by case basis. However, Contractor needs to obtain prior approval from Owner's Representative to make this change.

E. Technical Provision Section 7 (TP-07.04.A.5.b & c INSTALLATION/Sewer Service Line/No Building Connection)

Delete:
c)

Add:
c) A section of 4" SDR 35 pipe with a pvc cap, shall be installed to mark the service line terminus, as shown in the detail drawings. The pipe shall extend from the sewer service line terminus to approximately 12" above finished grade.

INCORPORATED INTO THE CONTRACT

F. Technical Provision Section 7 (TP-07.04.B.1.b INSTALLATION/Cleanouts/Locations)

Add after b):
For connections to deep mains (8' or greater) a two way cleanout may be required right before the service line slopes down to the sewer main, at the right of way or as shown on the plans or instructed by the Owner's Representative.

G. Technical Provision Section 7 (TP-07.04.C INSTALLATION/Sewer Main Connection)

Delete last sentence of second paragraph:
Any damage to sewer mains or property incurred during the tapping process shall be repaired by the Contractor at his own expense and in a method approved by the Owner or Owner's Representative.

Replace with:
Contractor shall take the necessary precautions to prevent damage to the sewer main during the tapping process.

H. Technical Provision Section 7 (TP-07.04.C.2 INSTALLATION/Sewer Main Connection/Connections to Existing Sewer Mains)

*Add New Section **3. Risers in Rock Trenches** after Section 2. Connections to Existing Sewer Mains:*

3. Risers in Rock Trenches

- ***a) Install riser pipe onto the sewer main approximately vertical.***
- ***b) Encase the bottom of riser, wye and 1/8 bend in crushed rock or sand.***
- ***c) Extend bedding the full width of the trench as excavated and not less than 18 inches in length from either side of the center of the riser.***
- ***d) Place bedding material to a point 12 inches above centerline of the sewer main at the location of the wye.***

I. Technical Provision Section 7 (TP-07.07.A MEASUREMENT AND PAYMENT – SEWER SERVICE LINES/Sewer Service Line)

Delete:
…***sewer wye or sewer saddle***…

INCORPORATED INTO THE CONTRACT

J. Technical Provision Section 7 (TP-07.07.B MEASUREMENT AND PAYMENT – SEWER SERVICE LINES/Cleanouts)

*Add New sections **C. Sewer Wye Main Line Connection** and **D. Sewer Saddle Main Line Connection** after Section B. Cleanouts:*

J. Sewer Wye Main Line Connection: Payment for the sewer wyes shall be at the unit bid price as stated in the Bid Schedule. Payment shall be full compensation for furnishing and installing the wye branch fitting, caps, plugs, riser pipe, compaction, water tight connection and appurtenances, including all incidentals, in conformance with the plans and specifications.

K. Sewer Saddle Main Line Connection: Payment for the sewer saddles shall be at the unit bid price as stated in the Bid Schedule. Payment shall be full compensation for furnishing and installing the sewer saddle, fasteners/bands, pvc tape, riser pipe, compaction, water tight connection and appurtenances, including all incidentals, in conformance with the plans and specifications.

SECTION 11 ROADWAY, RAILROAD AND SPECIAL UTILITY CROSSINGS

A. Technical Provision Section 11 (TP-11.01 SCOPE OF WORK)

Change second sentence in second paragraph from:
Copies of applicable permits obtained by the Owner shall be included in the Appendix to these Technical Provisions.

To:
Copies of applicable permits obtained by the Owner shall be ***provided to the Contractor, as necessary per each project site, to prepare their construction activities in accordance with the respective permit requirements.***

B. Technical Provision Section 11 (TP-11.01 SCOPE OF WORK)

Change third sentence in third paragraph from:
At least two (2) weeks prior to performing the crossing, the Contractor shall submit a signed and dated traffic control plan showing how they intend to safely control traffic in the area of the crossing for review and approval by the Owner and the respective road authority.

To:
At least two ***(3)*** weeks prior to performing the crossing, the Contractor shall submit a ***digitally generated,*** signed and dated traffic control plan showing how they intend to safely control traffic in the area of the crossing for review and approval by the Owner and the respective road authority.

C. Technical Provision Section 11 (TP-11.01 SCOPE OF WORK)

Change last sentence in third paragraph from:
For road crossings, the Contractor shall have at least one lane open to traffic at all times unless otherwise required by traffic control plan.

To
For road crossings, the Contractor shall have at least one lane open to traffic at all times unless otherwise required by traffic control plan ***or the approved road crossing permit.***

D. Technical Provision Section 11 (TP-11.05 RAILROAD AND SPECIAL UTILITY CROSSINGS)

Change fourth sentence in paragraph from:
Copies of such permits shall be included in the Appendix of these specifications. If no special crossing permits are appended, and such crossings are indicated on the plans, crossings will comply with all applicable provisions of Section 01 of these Technical Provisions in addition to those indicated under other provisions of this Section.

To
Copies of such permits shall be ***provided to the Contractor by the Owner, as necessary per each project site.*** If no special crossing permits are ***provided***, and such crossings are indicated on the plans, crossings will comply with all applicable provisions of Section 01 of these Technical Provisions in addition to those indicated under other provisions of this Section.

SECTION 12 NON-AGGREGATE SEWAGE DISPOSAL SYSTEMS

A. Technical Provision Section 12 (TP-12.03.E MATERIALS/Septic Tank Risers)

Change
Risers, a minimum of 24 inches in diameter…

To
Risers, ***8-***inches in diameter…

B. Technical Provision Section 12 (TP-12.03.E.1 MATERIALS/Septic Tank Risers)

Change:
Risers shall be corrugated HDPE with a 24 inches HDPE UV protected heavy duty cover and stainless steel locking screws, or equal.

INCORPORATED INTO THE CONTRACT

To:

Risers shall be ***PVC SDR 35 pipe with 8-inch PVC SDR 35 gasketed caps. The concrete lids on the septic tank shall have an 8-inch PVC SDR 35 coupler cast into the lid by the septic tank manufacturer.***

C. Technical Provision Section 12 (TP-12.03.E.2 – E4 MATERIALS/Septic Tank Risers)

Delete E.2 - E.4 (These sections are not applicable)

D. Technical Provision Section 12 (TP-12.03.G.2 MATERIALS/Distribution Box Risers)

Change:

Risers shall be corrugated HDPE with a Polylok 24" HDPE heavy cover, part # 3008-HD, with stainless steel locking screws or approved equal. Or may be made of concrete, such as concrete grade rings, with approved water tight seals to the tank and an approved compatible riser cover or approved equal.

To:

Risers shall be ***an Old Castle Precast High Density Concrete Box conforming to Mag Spec 320 #2 Meter Box with a diamond plate steel lid, or approved equal.***

E. Technical Provision Section 12 (TP-12.03.G.3 MATERIALS/Distribution Box Risers)

Delete G.3 (This section is not applicable)

F. Technical Provision Section 12 (TP-12.03.L MATERIALS/Paint)

Change:

...green in color...

To:

...**white** in color...

INCORPORATED INTO THE CONTRACT

G. Technical Provision Section 12 (TP-12.04.A.4.c INSTALLATION/Sewer Service Line/No Building Connection)

Change:

A PE marker painted green shall also be installed at this same location.

To:

A section of 4-inch PVC SDR 35 pipe with a pvc cap, shall be installed to mark the sewer line terminus. The pipe shall extend from the sewer line terminus to about 12-inches above finished grade.

H. Technical Provision Section 12 (TP-12.04.C.1.c INSTALLATION/Septic Tank/Setting Tank)

Change:

…6-inch thick, minimum, bed of sand or gravel…

To:

…6-inch thick, minimum, bed of gravel…

I. Technical Provision Section 12 (TP-12.04.E.2 INSTALLATION/Septic Tank Risers)

Change:

All septic tank risers shall be connected to the top of the tank with a Ram-Nek flexible gasket as manufactured by the Henry Group (formerly K.T. Snyder Company) or equal water-tight material and grouted to the top of the tank, to eliminate water infiltration.

To:

All septic tank risers shall be connected to the ***tank lid by solvent welding the riser pipe into the 8-inch pvc coupler cast into the tank lid. The Contractor shall assure a watertight seal between the pipe & coupler and between the coupler and concrete lid*** to eliminate water infiltration.

J. Technical Provision Section 12 (TP-12.04.E.3 – E5 INSTALLATION/Septic Tank Risers)

Delete E.3 - E.5 (These sections are not applicable)

INCORPORATED INTO THE CONTRACT

K. Technical Provision Section 12 (TP-12.04.E.2 INSTALLATION/Septic Tank Risers)

Add to After Existing Text:

3. Use approved lubricant to install the PVC gasketed caps onto the top of the risers.

4. Riser pipes and caps shall be painted with two (2) coats of epoxy white spray paint for UV protection.

L. Technical Provision Section 12 (TP-12.04.G.2 INSTALLATION/Distribution Box Riser)

Add to Existing Text:

3. A concrete pad shall be poured around the distribution box to the size of the riser (concrete meter box). The riser shall be set on and sealed onto the concrete pad. A minimum of (1) distribution box shall be used.

M. Technical Provision Section 12 (TP-12.04.J INSTALLATION/Observation Ports)

Change:

Observation ports shall be constructed of solid four (4) inch PVC pipe and shall installed at the end of each chamber leg or as indicated on the plans.

To:

Observation ports shall be constructed of solid four (4) inch PVC pipe and shall be installed at the ***beginning and*** end, of ***the outermost*** chamber leg ***(total of 4)*** or as indicated on the plans.

N. Technical Provision Section 12 (TP-12.04.J.4 INSTALLATION/Observation Pipe)

Change:

… (2) coats of epoxy green spray paint…

To:

… (2) coats of epoxy ***white*** spray paint…

INCORPORATED INTO THE CONTRACT

O. Technical Provision Section 12 (TP-12.07.D MEASUREMENT AND PAYMENT/Septic Tank Risers)

Change:

… including one septic tank cover for each riser.

To:

… including one septic tank ***gasketed cap*** for each riser.

P. Technical Provision Section 12 (TP-12.07.E MEASUREMENT AND PAYMENT/Riser Safety Screens)

Delete E (This section is not applicable for TP 12)

Q. Technical Provision Section 12 (TP-12.07.G MEASUREMENT AND PAYMENT/Distribution Box Risers)

Change:

Payment for distribution box risers shall be at the unit price shown on the Bid Schedule, and based on actual feet (measure vertically) installed…

To:

Payment for distribution box risers shall be at the unit price shown on the Bid Schedule, and based on ***each box riser*** installed…

R. Technical Provision Section 12 (TP-12.07.J MEASUREMENT AND PAYMENT/Septic Tank Abandonment)

Delete 2nd paragraph:

If the existing septic tank is any material other than concrete, the Contractor shall be paid at the contract unit price measured each to pump and remove the existing septic tank. The Contractor shall be responsible for all costs associated with the removal, including, but not limited to transporting and disposing of the septic tank at a State licensed and approved waste disposal site located off the particular reservation where the work is to be performed. The payment shall also be full compensation for backfilling the void with soil from the designated area, and compaction to prevent subsidence and to bring it to the same level as the surrounding grade.

INCORPORATED INTO THE CONTRACT

S. Technical Provision Section 12 (Submittal Review Form)

Delete "Safety Screen" from TP 12.03E Submittal Specification:

SECTION 16 SINGLE RESIDENCE EFFLUENT LIFT STATION

A. Technical Provision Section 16 (TP-16.03.I.1.a MATERIALS/Controls/Enclosure)

Change:
…weatherproof enclosure equal to NEMA Type 4 enclosure…..

To:
…weatherproof enclosure equal to NEMA Type 4 ***or 4X*** enclosure…..

B. Technical Provision Section 16 (TP-16.03.I.3 MATERIALS/Controls/Alarm System)

*Add New Section **I.4 External Splice Box** after section I.3 Alarm System.*

I.4 External Splice Box

a) The wiring from the floats and pump shall be connected to a splice box in the pump access riser. The splice box shall be connected to the control panel power and alarm system.
b) The splice box shall be placed external to the access riser as shown in the detail drawing.
c) The external splice box shall be an Orenco SBEX1-4 or approved equal.

C. Technical Provision Section 16 (TP-16.03.K. MATERIALS/Effluent Discharge Line)

Add after existing text:
The disconnect assembly shall be set to be reached within 24" from the top of the riser.

D. Technical Provision Section 16 (TP-16.03.K.3 MATERIALS/Effluent Discharge Line)

Add after existing text:
The wye fitting shall have a threaded cap on the wye for access to service force line.

INCORPORATED INTO THE CONTRACT

E. Technical Provision Section 16 (TP-16.03.M MATERIALS/Septic Tank and Pump Tank Risers)

Change:
Title from "Septic Tank and Pump Tank Risers"

To:
"Pump Tank Risers"

F. Technical Provision Section 16 (TP-16.03.M MATERIALS/Septic Tank and Pump Tank Risers)

Change:

Manhole risers, a minimum of 24-inches in diameter, must be installed to provide access to the inlet of the septic tank for pumping/maintenance purposes, to the outlet of the septic tank for easy access the effluent filter, and to the opening of the pump tank that allows access to the effluent pump and piping system.

To:

Manhole risers, a minimum of 24-inches in diameter, must be installed to provide access to the opening of the pump tank that allows access to the effluent pump and ***effluent discharge*** piping system.

G. Technical Provision Section 16 (TP-16.03.M.3 MATERIALS/Septic Tank and Pump Tank Risers)

Change:

The Contractor shall provide one (1) extra safety screen to the Tribe for each septic tank or pump tank installed.

To:

The Contractor shall provide one (1) extra Safety Screen to the Tribe for each ***pump*** tank installed.

H. Technical Provision Section 16 (TP-16.03.M MATERIALS/Pump Tank Risers)

*Add New Section **M1. Septic Tank Risers** after Section M. Pump Tank Risers:*

M1. Septic Tank Risers

1. ***Risers, 8-inches in diameter, must be installed to provide access to the inlet of the septic tank for pumping/maintenance purposes and to the outlet of the septic tank to access the effluent filter.***
2. ***Risers shall be PVC SDR 35 pipe with PVC SDR 35 slip-on gasketed caps. The concrete lids on the septic tank shall have an 8-inch PVC SDR 35 coupler cast into the lid by the septic tank manufacturer.***

INCORPORATED INTO THE CONTRACT

I. Technical Provision Section 16 (TP-16.03.N MATERIALS/Service Force Line)

Add after existing text:
…unless otherwise specified by the Owner or Owner's Representative and shown on the drawings.

J. Technical Provision Section 16 (TP-16.03.N.1 MATERIALS/Service Force Line)

Add after existing text:
The pressure rating of the pipe shall be as shown in the Bid Schedule and on the drawings.

K. Technical Provision Section 16 (TP-16.04.A.4.c INSTALLATION/Sewer Service Line/No Building Connection)

Change:

An HDPE marker painted green shall also be installed at this same location.

To:

A section of 4-inch PVC SDR 35 pipe with a PVC cap, shall be installed to mark the sewer service line terminus. The pipe shall extend from the sewer line terminus to approximately 12-inches above finished grade.

L. Technical Provision Section 16 (TP-16.04.C.1.c INSTALLATION/Septic Tank/Setting Tank)

Change:

…6-inch thick, minimum, bed of sand or gravel…

To:

…6-inch thick, minimum, bed of gravel…

M. Technical Provision Section 16 (TP-16.04.E.1.c INSTALLATION/Pump Tank/Setting Tank)

Change:

…6-inch thick, minimum, bed of sand or gravel…

To:

…6-inch thick, minimum, bed of gravel…

INCORPORATED INTO THE CONTRACT

N. Technical Provision Section 16 (TP-16.04.F INSTALLATION/Septic Tank and Pump Tank Risers)

Change:
Title from "Septic Tank and Pump Tank Risers"

To:
"Pump Tank Riser"

O. Technical Provision Section 16 (TP-16.04.F INSTALLATION/Pump Tank Risers)

Change:

Disregard all references to "septic" tank. This section only applies to the "pump" tank.

P. Technical Provision Section 16 (TP-16.04.F.3 INSTALLATION/Pump Tank Risers)

Change:

Delete Section 16.04.F.3 since the concrete lids will not remain on pump tank and thus will not need this rope.

Q. Technical Provision Section 16 (TP-16.04.F INSTALLATION/Pump Tank Risers)

*Add New Section **F1. Septic Tank Risers** after Pump Tank Risers:*

F1. Septic Tank Risers

1. ***The Contractor shall install the approved covered risers for the inlet and outlet of the septic tank.***
2. ***The top of the riser covers shall be set at least 6-inches above finished grade.***
3. ***All septic tank risers shall be connected to the tank lid by solvent welding the riser pipe into the 8-inch PVC coupler cast into the tank lid. The Contractor shall assure a watertight seal between the pipe and coupler and between the coupler and concrete lid to eliminate water infiltration.***
4. ***Septic tank riser pipes and caps shall be painted with two (2) coats of epoxy white spray paint for UV protection.***

INCORPORATED INTO THE CONTRACT

R. Technical Provision Section 16 (TP-16.04.H INSTALLATION/Electrical Controls and Cable)

*Add New Section **H.2 External Splice Box** after Section H Electrical Controls and Cable*

H.2 External Splice Box

1. Install the external splice box per the manufacturer's recommendations.
2. The external splice box shall be mounted to exterior side of the riser with the top set at finished grade, as shown on the detail drawing.
3. Connect effluent pump and float wires to site wiring within external splice box. Provide water proof wire connectors; install cord grips on wiring penetrations.
4. Unused cord grips shall be plugged water tight with cord grip plugs.
5. Run appropriately sized wire from the splice box back to the control panel. Electrician shall determine wire size per NEC code.

S. Technical Provision Section 16 (TP-16.07.C MEASUREMENT AND PAYMENT/Septic Tank)

*Add New Section **C1. Septic Tank Risers** after Section C. Septic Tank:*

C1. Septic Tank Risers: Payment for septic tank risers shall be at the unit price shown on the Bid Schedule, and based on actual feet (measure vertically) installed, including one septic tank slip-on gasketed cap for each riser. Payment shall be full compensation for all materials, labor, and equipment required for a complete installation including: the water tight connection to the septic tank, backfilling, and compaction around the risers. No separate payment for the caps shall be made.

T. Technical Provision Section 16 (TP-16.07.E MEASUREMENT AND PAYMENT/Septic/Pump Tank Risers)

Change:

Title: "Septic/Pump Tank Risers"

To:

Pump Tank Riser

INCORPORATED INTO THE CONTRACT

U. Technical Provision Section 16 (TP-16.07.E MEASUREMENT AND PAYMENT/Pump Tank Riser)

Change:

Payment for septic/pump tank manhole risers shall be at the unit price shown on the Bid Schedule, and based on actual feet (measure vertically) installed, including one septic/pump tank cover for each riser. Payment shall be full compensation for all materials, labor, and equipment required for a complete installation including the water tight connection to the septic tank, rope for the concrete tank lids/covers, backfilling and compaction around the risers. No separate payment for the covers shall be made.

To:

Payment for pump tank riser shall be at the unit price shown on the Bid Schedule, and based on actual feet (measure vertically) installed, including one pump tank cover for each riser. Payment shall be full compensation for all materials, labor, and equipment required for a complete installation including the water tight connection to the pump tank, backfilling and compaction around the riser. No separate payment for the covers shall be made.

V. Technical Provision Section 16 (TP-16.07.F MEASUREMENT AND PAYMENT/Riser Safety Screen)

Change:

Payment for septic/pump tank riser safety screen...

To:

Payment for pump tank riser safety screen...

W. Technical Provision Section 16 (TP-16.07.G MEASUREMENT AND PAYMENT/Effluent Pump with Controls)

Add:

...and bollards, as needed.

INCORPORATED INTO THE CONTRACT

X. Technical Provision Section 16 (TP-16.07.J MEASUREMENT AND PAYMENT/Septic Tank Abandonment)

Change:

...and crushing the existing concrete tank…

To:

...and crushing the existing tank…

Y. Technical Provision Section 16 (SUBMITTAL REVIEW)

Change:

Bid Item: 16.03.M Septic/Pump Tank Riser, Safety Screen and Cover

To:

Bid Item: 16.03.M ***Pump*** Tank Riser, Safety Screen and Cover

Z. Technical Provision Section 16 (SUBMITTAL REVIEW)

Add:

New Bid Items:

16.03.I.4 External Splice Box

16.03.M1 Septic Tank Risers and Caps

SECTION 28 HIGH DENSITY POLYETHYLENE (HDPE) MAIN & FITTINGS

A. Technical Provision Section 28 (TP-28.06 PIPE CLEANING)

Add text as second to the last sentence:

Water shall be obtained from the WMAT TUA through the submission and approval of a WMAT Water Use Permit.

INCORPORATED INTO THE CONTRACT

SECTION 43 SEWER FORCE MAIN

A. Technical Provision Section 43 (TP-43.03.A MATERIALS/General)

Change third sentence from:
Plastic pipe with scratches, gouges, or grooves deeper than 10% of the wall thickness or ultraviolet discoloration shall be rejected.

To:
Plastic pipe with scratches, gouges, or grooves or ultraviolet discoloration shall be rejected.

B. Technical Provision Section 43 (TP-43.03.I.3 MATERIALS/Transition Manholes)

Add after 3.:
4. Payment for a new transition manhole shall be based on the type of manhole constructed (i.e. shallow, standard, etc.)

C. Technical Provision Section 43 (TP-43.03.F.2 MATERIALS/Gate Valve Boxes/Debris Cap)

Add into last sentence:
… or DC457…

D. Technical Provision Section 43 (TP-43.06.C.3 CONNECTIONS TO TRANSITION MANHOLE/Pipe to Manhole Connection)

Add after existing text:
4. The inner surface and rings of the transition manhole shall be lined with the manhole coating product as specified in TP 06. Surface preparation, application methods and safety measures shall follow the manufacturer's recommendation.

E. Technical Provision Section 43 (TP-43.10.A.1 WASTEWATER COMBINATION AIR/VACUUM VALVE AND MANHOLE INSTALLATION/General)

Change:
The air release valve and vault shall meet the requirements of TP 43.03.G.

To:
The air release valve and vault shall meet the requirements of TP 43.03.***H.***

INCORPORATED INTO THE CONTRACT

F. Technical Provision Section 43 (TP-43.14.A MEASUREMENT AND PAYMENT/Force Main)

Add to end of text:

…***and utility line marker, metal marker post, polywrap and board insulation, as needed.***

G. Technical Provision Section 43 (TP-43.14.E MEASUREMENT AND PAYMENT/Connection to Transition Manhole)

Add to end of text:

…***and manhole coating.***

INCORPORATED INTO THE CONTRACT

PAO/SFC TECHNICAL PROVISIONS (March 2019)

SECTION 01	TRENCH EXCAVATION & BACKFILL FOR PIPELINES AND APPURTENANT STRUCTURES
SECTION 02	CONCRETE
SECTION 03	REINFORCING STEEL
SECTION 04	WATER TRANSMISSION AND DISTRIBUTION MAINS
SECTION 05	WATER SERVICE LINES
SECTION 06	GRAVITY SANITARY SEWERS
SECTION 07	SEWER SERVICE LINE
SECTION 11	ROADWAY, RAILROAD, AND SPECIAL UTILITY CROSSINGS
SECTION 12	NON-AGGREGATE SEWAGE DISPOSAL SYSTEMS
~~SECTION 13~~	~~INDIVIDUAL PRESSURIZED DOSED SEWAGE DISPOSAL SYSTEM~~
SECTION 16	SINGLE RESIDENCE LIFT STATION
SECTION 28	HIGH DENSITY POLYETHYLENE (HDPE) PIPE & FITTINGS
~~SECTION 30~~	~~BOLTED STEEL WATER STORAGE TANK AND FOUNDATION~~
~~SECTION 31~~	~~WELDED STEEL WATER STORAGE TANK AND FOUNDATION~~
~~SECTION 34~~	~~COATINGS FOR WELDED STEEL WATER STORAGE TANKS~~
~~SECTION 42~~	~~SEWAGE LIFT STATION~~
SECTION 43	SEWER FORCE MAINS
SECTION 56	HORIZONTAL DIRECTIONAL DRILLING
SECTION 60	CHAIN LINK FENCING

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 01 - TRENCH EXCAVATION AND BACKFILL FOR PIPELINES AND APPURTENANT STRUCTURES

TP - 01.01 SCOPE:

The work covered by this section includes the furnishing of all labor, tools, equipment, and materials and performing all operations in connection with the excavation, trenching and backfilling of all pipe lines, structures and accessories.

Excavation, as used in these specifications refers to all construction activities necessary to install subsurface utilities in accordance with the plans and specifications. Such activities include, but are not limited to:

A. All necessary clearing, grubbing and site preparation; removal of all materials that may interfere with construction activities (except existing pipe work, conduits, utility structures or other items to be left in place) to the lines and grades indicated on the plans and otherwise described herein.

B. Removal and/or storage of subsurface materials from trench and construction excavation areas to allow installation of designated utilities or structures. All suitable material removed from excavations shall be used, insofar as practicable, in the formation of embankments, fills and backfilling.

C. Preparation of sub-grades and backfilling of trench and construction areas upon completion of utility or structure construction.

D. All necessary bracing, shoring and protection (but not including tight sheeting in trenches and structure excavation ordered left in place by the Owner or Owner's Representative).

E. Final grading, dressing and cleanup of the construction site.

TP - 01.02 SAFETY - PROTECTION OF EXCAVATION, WORK AND PERSONS:

The Contractor shall provide safe working conditions at all excavations. All trench excavation shall be coordinated in strict accordance with current Occupational Safety and Health Standards (OSHA) - Construction Standards for Excavations (29 CFR Part 1926, Subpart P) issued by the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) as well as applicable state and local regulations. It is the Contractor's responsibility to become knowledgeable of the regulations and comply with all requirements contained therein.

Excavations and adjacent areas shall be inspected daily by an OSHA certified competent person provided by the Contractor for evidence of hazardous conditions. A record of these inspections shall be kept by the Contractor and be made available to the Owner upon request. Workers in excavations shall be protected from cave-ins. Protection can be by sloping and benching systems, support systems, shield systems, and/or other protective systems as described in the regulations. Only excavations which are entirely in stable rock or excavations which are less than five (5) feet in depth and, upon examination by a competent person, show no indication of potential cave-in are exempt from the requirement for cave-in protection.

A. Trenches: No material shall be placed within two (2) feet of the edge of the excavation. Where employees are required to be in excavations more than four (4) feet deep, an adequate means of exit such as a ladder or steps shall be provided and located so as to require no more than 25 feet of lateral travel. It is the Contractor's responsibility to become knowledgeable of the regulations and comply with all requirements contained therein. The total length of open trench shall not exceed 500 feet at any time. Trenches shall be completely backfilled at the end of each working day, unless otherwise approved by the Owner or Owner's Representative and appropriate protection is utilized.

B. Shoring and Sheeting Sections:

1. Protection of employees in excavations shall conform to applicable OSHA Standards. Any trench protection and modification to trenching safety plans shall be submitted to the Owner or Owner's Representative in writing to be maintained as part of the record.
2. The Contractor shall install all shoring and sheeting systems required to prevent cave-ins and protect employees, adjacent property, and adjacent structures in accordance with current OSHA standards. No extra payment will be made for these items, the cost thereof being merged with and considered a part of the cost for the related excavation.
3. Before sheeting is withdrawn, or trench boxes moved forward, they shall be raised, in place, just above the pipe crown to safely allow the Contractor to completely fill any voids left in the pipe zone.

C. Personal Protective Equipment: The Contractor shall ensure that all employees wear proper protective clothing during construction in accordance with the current OSHA standards. The following measures or provisions are to be adhered to at all times during the construction project:

1. Hard hats shall be worn by all personnel working on the site.
2. Safety shoes or boots will be worn by all personnel working on the site.
3. When appropriate, proper safety vest or fluorescent (yellow, green or orange) safety shirts shall be worn by all personnel working on the site
4. When appropriate, proper eye and hearing protection shall be worn by all personnel working on the site.
5. When appropriate, proper gloves shall be used by personnel working on the site.
6. All visitors to the project job site shall be required to wear proper hard hat and safety vest while on the job site. No unauthorized person(s) shall be allowed on the job site. Owner's Representatives on the job site for inspection or engineering consulting work shall wear all of the above listed personal protective equipment, as appropriate.
7. All heavy construction machinery, such as trenching machines, bulldozers, and backhoes, must be equipped with a roll bar and a back-up beeper meeting the requirements of the above referenced regulation.

TP - 01.03 WORK WITHIN RIGHT-OF-WAYS & TRAFFIC CONTROL:

All work within the right-of-way of a street, road, highway, or other public thoroughfare, including roads, sidewalks or trails, or work which requires encroachment into the right-of-way of a public thoroughfare, shall incorporate adequate signs, barricades, warning lights, and/or flagmen to ensure the protection of the work, protection of the workers, and the safety of the public. When performing any work within the right-of-way of roads or railroads, the Contractor shall comply with the right-of-way permit, as applicable, for the installation including all of the requirements for traffic control and compaction. All work within the right-of-way of roads shall be performed in accordance with the "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects FP-14, Division 600" and/or local, municipal, state or other federal requirements as noted.

In addition, the Contractor shall submit a traffic control plan to the appropriate right-of-way controller and the Owner or Owner's Representative for review and approval prior to any work within the right-of-way of any roads or railroads. The plan shall be in accordance with any applicable encroachment permits prior to any work with the right-of-way of any road or land. Any deviation from the plan must be submitted for review and approval by the appropriate right-of-way controller and Owner or Owner's Representative. All open construction, obstructions, or other hazards left in place at the end of a work session shall be barricaded and marked by yellow warning lights, which shall be illuminated from sunset to sunrise. All signs, barricades, warning lights, and other

traffic control devices, and all traffic control activities shall be in accordance with the most recent edition of the Federal Highway Administration "Manual on Uniform Traffic Control Devices" (ANSI D6.1), OSHA regulations, and the requirements of the transportation department which owns or maintains the thoroughfare.

The Contractor shall at all times perform his work so as to cause the least possible inconvenience to the general public and the residents in the vicinity of the work, and to ensure the protection of persons and property in a manner satisfactory to the Owner.

No road or street shall be closed to the public except with the permission of the Owner and proper governmental authority. Private driveways shall remain open to the maximum extent possible. Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times.

Temporary provisions shall be made by the Contractor to ensure the use of sidewalks, and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by the Owner.

TP - 01.04 ROAD, RAILROAD AND SPECIAL UTILITY CROSSINGS (IF REQUIRED):

The Contractor shall be responsible for compliance with all requirements of special crossing permits applicable to this project. The Contractor shall provide copies of such permits prior to the commencement of work. If no crossing permits are appended, and such crossings are indicated on the plans, crossings will comply with all applicable provisions of Technical Provisions 11, in addition to those indicated under other provisions of this Technical Provision. At least two (2) working days' notice shall be given to the Owner or Owner's Representative before work is done on any crossing.

TP - 01.05 DRAINAGE:

The Contractor shall control the grading in the vicinity of the excavation so that the ground surface is properly sloped to prevent water from running into the excavated areas. Water that has accumulated in the excavation from rainfall and/or surface runoff, or from any other cause which might have been prevented by proper care and foresight, shall be removed and the subgrade restored to its proper bearing capacity prior to commencing construction activities, all at the Contractor's expense.

TP - 01.06 PROTECTION OF EXISTING UTILITIES:

The Contractor shall call and utilize the appropriate underground service location company to mark existing utilities within the project area. It shall be the Contractor's responsibility to determine the locations of existing underground utilities including, but not limited to, gas lines, fiber optic lines, telephone lines, pipelines, and drainage lines (storm drains, channels and ditches), not shown on the plans and to confirm the exact locations of those existing utilities shown on the plans. Existing utilities shall be protected from damage during excavation and backfilling of trenches, and if damaged, shall be repaired or replaced at the Contractor's expense. Broken water lines must be cleaned, disinfected, and flushed in accordance with AWWA C651 before being returned to service.

Continuation of the excavation shall not be permitted until damaged utilities have been repaired to the satisfaction of the Owner and the respective utility company. It shall be the Contractor's sole responsibility to protect or remove and replace any or all culverts as required for the satisfactory performance of the work.

TP - 01.07 LOCATING FACILITIES FOR INSTALLED SANITATION FACILITIES:

A. Warning Tape and Tracer Wire:

1. Warning Tape: Warning tape shall be installed 18-inches directly above the crown of the water, sewer, electrical, or other pipe with the printed side up. The warning tape shall also be installed as continuous skirting at the exterior of manholes, valve boxes, or other installed apparatus. For water pipes (mains and service lines), the warning tape shall be BLUE in color with "CAUTION: BURIED WATER

LINE BELOW" continually printed on it. For sewer pipes (mains and service lines), the warning tape shall be GREEN in color with "CAUTION: BURIED SEWER LINE BELOW" continually printed on it. For electrical lines, the warning tape shall be RED in color with "CAUTION: BURIED ELECTRICAL LINE BELOW" continually printed on it. The tape shall be minimum 3-inches wide, 5 mils total thickness and composed of plastic with a metal foil core. Where tracer wire is buried with the pipe line, the locator/warning tape may be plastic without metal foil.

2. Tracer Wire: For water mains and water service lines. Direct bury 10 AWG copper clad steel wire as manufactured by Copperhead Industries, LLC, or direct bury 10 AWG solid copper wire as manufactured by Agave Wire LTD, minimum 261-lb break load with 30 mil High Molecular Weight Polyethylene jacket, blue color, or approved equal. The tracer wire shall be attached to the pipe a minimum of three (3) times for each pipe length.

   a. The tracer wire shall be securely bonded together with an approved underground waterproof splice kit at all wire joints to provide electrical continuity, and it shall be accessible at all trace wire access points. The underground waterproof splice kit shall be equal to 3M Direct Bury Splice Kit DBR/Y-6. If tracer wire is installed, the Contractor shall provide (2) extra Underground Waterproof Splice Kits to the operating utility.

   b. Tracer wire access points shall be Copperhead SnakePit Roadway as manufactured by Copperhead Industries, LLC or approved equal. Materials used to construct lid and tube shall be non-corrosive or corrosion resistant. Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements. Lid material shall be of cast iron or ductile iron and color-coded according to American Public Works Association (APWA) standards. Blue designates water, and green designates sewer. Spacing between tracer wire access points shall be indicated on the plans or as specified be the Owner.

      Tracer wire shall be connected securely to the direct connection hook-up point. Soil around the access box shall be properly compacted. The top of the access box shall be installed to finished grade. Slope final grade away from box for drainage.

   c. All tracer wire shall be tested for continuity after installation in the presence of the Owner's Representative. Tracer wire shall be repaired or replaced, as necessary, until continuity is achieved, at no additional cost to the Owner.

B. Utility Line Markers, Bollards, and Metal Marker Posts: Retroreflective tape shall be installed around the utility line markers, bollards, and metal marker posts according to the manufacturer's recommendation. Tape placement shall be approximately 6-inches from the marker top as shown on details. The 6-inch tape shall be 3M High Density Yellow Pressure Sensitive or approved equal. Concrete shall meet the requirements of TP 02.

   1. Utility Line Marker: Shall be a minimum of 66 inches in length and 3-3/4 inches in width. The utility marker may be installed within the ROW if approved by the Owner or Owner's Representative. The location and frequency of the utility line markers is indicated on the plans. The utility line markers shall be installed directly over the item that it is marking with an anchor barb bury depth of 18-inches.

      a. Water markers shall be blue in color, model CRM306608 with anchor barb and "CAUTION WATER PIPELINE" text on the marker as manufactured by Carsonite Composites, or equal.

      b. Sewer markers shall be green in green, model CRM306607 with anchor barb and "CAUTION SEWER PIPELINE" text on the marker as manufactured by Carsonite Composites, or equal.

   2. Bollards: Bollards shall be 78 inches long with a four (4) inch diameter post. They shall be installed to leave 48 inches exposed above ground.

      a. The four (4) inch diameter posts shall be aluminum or steel pipe filled with concrete. Bollards shall be painted with a minimum of two (2) coats of yellow paint designed for outdoor commercial

use. Bollards shall be properly cleaned and the surface prepared in accordance with the paint manufacturer's recommendations prior to painting. Under no circumstances shall bollards be installed within the right-of-way of any roadways, unless specifically indicated on a right-of-way permit or as approved by the right-of-way controller.

b. Set bollards in 12-inch diameter holes full of concrete. Set depth of bollard in 30-inches of concrete according to the detail drawing. Posts shall be set in a vertical position, plumb, in line and centered in the footing. Six (6) inches of concrete shall be placed under the post and concrete shall extend two (2) inches above grade and be crowned to shed water. Forms are not required, but may be used.

3. Metal Marker Posts: Markers shall be 66 inches long, 2-1/2 inches diameter, concrete filled, with a two (2) inch diameter stampable aluminum or brass cap. The cap shall be Berntsen Model CD2L, or approved equal. Metal marker posts shall be installed to leave 36 inches exposed above ground.

a. The 2-1/2 inch diameter aluminum or steel utility markers with stampable aluminum or brass caps shall be installed to mark the location of all marked facilities. Marker posts shall be painted with a minimum of two (2) coats of yellow paint designed for outdoor commercial use. The marker posts shall be properly cleaned and the surface prepared in accordance with the paint manufacturer's recommendations prior to painting. Under no circumstances shall metal marker posts be installed within the right-of-way of any roadways, unless specifically indicated on a right-of-way permit or as approved by the right-of-way controller.

b. Set metal marker posts in concrete in 10-inch diameter holes and depth of metal marker post in concrete of 30 inches. Posts shall be set in a vertical position, plumb, in line and centered in the footing. Six (6) inches of concrete shall be placed under the post and concrete shall extend two (2) inches above grade and be crowned to shed water. Forms are not required, but may be used.

TP - 01.08 EXCAVATION:

All excavation, other than by drilling and blasting, undertaken with the excavation equipment commonly used in the industry for this type of excavated material shall be classified as common excavation.

All excavation shall be made by open cut method except as approved or specified. During excavation, materials suitable for backfill shall be neatly piled no closer than 24-inches from the edge of the excavation. All materials not required or not suitable for backfill shall be removed and wasted at locations designated by the Owner or Owner's Representative.

A. Width: The sides of all trenches for the installation of utility piping systems shall be as nearly vertical as soil conditions will permit from ground level to the pipe. Except for the trenching of 1-inch water service lines, the width of the trench shall not be less than 16-inches nor more than 24-inches wider than the outside diameter of the pipe barrel. Trench excavation shall be centered on pipe alignment such that a minimum clear space of eight (8) inches is provided on each side of the pipe. Trench width above the level of the top of the pipe may be as wide as necessary for shoring or sheathing and for proper installation of the work.

B. Depth: The trench shall be excavated to the depth that permits pipe to be laid at the elevations shown on the plans or with the required depth of cover specified by the Owner or Owner's Representative, such as below the frost line. Depth of cover shall be measured from the finished grade or the surface of the permanent improvement to the top of the pipe barrel.

C. Preparation: The bottom of the trenches shall be accurately shaped to line and grade and shall provide uniform bearing and support for each section of the pipe on specifically placed bedding material at every point along its entire length. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and shall be only of such length, depth and width as required for properly making the

particular type joint. Care shall be taken not to excavate below the depths indicated. Unauthorized over depths shall be backfilled with suitable bedding material at the Contractor's expense.

D. Previous Excavation: If the trench passes over a sewer or other previous excavation, the trench bottom shall (1) be compacted to provide support equal to that of the undisturbed native soil or (2) conform to the specific regulatory requirements that preclude damage to the existing installed facility.

E. Unstable Subgrade: Where soft, spongy or otherwise unsuitable material is encountered, which will not provide a firm foundation for pipe, the Owner or Owner's Representative will direct the extent to which removal and replacement shall be made with suitable material. Special pipe foundation material is NOT anticipated. However, if required, a price shall be negotiated between the Owner and Contractor for special pipe foundation material.

F. Underground Obstructions: The Contractor shall preserve intact any underground pipes, culverts or other utilities encountered during construction (except as hereinafter permitted) provided their location is such that they do not interfere with new pipelines or structures being installed. The Contractor shall notify all appropriate utility authorities of his construction schedule so they may be at the site to locate and protect their property. If any utilities or structures are accidentally broken or disturbed, they shall be replaced immediately to a condition at least equal to that in which they were found, all at the Contractor's expense.

Couplings used to repair water and sewer mains or service lines shall be approved by the operating utility and the Owner or Owner's Representative. The repair work shall be done in a manner acceptable to the Owner or Owner's Representative and the utility company. Any existing water or sewer services that will intersect or interfere with the new pipelines or structures shall be rerouted by the Contractor in the manner indicated by the Owner or Owner's Representative.

Existing water or sewer services from the mains to private property that interfere with trenching operations may be cut and replaced at the Contractor's option and expense, provided that users of such services are notified at least 2 hours in advance and that the use of such service shall in no case be interrupted for more than 4 hours, unless specifically permitted in writing by the user. Materials and construction for these items shall be as provided in other sections of these specifications. All new and existing water and sewer mains and water and sewer services shall be protected from freezing at all times during construction.

G. Rock: The inclusion of a bid item and estimated quantity for rock excavation in the Bid Schedule indicates that rock excavation is probable. However, the exclusion of this item from the Bid Schedule does not preclude the possibility that rock will be encountered; it merely indicates that it is not anticipated. If unanticipated rock excavation is needed , the Contractor and the Owner will negotiate a price for the rock excavation.

Should rock excavation be required, it shall be the responsibility of the Contractor to have an experienced powderman handle all blasting and be able to furnish proof of credentials to the Owner. The Contractor shall comply with all laws, ordinances, applicable safety code requirements and regulations relative to the handling, storage and use of explosives and the protection of life and property. The blasting Contractor shall be licensed by the state in which the blasting is conducted. Blasting shall be conducted in accordance with OSHA guidelines. All necessary permits shall be secured and submitted to the Owner or Owner's Representative. The Contractor shall protect all adjacent utilities lines, property and structures from the blasting operation. The Contractor shall be responsible for any damage and injury caused by blasting operations. The Contractor shall inform all residents in the vicinity of proposed blasting activities and shall be responsible for any damage to persons or property as covered in the General Provisions.

Vibration Control (Ground Vibration) – Whenever vibration damage is possible, monitor each blast with a seismograph located, as approved, between the blast and the closest structure subject to blast damage. Peak particle velocity shall not exceed safe blasting recommended criteria, established by the Office of Surface Mining – OSM Alternative Blasting Level Criteria (Modified from Figure B 1, R1 8507 U.S Bureau of Mines.

Where blasting is required within 2,000 feet of any building, the blasts shall be covered with suitable weighted plank coverings or mats to confine all materials lifted by blasting. There shall be no blasting within 40 feet of the finished pipeline. The open end of the finished pipe line shall be closed and covered with earth to a depth 1 foot or greater before each blast. All charges shall be fired electrically. Erect suitable barricades and/or warning signs on all public thoroughfares leading to the site of blasting operations. Give adequate audible warning before each blast.

The Contractor shall repair any damages caused by rock excavation operations. The Contractor shall remove the excavated rock from the site unless otherwise directed by the Owner or Owner's Representative.

The following paragraphs define solid rock and loose rock excavation.

1. Solid rock shall be defined as large masses of igneous, metamorphic, or sedimentary rock that, in the opinion of the Owner or Owner's Representative, cannot be excavated without drilling, blasting, or the use of rippers or other specialized equipment. Any material excavated without the use of blasting or specialized ripping equipment shall not be considered solid rock.

   Solid rock excavation shall be measured in cubic yards from the top of the rock to a point 4-inches below the invert of the installed pipe and an assumed 24-inch trench width, regardless of the actual trench width and depth excavated. For structures, the rock shall be profiled at 12-inches outside the perimeter of the structure. The profile shall extend from the top of the rock down to the bottom of the rock to a maximum of 6-inches below the structure's footing. The rock volume shall be measured and computed by the Owner or Owner's Representative. The measurements shall be within the nearest 0.1-feet from the surface and no less than every 10-feet along the rock profile by one of the following methods:

   a. Excavating, ripping and exposing the rock profile for measurement, prior to any blasting. This shall be the responsibility of the Contractor and no additional payment shall be made for this excavation.

   b. Rock profile determined by drilling without excavating and measurements taken prior to any blasting.

   c. Rock profile measured after blasting and excavation. A 20% deduction shall be made in rock determination when this method is used to allow for expansion in ledge due to blasting.

2. Loose rock shall be defined as boulders and other detached stones each having a volume of one (1) cubic yard or more, but can be removed without drilling, blasting, or the use of a ripper or other specialized equipment. Loose rock shall be removed from the excavation in such a way that a clear distance of at least 4-inches exists between the rock and the bottom of the pipe, and 6-inches exist between the rock and the bottom of the structure. Loose rock shall not be used for backfill. Loose rock excavation shall be measured in cubic yards as the total volume of only those rocks or boulders that are individually over one (1) cubic yard in volume. The rock volume shall be confirmed with the Owner or Owner's Representative.

   A trench in which rock is encountered shall be excavated at least 4-inches deeper than the pipe invert and refilled to the required elevation with sand, gravel, or crushed rock passing a ¾-inch mesh screen. Bedding material shall extend upward at least 12-inches above the top of the pipe. Payment for this fill material shall be considered incidental to the rock excavation and no additional payment shall be made.

H. Structural Excavation: Excavation for structures (e.g., vaults, tanks, manholes, lift stations), shall extend a sufficient distance from walls and footings to provide for forming, except where concrete for walls or footings is authorized to be deposited directly against excavated surfaces. Care shall be taken to avoid

excavating below the depths indicated in the plans. Over-excavation shall be restored to proper elevation by filling with suitable granular bedding material at the Contractor's expense.

I. Removal of Nuisance Water: The Contractor shall remove and dispose of water entering the trenches and shall keep the trenches water free until the facilities are in place and sealed against the entrance of water. Use of a "trash" pump for removal of nuisance water shall be at no extra cost and shall not be considered dewatering. In no case shall water, earth, or any foreign materials be allowed to enter the water or sewer lines.

1. The removal of nuisance water is determined by pumping the water out of the trench with a heavy-duty 4 inch construction trash pump with a strainer for a minimum of 1 hour. The strainer shall be placed in a bed of pea gravel or a slotted PVC pipe in order to screen the debris.

2. All water removed from trenches shall be conveyed to natural drainage channels, storm sewers, or proper reservoirs as approved by the Owner or Owner's Representative. Such removal of water shall be in a manner that prevents property damage, erosion, or sedimentation.

TP - 01.09 DEWATERING:

The inclusion of a fee schedule item and estimated quantity for dewatering in the fee schedule indicates that dewatering is probable. However, the exclusion of this item from the bid schedule does not preclude the possibility that water will not be encountered, it merely indicates that it is not anticipated.

If continuous pumping with well points is required to maintain a satisfactory trench, and the Contractor is so directed by the Owner, this work shall be considered as dewatering. Well points shall be set separately for each trench being dewatered. Dewatering shall be based on the actual number of lineal feet of trench dewatered. Should dewatering not be included within the fee schedule, dewatering shall be paid for at the negotiated price between the Contractor and Owner.

TP - 01.10 SEPARATION OF WATER AND SEWER PIPELINES:

Water lines located near sewer facilities present conditions for potential cross contaminations. Protection from cross contamination can be provided by separation of the facilities and use of extra protection measures. For measuring separation, all measurements shall be the clearance between pipes and/or structures.

The angle of a water line and sewer line crossing shall be limited to between forty-five (45) degrees and ninety (90) degrees from parallel. Intersection angles of less than forty-five (45) degrees shall not be permitted.

Water lines and sewer lines shall not be constructed within a common trench.

For the purposes of this section, the term "lines" shall include mains, laterals, and service lines for both water and sewer.

A. Separation of Water and Gravity Sewer Lines: When water and sewer lines are laid parallel to each other, the horizontal distance between the water and sewer lines shall be at least 10 feet. Each line shall be laid in a separate trench.

When physical conditions, such as an existing obstruction, do not allow the required ten (10) foot horizontal separation, the water and sewer lines may be laid as close as five (5) feet if the bottom of the water line is at least 18 inches above the top of the sewer line.

If these requirements cannot be met, extra protection shall be required per section TP-01.10.F.

When water lines cross sewer lines, the water line shall be above the sewer line with no less than 18 inches vertical clearance.

Where a water line must cross under a sewer line, a 20 foot water pipe section shall be centered under the sewer line with a minimum vertical clearance of at least 18 inches between the bottom of the sewer line

and the top of the water line. New water and sewer lines being installed that are crossing, shall be arranged so that the pipe line joints of both the water and the sewer are equidistant and as far as possible for each line's joints.

If these requirements cannot be met, extra protection shall be required per section TP-01.10.F.

B. Separation of Water and Pressurized Sewer Lines: Water lines shall not be placed within ten (10) feet horizontal and within three (3) feet vertical above or below a pressurized sewer line.

Extra protection, as described in section TP-01.10.F, shall be required where a water line is placed within ten (10) feet horizontal and within three (3) feet vertical above a pressurized sewer line.

Extra protection, as described in section TP-01.10.F, shall be required where a water line is placed within ten (10) feet horizontal and any distance below a pressured sewer line.

C. Service Line Separation: Water and sewer services shall meet the horizontal separation requirements listed above, except where water and sewer services unavoidably must enter the building with less than 10 foot separation, the services shall diverge to achieve the required separation within 10 feet of the building wall. Water and sewer services crossing other service or mains shall meet the vertical separation requirements listed above.

If these requirements cannot be met, extra protection shall be required per section TP-01.10.F.

D. Water Main Separation from Sewer Manholes: No water pipe shall pass through, under, or come into contact with any part of a sewer manhole and shall be separated ten (10) horizontal feet from the closet edge of a sewer manhole.

If these requirements cannot be met, extra protection shall be required per section TP-01.10.F.

E. Separation between Water Lines and Components of the Sewage Disposal System: Water mains and water service lines shall meet the following minimum separation distances:

1. 10 feet to Sewer Manhole
2. 10 feet to Septic Tank
3. 25 feet to Septic Drainfield
4. 50 feet to Outhouse
5. 100 feet to Fence of Individual Lagoon
6. 500 feet to Fence of Community Lagoon

F. Extra Protection: When separation between water lines and sewer facilities cannot be accommodated, extra protection shall be required. Prior to the use of these extra protection measures, approval must be obtained in writing from the Owner.

New water lines that require extra protection from new sewer lines, shall have extra protection provided by using ductile iron pipe for one of the water or sewer lines. Lines of standard pipe length shall be centered at the point of crossing so that no joints exist within six (6) feet horizontal and only restrained or mechanical joints exist within 15 feet horizontal.

New water lines that require extra protection from existing sewer lines shall be constructed using the extra protection specified for new water lines, and the existing sewer line shall be encased in 6 inches around the circumference of the pipe of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal to ensure a water tight seal.

New water lines that require extra protection from existing sewer lines shall be constructed using the extra protection specified for new water lines, and the existing sewer line:

1. shall be reconstructed using a standard length of ductile iron pipe centered at the point of crossing so that no joints exist within six (6) feet horizontal and only restrained or mechanical joints exist within ten (10) feet horizontal, this shall include providing the necessary sewage by-pass means during construction as needed to prevent obstructing sewage flow in the existing line or.
2. shall be encased in 6 inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

Existing water lines that require extra protection from new sewer lines shall provide for extra protection by:

1. constructing the new sewer line and reconstructing the existing water line using ductile iron pipe for both lines with standard pipe lengths centered at the point of crossing so that no joints exist within six (6) feet horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or
2. encasement of both the existing water line and the new sewer line in six (6) inches of concrete for the horizontal distance of the lines that require extra protection but for a distance no less than ten (10) feet horizontal.
3. Extra protection for existing ductile iron water lines shall be met by the installation of restrained or mechanical joints on the existing water line within ten (10) feet horizontal of the crossing and either
   a) construction of new sewer line using a standard pipe length of ductile iron pipe centered at the point of crossing so that no joints exist within six (6) feet horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or
   b) encasement of the new sewer line in six (6) inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

Encasement of either the water lines or the sewer lines may be encased in a watertight carrier pipe that extends 10 feet on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be made of materials approved by the Owner or Owner's representative.

Installation of additional pipe or fittings or concrete for extra protection as required by the pipe alignment shown on the plans shall be incidental to the respective water or sewer line construction. Payment for unexpected utility crossings that require extra protection shall be negotiated between the Contractor and the Owner.

G. Polystyrene Insulation: Rigid extruded polystyrene insulation board shall have a minimum compressive strength of 25 psi. Width shall be 4-feet for mains 6-inch (nominal diameter) and larger and 2-feet for mains and service lines less than 6-inches (nominal diameter). Unless otherwise shown on the plans, the insulation board shall be installed 6-inches above the pipe and shall be a minimum of 2-inches thick.

TP - 01.11 BACKFILLING:

This section describes requirements for backfilling any excavation made to install buried pipeline, structure, or other item where structural fill is placed. It describes the material, placement, and compaction requirements.

A. Trenches and Pipes: Bedding and backfill materials to a depth of 12 inches above the pipe shall be carefully deposited in layers not more than six (6) inches thick (loose measurements), wetted to optimum moisture content, and hand or mechanically compacted. Fill used for this bedding and initial backfill shall meet the requirements set forth herein. The excavation material shall be placed in layers not to exceed 12 inches and compacted to the density specified in section TP-01.12 from 12 inches above the pipe to ground surface. Final backfill shall be left in a uniform, neat condition matching the surrounding grade.

B. Structures: Backfill materials shall be placed gradual and even to prevent tipping. Backfill shall be placed around structures with lifts not exceeding 12 inches and compacted to the density specified in TP-01.12. Backfill material shall meet the specifications identified herein. Generally, compact the fill in the same

manner as the standard trench procedure. Backfill compaction equipment should be suited for site conditions to avoid damage to installed structures.

Wherever trenches or surrounding structures have not been properly filled, or if settlement occurs, they shall be reopened to the depth required for proper compaction and refilled and re-compacted as specified and approved by the Owner or Owner's Representative at the Contractor's expense.

Compaction methods and equipment may utilize hand and mechanical tampers and rollers. The equipment and procedures proposed by the Contractor shall be appropriate for the respective soils and shall be subject to the approval of the Owner or Owner's Representative.

C. Materials: All backfill material shall be approved in advance of installation by the Owner or Owner's Representative. Materials shall be obtained from areas approved by the Owner or Owner's Representative.

Backfill material will not be paid for separately, but shall be considered as subsidiary to and a part of the cost for the applicable contract bid item.

1. Embedment: Embedment is that material from the bottom of the trench to 12 inches above the pipe, and includes the pipe bedding material (upon which pipe is placed), haunching material (extending from pipe bottom to pipe's vertical centerline), and initial backfill material (extending from pipe's vertical centerline to 12 inches above pipe). Native soil used for embedment must be free from clods of earth or stones larger than 3/4 inch in any dimension, organic refuse, debris, frozen soil, and other objectionable material. If native soil does not meet this criteria and cannot be screened to this criteria, the Contractor shall use imported material.

2. Imported Bedding Material: If required, special bedding material shall consist of sand, sandy gravel, or other suitable granular material having a maximum plasticity index of 6, with 100% of the bedding material smaller than 3/4 inches, and no more than 5% passing a No. 200 sieve. Contractor shall be responsible for the costs of any imported material.

3. Stabilization: Granular stabilization material shall be used to replace soft, spongy, or other unsuitable material, including rock encountered in excavation, to the depths necessary to support the pipe or structure. Stabilization materials shall be underlay bedding material (as applicable) and shall consist of suitable hard, durable granular material having a maximum size of 6-inches, graded so that a maximum of 20% passes a No. 4 sieve. Granular stabilization is not anticipated. If required, a price for granular stabilization shall be negotiated between the Contractor and the Owner.

4. Final Backfill: In general, final backfill will be that material originally excavated from the trench and will extend from 12 inches above the pipe to surface grade. Final backfill material shall be the same as that around the pipe except that the inclusion of a limited amount of stones up to 6 inches in diameter will be permitted.

D. Placement:

1. Embedment: Embedment shall be placed in 6-inch loose lifts and compacted as described herein. Care shall be taken to ensure that the pipe is not supported by the bells of the pipes.

   a) Bedding: Bedding is the fill material below the pipe. To remove stony soils, the Contractor shall excavate approximately 4 inches deeper than the required grade and bed the pipe with imported material. Bedding material is to be compacted to 90% of the maximum dry density as determined by the Standard Proctor density test (ASTM D-698).

      If over-excavation is required for removal of unsuitable native soils (weak structural soils), and bedding material is to be compacted to 95% of the maximum dry density as determined by the Standard Proctor density test (ASTM D-698).

b) Haunching: Haunching is the material from the bottom of the pipe to the vertical centerline of the pipe. The same material used for bedding the pipe shall be used for haunching. After the jointing is completed and the pipe has been approved by the Owner, the haunching material shall be placed by hand and worked under the pipe haunch to provide adequate side support for the pipe. The haunching shall be compacted to 85% of the maximum dry density as defined in TP Section 01.12. Placement and compaction of the haunching shall be achieved so as to avoid damage to or displacement of the pipe.

c) Initial Backfill: Initial backfill is the material from the vertical centerline line of the pipe to 12 inches above the top of the pipe. The same material used for bedding the pipe shall be used for the initial backfill. The initial backfill shall be compacted to the density as defined in section TP Section 01.12. The Contractor shall carefully place and compact the initial backfill in such a manner that damage to or displacement of the pipe does not occur.

2. Final Backfill: Final backfill shall not be placed until the embedment material is placed and compacted to the maximum dry density as defined in section TP-1.12, and the Owner or Owner's Representative have inspected and approved the installation. Final backfill shall be placed in lifts not to exceed 12-inches unless otherwise approved by the Owner or Owner's Representative. Compaction shall be as defined in Section 01.12.

3. Backfill for Road Subgrade: Under existing and proposed roadways, to a distance of 10-feet on either side of the road, bedding and backfill materials shall be carefully deposited in layers not more than 6-inches thick, loose measurements, wetted to optimum moisture content and mechanically compacted as described in the Compaction Requirements, Methods, and Testing section. If applicable, the Contractor shall comply with local, municipal, county, state, and federal highway authority's roadway subgrade standards.

   a) In areas where pavement is to be replaced, or in roads that are to be paved, remove cobbles that may interfere with subgrade preparation. This shall include the backfill within 12 inches of the finished subgrade elevation. The upper 12 inch layer, forming the subgrade for pavements, shall be compacted to a density of at least 95% (ASTM D-698 - Standard Proctor Test). See Section 11 of the Technical Provisions where this is required.

   b) Cement slurry can be substituted for compacted native backfill and subgrade if approved by Owner or Owner's Representative. The cement slurry shall meet the requirements for slurry as provided in TP 02 and shall be placed from the concrete truck at a slump of 6 to 8 inches. Steel plates 5/8 inch thick are to be placed over the trench with at least 6 inches overlap on each side and edged with asphalt to prevent traffic movement. The concrete slurry shall be allowed to set for a minimum of 12 hours before completing the asphalt patch. Slurry can typically be installed from the trench bottom to ground surface and no intermediary subgrade material is required for placement of asphalt patch.

4. Where trenches cross roads, streets, or driveways, backfilling shall be completed immediately following excavation and inspection. No trenches across roads shall remain open overnight. All crossings shall be backfilled, compacted and open to traffic at the end of each day's work. Major road crossings shall be excavated and backfilled in half widths of the traveled way so that at least one-half of the roadway is open to controlled traffic at all times during the work.

5. Backfill Around Structures: Backfill around structures shall conform to the same requirements as those for backfill around piping in unpaved areas, unless more stringent requirements are indicated in other sections of these specifications.

INCORPORATED INTO THE CONTRACT

TP - 01.12 COMPACTION REQUIREMENTS, METHODS AND TESTING:

A. Minimum Density: Unless otherwise specified by applicable permits initial and final backfill and gravel resurfacing shall be compacted to the following minimum requirements. The minimum acceptable percent of compaction is the in place dry density divided by the reference density times 100. Compacted soil shall also be at plus or minus 2% of optimum moisture content. Contractor shall contact the operating utility prior to obtaining water from the public water system.

TYPE	LOCATION	REQUIRED COMPACTION
I	Under any existing or proposed pavement, curb, gutter, sidewalk, roadway, shoulder, alley, slab, footing, canal embankment, or when within 2 feet of the above.	95%
II	Within any gas, electric, or telephone utility easement, or within any street or road right-of way outside the limits defined above as Type I.	90%
III	All other locations not defined above as Type I or Type II.	85% (or 100% of adjacent natural ground)

B. Reference Densities/Baseline Testing: The Contractor, at his expense, shall provide the reference densities for the various bedding and backfill materials used. All tests shall be performed by a certified soils testing laboratory approved by the Owner or Owner's representative. If reference to natural ground is used, a nuclear gauge may be used to measure the density of the natural ground.

The reference densities for compaction tests shall be established in accordance with ASTM D-698, Standard Proctor Test. The Contractor shall submit for approval a testing plan identifying proposed testing locations prior to the start of any excavation work. Contractor shall provide copies of the Standard Proctor Tests with 3 point minimum moisture versus density curves.

The Contractor shall coordinate the collection of soil samples for proctor testing with the Owner or Owner's Representative such that both parties are on-site during the collection of soil samples. This will ensure that enough samples are collected to provide for accurate density testing during construction by providing reference density for differing soil conditions within the project area. Should a change in soil be encountered at any point of the installation, a new sample shall be taken and additional test shall be conducted.

C. Methods: Mechanical compaction is permitted. Water jetting methods are not permitted. The backfill shall be uniformly moistened to optimum moisture content, placed in sufficiently thin layers to obtain the specified results, and compacted with hand and/or pneumatic tamping rammers, vibrating plate compactors, sheepsfoot rollers, compaction wheels, hydrohammer, or other device(s) which will obtain the specified density for the particular soil type, without injury to the pipe or related structures.

D. Density Tests: Backfill density tests shall be performed in accordance with the latest versions of ASTM D-1556 (Sand Cone Method), ASTM D-2167 (Rubber Balloon Method), ASTM D-2216 (Moisture Content), ASTM D-2922 (Nuclear Density), and ASTM D-3017 (Nuclear Moisture Content). The Contractor will perform initial field density tests for each location listed in the next paragraph at the expense of the Contractor. Results of the test shall be provided to the Owner and approved prior to continuing. Any additional tests due to failure of initial tests shall be at the expense of the Contractor.

E. The Contractor will perform at least one (1) compaction test at each Type I or II location as defined in TP-1.12. Compaction tests shall be performed at a minimum of five hundred (500) linear feet of trench at Type II or III locations as defined in TP-1.12 and in accordance with the approved Contractor's testing plan as specified above in 01.12.B or as determined by the Owner. The exact test locations shall be

specified by the Owner's Representative. The Owner may request performance of additional tests at the Owner's expense.

If the results of any of the compaction tests indicate insufficient compaction, the area in question shall be reopened to a depth required for proper compacting, then refilled, compacted and retested, at the expense of the Contractor, until the compaction tests indicate that the necessary compaction requirements have been met. Two copies of the test results of any retesting performed by the Contractor shall be provided to the Owner, for his approval, prior to any permanent surfacing. Any improperly placed backfill, or locations where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted at the expense of the Contractor. The surface shall be restored and resurfaced, if necessary to the required grade.

TP - 01.13 ROADWAY RESTORATION AND PATCHING:

Whenever existing roadways or driveways are disturbed during the normal course of construction, the Contractor shall restore the roads and driveways to their original condition. Surfacing shall be replaced where the roadway has gravel, concrete or asphaltic surfacing. The Contractor shall comply with the standards and construction requirements of the applicable local, municipal, county, state and federal highway authorities, as noted on the plans, special provision or exhibits/crossing permits in this contract. The Contractor shall observe all prescribed traffic safety regulations.

A. Repair of the road shall be complete with adequate subgrade compaction and acceptable restoration of the roadway surface, as specified herein. No scarring of pavement will be allowed from excavation equipment tracks, outrigger shoes or other stabilizers.

Gravel used in regraveling and road base shall be well graded and conform to the following:

SIEVE SIZE	% PASSING
1-1/4	100
#4	38-65
#8	25-60
#30	10-40
#200	3-12

B. All cuts in the pavement between pavement that is to remain and pavement that is to be removed shall be cut straight leaving a clean regular and vertical edge. This edge shall be protected throughout the work, or shall be re-cut before placing the final surfacing material. After the pipe is installed, compacted backfill shall be placed to within 9 to 12 inches of the level of the roadway surface, as applicable.

1. Reinforced Concrete Patch: Compacted aggregate base course, six inches in depth, shall be placed in the roadway immediately beneath the concrete patching. The cut shall be filled with a six inch thick reinforced concrete patch. Concrete shall meet the requirements of Section 02-Concrete. The reinforcement shall be #6 welded wire reinforcement mesh (6-inch by 6-inch). The concrete patch shall be a minimum of four feet wider than the top of the trench and centered over the trench. The Contractor shall notify the Owner at least 48 hours before concrete is poured to allow the Owner or Owner's Representative to inspect patch preparation.

2. Asphalt Patch: Compacted aggregate base course, six inches in depth, shall be placed in the roadway immediately below a bituminous wear course. Asphalt mix surfacing conforming to ASTM D-3515 (Hot-Mixed, Hot Laid Bituminous Paving Mixtures) shall be placed and compacted in accordance with the detail to make the crossing level with the existing roadway. Cold mix is not permitted as a permanent asphalt patch.
3. Regraveling: Where regraveling is required after crossing of the existing roads or driveways, the Contractor shall remove existing gravel surfacing, stockpile the material, and restore the road surface after installation of the pipe. The stockpiled material shall be used for backfilling to within two inches of finished level. The final two (2) inches of gravel surfacing shall conform to the requirements of gravel for re-graveling as listed above in TP 01.13.A. This material shall be placed only in the amount and at the locations designated by the Owner or Owner's Representative. All quantities shall be verified by the Owner or Owner's Representative during placement of the gravel.

TP - 01.14 DISPOSAL OF EXCESS MATERIAL:

Excess material, including rock, broken concrete, bituminous materials, debris, or other materials not suitable for backfill, shall be removed from the site and wasted in the disposal areas selected by the Contractor and approved by the Owner or Owner's Representative.

The disposal of such excess materials will not be paid for separately, but shall be considered as incidental to and a part of the cost for the applicable contract bid item.

TP - 01.15 CLEAN-UP:

Upon completion of the work, the entire site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes, and shall present neat and workmanlike appearance. All slopes shall be trimmed and dressed, and all surfaces graded such that effective drainage is assured. Unpaved streets shall be graded smooth to the satisfaction of the Owner or Owner's Representative.

TP - 01.16 TRENCH MAINTENANCE:

The Contractor shall, for a period of one year after completion and final acceptance of the work, maintain, and repair any trench settlement that may occur and shall make suitable repairs to any pipe, pavement, or other structures that may become damaged as a result of backfill settlement.

TP - 01.17 STORM WATER POLLUTION PREVENTION PLAN (SWPPP):

For surface disturbances greater than one (1) acre in size, the Contractor shall prepare a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the latest requirements of the Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges from Large and Small Construction Activities. The SWPPP must be prepared in accordance with good engineering practices and must 1) Identify all potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges from the construction site; 2) Describe practices to be used to reduce pollutants in storm water discharges from construction site; 3) Assure compliance with the terms and conditions of the NPDES General Permit.

If the Contractor is not experienced in the preparation of SWPPP, the Contractor shall retain the services of a sub-consultant regularly engaged in the preparation of SWPPP to perform said service. The completed SWPPP must be approved by the Owner or Owner's Representative at least 10 business days before the start of construction so that a Notice of Intent can be sent to EPA.

The Contractor shall fully implement the SWPPP from the commencement of construction until final stabilization, as defined in the NPDES General Permit is achieved.

INCORPORATED INTO THE CONTRACT

The Contractor shall maintain and update the SWPPP, as required in the NPDES General Permit, during construction. Updates shall include amendments required as a result of the ineffective controls discovered through the course of inspections or investigations conducted by the Owner or Owner's Representative, site staff, or by local, state, tribal or federal officials. The Contractor shall submit a Notice of Intent to EPA to obtain permit coverage, modify the coverage as necessary, and terminate permit coverage once final stabilization is achieved.

TP - 01.18 LINES AND GRADES:

The Owner or Owner's Representative will give all lines, grades and building locations on the plans and will supply the Contractor with the AutoCAD drawing to stake out the facilities to be installed. The Contractor shall be responsible for staking out pipeline centerlines with a lath every 200 feet or line-of-sight whichever is less. Bends, alignment, intersections, manholes, lift station centers and fence corners shall be staked by the Contractor and provided with two offsets for alignment. Elevation references will be provided as shown on the plans, for sewer lines, lift stations, vaults, tanks, sewer manholes, and other facilities where elevations are critical to the performance of the system. The Contractor shall be responsible for the preservation of the location and line and grade stakes when set, and if disturbed, shall have such stakes replaced.

TP - 01.19 CLEARING AND GRUBBING:

It is the Contractor's responsibility to clear and grub the site prior to or during construction. The Contractor shall remove all trees along the water and sewer main alignments in accordance with Tribal and local regulations. Proper approvals must be obtained as necessary prior to removing and disposal of trees and vegetation. Trees may either be chipped with a wood-chipper and placed over the trench for erosion control or disposed of at the Contractor's expense. Clearing and grubbing shall be done at the Contractor's expense.

TP - 01.20 FINISH GRADING:

After the structures have been constructed and installed, all piping installed, all required compaction and density testing has been performed and all backfilling and embankments have been completed, areas on the site of the work shall be brought to the true grades. All slopes shall be trimmed and dressed, and all surfaces graded such that effective drainage is assured. Final grading shall prevent water runoff from pooling around installed facilities. The Contractor shall leave each project site in a neat and orderly condition, restoring it as near as possible to its original condition and to the approval of the Owner or Owner's Representative.

TP - 01.21 SEEDING:

All disturbed areas shall be returned to their pre-construction vegetative state. The Contractor shall submit a seed mix that is equivalent to state highway or local road authority's approved seed mix. The Contractor shall protect the seed after it is placed with a tackifier, hay mulch, straw mulch, wood cellulose mulch, or as approved by the Owner. A minimum of 20 pounds of seed per acre shall be placed. Seed shall be placed by either drill seeding at a depth of approximately one (1) inch or broadcast seeding. If broadcast seeding is utilized, the Contractor shall apply twice the minimum seeding rate (i.e. 40 pounds of seed per acre). The Contractor shall perform maintenance as needed to ensure that adequate vegetative growth and stabilization has taken place to minimize erosion after construction is completed.

TP - 01.22 RECORD DRAWINGS:

The Contractor shall be responsible for keeping accurate records of all installed items under sections of the Technical Provisions package. These records shall indicate revised changes ("red-lines") of the construction drawings in sufficient detail to be accepted by the Owner or Owner's Representative for record drawings. Sufficient detail under this contract means that the Contractor shall take accurate measurements and record them on the drawings to provide the minimum information of at least two swing ties and distances to permanent objects. These permanent objects shall include but not be limited to all: valves, pressure reducing valves, air and vacuum valves, meters, curb stops, hydrants, connections to other lines, bends, marker posts, manholes, fence corners,

inspection ports, water and sewer tapping points, cleanouts, septic tank access covers, drainfield extents, intersection with other utilities, connection to existing utilities or home, roadway crossing locations, abandoned facilities, and depths of noted facilities; the beginning and end of any stabilization material placed; the beginning, end, and depth of rock encountered; the beginning, end, and depth of any encasement installed; and the location and depth of any each utility encountered. Further information on record drawings may be contained in the Supplementary Conditions.

The recording of the as-built information is considered an integral part of the progress of this construction and shall be reviewed with the Owner and Owner's Representative in determining progress under this contract. Record drawings shall be submitted by the Final Inspection and before final payment can be made.

TP - 01.23 MEASUREMENT AND PAYMENT:

Except for the following items, the cost of all work done by the Contractor as required under Section 01 of the Technical Provisions shall be merged with the pay items defined within the Measurement and Payment portions of other Technical Provisions of this contract.

A. Solid Rock Excavation: Payment for rock excavation shall be at the unit price listed in the Bid Schedule based on the computed number of cubic yards removed. Separate payments will be made between solid and loose rock excavations.

B. Loose Rock Excavation: Payment for loose rock excavation shall be at the unit price listed in the Bid Schedule based on the computed number of cubic yards removed. Separate payments will be made between solid and loose rock excavations.

C. Imported Bedding Material: If imported bedding material is required as fill to replace stony soil (stones less than 1 cy), it shall be considered incidental to pipe installation and no separate payment shall be made. If imported bedding material is required to replace unsuitable native material (weak structural properties), payment shall be at the unit price shown on the Bid Schedule based on the volume of compacted bedded material as computed by the Owner or Owner's Representative. Payment shall include the necessary over-excavation and the furnishing, installing, grading and compaction of the bedding. No payment shall be made for any imported material not approved by the Owner.

D. Dewatering: Dewatering shall be based on the actual number of lineal feet completed. Payment for dewatering shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete dewatering installation.

E. Mobilization/Demobilization: Payment for mobilization/demobilization shall be at the unit price listed in the Bid Schedule. 60% of this line item may be requested upon complete mobilization to the job site and the remaining 40% may be requested upon demobilization from the job site.

F. Storm Water Pollution Prevention Plan: Payment for the preparation and implementation of the SWPPP shall be paid on a lump sum basis as shown on the Bid Schedule. Payment shall be full compensation for plan preparation including required revisions for Owner's acceptance, updates to the SWPPP during construction, permit application, inspections, installation and maintenance of controls, modification of controls as determined by inspections, removal of pollutants due to failed controls, and permit termination.

G. Seeding: Seeding shall be paid for on a lump sum basis to seed the site in accordance with these specifications. Payment for seeding shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for complete installation.

H. Exploratory Time: Exploratory time shall be measured on an hourly basis for an actual period spent on locating the existing utility line exceeding two (2) hours. Contractor shall follow these steps:

1. Call the representative from the operating utility and make every effort to locate the existing utility line prior to excavation.
2. Locate the existing utility line for two hours at the Contractor's expense.
3. If the Contractor is unable to locate the existing utility line within two hours, the Contractor shall notify the Owner or Owner's Representative and both agree upon a start time. The start time shall be recorded. When the Contractor locates the existing utility line, the end time shall be recorded.

If the Contractor fails to notify the Owner or Owner's Representative when the Contractor will start locating the existing utility line, the Contractor will not be compensated. Payment for exploratory time shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for locating the existing utility line.

I. Record Drawings: The record drawings shall be submitted with or prior to submitting the final invoice and shall be reviewed and approved prior to making the final payment. Payment for this item shall be merged into the other pay items.

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SUBMITTAL REVIEW FORM
SECTION 01 - TRENCH EXCAVATION & BACKFILL FOR PIPELINES AND APPURTENANT STRUCTURES

	DATE	INITIALS		
			Submittal No.	
Received by ENGINEER:			Project No.	
Received by OWNER:			Contract No.	

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
1.02	Trench Safety Plan, including certified competent person		
1.03	Traffic Control Plan and Right of Way Permit		
1.07	Warning Tape		
1.07	Tracer Wire, Tracer Wire Access Points, and Tracer Wire Splice Kit		
1.07	Utility Line Marker		
1.07	Bollard		
1.07	Metal Marker Post and Stampable Cap		
1.08	Rock excavation methods (Solid and Loose)		
1.08	Blasting License, Credentials and Permits		
1.09	Dewatering procedures		
1.10	Extra Protection (Water Line or Sewer Line)		
1.11	Embedment and Bedding Material		
1.11	Stabilization Material		

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1.11	Cement Slurry		
1.12	Soil Testing Lab		
1.12	Standard Proctor Test		
1.12	Density Testing Location Plan		
1.12	Density Test Results		
1.13	Gravel		
1.13	Pavement Patch Mix		
1.17	SWPPP		
1.18	Stake Out Plan, Survey Sub-Contractor		
1.20	Seed, Seeding Method, and Seeding Protection		

Approval:

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 02 - CAST-IN-PLACE CONCRETE

TP - 02.01 SCOPE:

Furnish all labor, materials, equipment, and incidentals as required, and perform all operations in connection with the placement of concrete in accordance with the applicable drawings and these specifications.

TP - 02.02 MATERIALS:

A. Cement: Portland cement shall conform to ASTM C150 Cement, Portland Type I, Type IA, Type II, Type IIA, Type III, or Type IIIA.

B. Concrete: Ready Mix Concrete shall conform to ASTM C94.

C. Aggregate: Aggregate shall be composed of clean, hard, durable, uncoated grains and crushed stone, free from detrimental amounts of clay, dust, soft or flaky particles, loam, shale, schist, slate, alkali, disintegrated stone, organic matter or other deleterious matter. The aggregates shall conform to ASTM C33.

D. Water: All water used for concrete shall be of potable quality.

E. Grading: Exposed horizontal surfaces shall slope approximately 1/8 inch per linear foot downward in all directions from the center.

TP - 02.03 CONCRETE REQUIREMENTS:

Property	**Unit**	**Minimum**	**Maximum**
Cement Factor	(sacks per cu. yd.)	6.0	---
Water-Cement Ratio	(gal. per sack)	---	6.0
Entrained Air	(percent)	4.0	6.0
Slump	(inches)	1.0	4.0
	Compressive Strength		
7 day	(psi)	1,800	
28 day	(psi)	3,000	

Concrete shall be uniformly plastic, cohesive and workable, i.e., can be placed without honeycomb and without voids in the surface. Workability shall be obtained without producing a separation of ingredients. Free water shall not appear on the surface. In general, a minimum amount of water required to produce a workable mixture shall be used.

TP - 02.04 WEATHER:

A. Freezing: No concrete work shall be done if the air temperature is below 40°F, except with the approval of the Owner or Owner's Representative. If approval is given to work, the water and aggregate shall be heated to at least 80°F before mixing. In all cases where the air temperature is predicted to be below 40°F, the concrete shall be insulated for at least 72-hours by insulating blankets, batt insulation with moisture proof covering, layers of dry porous material such as straw, hay, or multiple layers of impervious paper meeting ASTM C 171. No concrete shall be poured against frozen ground. The use of salt or other

compounds to prevent concrete from freezing shall not be permitted. Any work that has been injured by freezing shall be removed and replaced at the Contractor's expense.

B. Ambient Temperature Above 80 °F: The concrete temperature shall not exceed 95 °F, unless appropriate and approved admixtures are provided in the concrete mix. Concrete placement and finishing shall be completed as quickly as conditions permit. The concrete shall be protected against thermal shrinkage cracking due to rapid drops in concrete temperature greater than 40 °F during the first 24 hours. Acceptable protection materials to prevent these drops include: insulating blankets, batt insulation with moisture proof covering, layers of dry porous material such as straw, hay, or multiple layers of impervious paper meeting ASTM C 171. These materials shall not be applied until the concrete surface temperature has become steady or is beginning to decline.

TP - 02.05 CURING:

Fresh concrete shall be adequately protected from heavy rains and mechanical injury. All concrete shall be kept moist and protected from rapid drying or freezing for at least seven days. Concrete surfaces shall be kept moist by spraying with liquid membrane coating. Foundations and thrust blocks may be cured by covering with water saturated soil or backfill. All concrete shall be cured at least 72 hours prior to stripping forms or structural loading. Horizontal surfaces shall be covered with burlap as quickly as it can be safely applied, and then saturated by sprinkling. After 24-hours, burlap may be removed and water applied directly to the concrete surfaces. Suitable plastic covering may be substituted if no detrimental effects occur.

TP - 02.06 TRANSIT MIXED CONCRETE:

Ready-mixed concrete from a central batching plant and mixed in transit will be permitted with the Owner or Owner's Representative's approval. A time stamped plant batch certification sheet shall be provided by the concrete supplier listing the batch components for approval by the Owner or Owner's Representative.

TP - 02.07 FIELD TESTING:

Four test-cylinders shall be taken for each 50 cubic yards of concrete placed or portion thereof. If the Owner or Owner's Representative suspects, by visual inspection, slump, or other tests, that any other concrete appears substandard, additional test cylinders shall be required. The Contractor shall provide cylinder molds at the construction site and shall have the cylinders tested by an approved laboratory, with the Contractor bearing all costs. If any test cylinder falls below 3,000 psi at 28 days, this shall be sufficient cause to reject that portion of concrete. The Contractor shall remove and replace defective concrete with acceptable material at his own expense. The test cylinders shall comply with ASTM C31 for making and curing test specimens in the field.

The Contractor shall also perform one slump test and one air entrainment test for each ready-mixed concrete batch from a truck.

Field testing will not be required for non-structural concrete placement such as pre-cast manhole bases, concrete collars, yard hydrant concrete pads, fence post concrete anchors, monitoring well concrete pads, control panel concrete pads, cleanout collars, manhole collars, and drop manhole concrete encasements.

TP - 02.08 PLACING CONCRETE:

Before placing concrete, the Contractor shall provide 72-hour advance notice to permit proper inspection of forms and reinforcement by the Owner or Owner's Representative.

After completion of mixing, the concrete shall be rapidly conveyed to and deposited in the forms. Consolidate the concrete immediately after placing by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

Concrete shall not be placed against surfaces of absorbent material that are dry and concrete shall not be placed against surfaces that have free water. The concrete shall be placed in such a manner as to prevent excessive crawling and segregation of the aggregate. No concrete shall be used that has partially set before final placing, nor shall retempering of the concrete be permitted. All concrete shall be placed in the forms no more than 90-minutes after mixing.

TP - 02.09 FORMS:

The Contractor shall provide forms that will produce correctly aligned concrete. The centering of the forms shall be true and rigid and thoroughly braced both horizontally and diagonally. Forms shall be sufficiently strong to carry the dead weight of the concrete as a liquid without deflection, and tight enough to prevent leakage of mortar. The inside of forms shall be coated with an approved oil or thoroughly wetted. The Owner or Owner's Representative shall be notified prior to removal of form work.

The final concrete structure shall be inspected for alignment, elevation, and concrete quality. Final concrete structure alignment and elevation shall be checked by use of land surveying instruments.

Should the concrete structure alignment, elevation, and/or quality test results be determined unsatisfactory by the Owner or Owner's Representative, the entire structure or parts of the structure will be rejected. All further alignment or elevation corrections, or any concrete removal and/or replacement, shall be at the Contractor's expense.

Honeycombed and void areas in the concrete shall be removed and patched to produce a sound concrete product by a method selected by the Contractor and approved by the Owner or Owner's Representative.

TP - 02.10 MORTAR:

Mortar shall be made of one part masonry cement, three parts sand, and only a sufficient amount of water to make a workable plastic mix. Retempered mortar shall not be used.

TP - 02.11 GROUT:

Surface aesthethic grout with non-structural or adhesive properties shall be made of one part Portland cement, two parts sand, and only a sufficient amount of water to make a workable plastic mix. Re-tempered grout shall not be used.

TP - 02.12 SLURRY:

Concrete slurry used for road crossings shall meet the requirements of the Federal Highway Administration FP-14 Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, Section 614 Lean Concrete Backfill.

TP - 02.13 MEASUREMENT AND PAYMENT:

Concrete and other work or materials required by this section shall not be measured and paid separately. Rather, they shall be included in the unit or lump sum bid prices of those items shown on the Bid Schedule that require the inclusion of such materials or work, even if not specifically mentioned within the measurement and payment sections of those particular pay items.

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SUBMITTAL REVIEW FORM

SECTION 02 – CAST-IN-PLACE CONCRETE

	DATE	INITIALS		
Received by ENGINEER:			Submittal No.	
Received by OWNER:			Project No.	
			Contract No.	

TP	Specification	Description (Indicate Type, Model No. Manufacturer, etc.)	Action by Owner
2.04	Concrete Protection		
2.05	Concrete Compound		
2.06	Concrete Mix		
2.07	Concrete Testing Laboratory		
2.07	Strength, Slump, & Air Test Results		

	Signature	Date:
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 03 - REINFORCING STEEL

TP - 03.01 SCOPE:

Furnish all labor, materials, equipment and incidentals as required, and perform all operations in connection with the placement of reinforcing steel and wire fabric reinforcing, complete, in strict accordance with the applicable drawings and these specifications

TP - 03.02 MATERIAL:

Reinforcing bars shall meet the requirements of the Standard Specifications for Billet-Steel Bar (intermediate grade) for Concrete Reinforcement, ASTM A615. Welded wire mesh shall meet the requirements of the Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement, ASTM A185. The bars and wire mesh shall be placed in accordance with the approved shop drawings. Any excess rust or scale shall be removed by wire brushing prior to concrete placement. The use of cold twisted bars will not be permitted. Wire fabric shall be used only when specified and shall be the type shown on the drawings and approved by the Owner or Owner's Representative.

Tie wire size is shown in the plans and shall conform to ASTM A1064.

TP - 03.03 METHOD OF CONSTRUCTION:

All reinforcement shall be free from dirt, oil, paint, grease, mill scale and loose or thick rust. When bending is required, it shall be accurately done without the use of heat, and bars having cracks or splits at the bends shall be rejected. All reinforcement shall be placed in the exact position shown on the drawings, and shall be securely held in position by wiring to and blocking from the forms, and by wiring together at intersections, such that it will not be displaced during depositing and compacting of concrete. Precast concrete blocks, concrete masonry units, or metal chairs shall be used for supports where applicable. Rock supports will not be allowed.

Placing and fastening of reinforcement in each section of the work shall be approved by the Owner or Owner's Representative before any concrete is deposited in the section. All joints or splices shall be made by using approved clamps, welding or by lapping the ends of the bars a distance of at least 40 times their nominal diameters unless otherwise noted on the plans. Lap adjoining wire mesh by no less than one full mesh and lace securely with wire.

Cutting and bending, placement, welding, handling and storage, and installation of reinforcement shall be in accordance with applicable American Concrete Institution (ACI), American National Standards Institute (ANSI), and Concrete Reinforcing Steel Institute (CRSI) standards.

TP - 03.04 MEASUREMENT AND PAYMENT:

Reinforcing steel shall not be measured and paid separately. Rather they shall be included in the unit or lump sum bid prices of those items shown on the Bid Schedule that require the inclusion of reinforcing steel, even if not specifically mentioned within the measurement and payment sections of those particular pay items.

INCORPORATED INTO THE CONTRACT

SUBMITTAL REVIEW FORM, SECTION 03 – REINFORCING STEEL

	Date	Initials		
Received by ENGINEER:			Submittal No.	
Received by OWNER:			Project No.	
			Contract No.	

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
3.02	ASTM chemical & physical test certificates		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 04 - WATER TRANSMISSION AND DISTRIBUTION MAIN

TP - 04.01 SCOPE:

The work covered by this Section consists of furnishing all labor, equipment and materials in connection with the construction of water mains, including piping, valves, hydrants, other appurtenances and connection of the water mains to the structures for community water systems, all installed in strict accordance with the plans and technical provisions.

TP - 04.02 GENERAL:

The waterlines shall be constructed in the locations and of the sizes, materials and pressure class shown on the plans, or as directed by the Owner or Owner's Representative. All permits, permissions or other authorizations required by the tribal or municipal utility authority for tapping and connection are the responsibility and cost of the Contractor. Excavation, trenching, backfilling, compaction and any needed dewatering shall be in accordance with Section 01 of these Technical Provisions. Staking, utility locates and existing system abandonment shall be conducted in accordance with Section 01 of these Technical Provisions.

Pipe joints, fitting and appurtenance installation shall be in accordance with the manufacturer's recommendations. All pipes and joints shall be approved by the Owner or Owner's Representative prior to backfilling. The work will not be accepted until satisfactory backfilling, compaction, testing and cleanup is complete. Final grading should prevent surface water runoff from pooling around installed facilities. If the work does not meet the specified requirements of this Section, the Contractor shall remove and replace and re-test, as necessary, at the Contractor's expense. The Contractor shall leave each premise in a neat and orderly condition, restoring it as near as possible to its original condition and to the approval of the Owner or Owners' Representative.

TP - 04.03 MATERIALS:

Materials shall be inspected to verify that they meet these specifications and match the approved submittals. Materials not meeting these requirements shall not be permitted to be installed. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes and regulations, and these specifications.

The unloading, handling, and storage of the pipe and materials shall be conducted in a safe manner. Handle pipe with padding between metal machinery and pipe. Keep dirt and foreign material away from pipe interiors and sealing surfaces. Lower pipe carefully into the trench without dropping, rolling or dumping the pipe.

A. General: Inspect all materials prior to installation to ensure that they are in new condition. Ensure that pipe, fittings and materials are free from defects and damage at the time of delivery and prior to installation in the trench. Plastic pipe with scratches, gouges, or grooves deeper than 10% of the wall thickness or ultraviolet discoloration shall be rejected. Remove all materials from site that are defective, damaged, used, unsound, or that otherwise do not meet the specifications within 24-hours of discovery.

B. Pipe: All pipe shall be listed under the National Sanitation Foundation (NSF) Part 61. The standard pipe length shall be 20 feet. Each length of pipe shall be clearly marked with the following: Manufacturer, Nominal Pipe Size, PVC Cell Classification, Type PSM PVC Sewer Pipe, ASTM Designation and Pipe Class.

1. Polyvinyl Chloride Pipe (PVC): PVC pipe shall meet the requirements of NSF 14.

a) PVC Pipe and Fittings (2-inch): PVC pipe shall be SDR 21 (200 psi). Each joint of pipe shall carry the NSF seal of approval for pipes for potable water. Pipe shall conform to ASTM D2241 and ASTM D1784. Fittings shall be 2-inch SDR-21 gasketed fittings with the PVC material

conforming to ASTM D1784, NSF 14, joints conforming to ASTM D3139, and gaskets (elastomeric seals) conforming to ASTM F477.

b) PVC Pipe and Fittings (4-inch to12-inch): PVC pipe and joints shall conform to the requirements of ANSI/AWWA C900 DR 18 or C909 DR18 pressure class 235 (minimum), Standard for Polyvinyl Chloride (PVC) Pressure Pipe, with gaskets meeting ASTM F477 joints conforming to ASTM D3139, and gaskets (elastomeric seals) conforming to ASTM F477 or as otherwise defined on the Bid Schedule.

c) PVC Pipe and Fittings (14-inch and larger): All 14-inch and larger PVC pipe shall conform to the requirements of AWWA C905 with gaskets meeting ASTM F477 and joints in compliance with ASTM D3139 and gaskets conforming to ASTM F477.

2. Ductile Iron Pipe (DIP): All ductile iron pipe shall be manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51 for centrifugally cast ductile iron pipe. Pipe shall be manufactured in accordance with ANSI/AWWA C111/A21.11 for rubber gasket joints for ductile iron pressure pipe and fittings.

a) Pipe thickness shall meet the requirements of ANSI/AWWA C150/A21.50 for thickness design of ductile iron pipe.

b) Pipe shall be cement mortar lined and seal coated meeting the requirements of ANSI/AWWA C102/A21.4 for cement mortar lining for ductile iron pipe and fittings for water.

c) Pipe shall have push-on joints, unless otherwise indicated on the plans or in the Bid Schedule.

3. High Density Polyethylene Pipe (HDPE): All HDPE used in constructing the water main shall conform to Section 28 of these Technical Provisions.

C. Ductile Iron Fittings: Ductile iron fittings shall meet ASTM A536, 350 psi pressure rating for 2-inch to 24-inch diameter fittings in accordance with ANSI/AWWA C153/A21.53. Ductile and gray iron fittings shall conform to AWWA C110 and AWWA C111. Refer to manufacturer's recommendations for allowable deflection of fittings.

Flanged ends on fittings shall meet ANSI/AWWA C115/A21.15 and ANSI B16.1 class 125 flanges. Fittings shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4 or shall be epoxy lined. Fittings shall be coated with an asphaltic seal coat on the outside only in accordance with ANSI/AWWA C153 and C104/A21.4 and referenced in ANSI/AWWA C153/A21.53. Gaskets shall be styrene butadiene rubber (SBR) meeting ANSI/AWWA C111/A21.11. Fittings shall have t-bolts and nuts manufactured of low alloy steel meeting ANSI/AWWA C111/A21.11 and ASTM A307. Fittings shall be listed under the National Sanitation Foundation (NSF) Part 61.

D. Mechanical Joint Restraints:

1. General: Mechanical joint restraints shall be manufactured of DI in accordance with ASTM A536 with the following additional requirements or exceptions. Joint restraint thrust bolts and nuts shall be ¾" low alloy (mild) steel. Mechanical joint restraints shall be incorporated into the design of a follower gland. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts in accordance with AWWA C111 and C153. A fully restrained joint shall have the same working pressure rating as the pipe itself.

2. Design: The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges that are designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized the same as tee-head bolts, shall be used to ensure the proper actuating of restraining devices. When the nut is sheared off, a standard hex nut shall remain.

3. Pressure Rating: The mechanical joint restraint device shall be as listed below:

Type of Pipe	Sizes (Inches)	PSI	Safety Factor
DI	3 to 16	350	2
	20 to 36	250	2
PVC	Various	Equal to that of the pipe being used	2

4. Acceptable Models and Manufacturers:

Mechanical Joint Restraint – PVC Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
EBAA Iron, Inc.	Megalug 2000 PV Series	4 to 20
Sigma Corporation	One-Lok SLCE Series	4 to 20
Star Pipe Products	StarGrip 4000 Series	4 to 20

Mechanical Joint Restraint – DI Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
EBAA Iron, Inc.	Megalug 1100 Series	3 to 24
Romac Industries	RomaGrip	3 to 24
Sigma Corporation	One-Lok SLDE Series	3 to 12
Star Pipe Products	StarGrip 3000 Series	3 to 24
Uni-Flange (Ford)	UFR 1400 Series	3 to 24

Bell-Spigot Restraint – PVC Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
EBAA Iron, Inc.	Series 1500 TD	4 to 12
	Series 1500	4 to 12
Ford Meter Box	Ford 1390	4 to 12
Star	Series 1100	4 to 12

Bell-Spigot Restraint – DI Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
American	Fastgrip Gasket	4 to 16
EBAA Iron, Inc.	Megalug 1700 Series	3 to 20
	Series 1500 TD	4 to 12
Star Pipe Products	StarGrip 3100P Series	3 to 20
U.S. Pipe	Field Lok Gasket	4 to 16

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Bolt-Through Mechanical Joint Restraint
Foster Adaptor

Hydrants and Valve Restraint – DI Pipe
Mueller Aquagrip Restraint Device

E. Gate Valves: Gate valves shall conform to the latest revision requirements of AWWA C509 or C515 for resilient-seated gate valves. All valves shall be equal to the AVK Series 25 or 65 or the American Flow Control Series 2500, or approved equal.

1. General:

   a) Gate valves shall be of cast iron or ductile iron body construction, bronze mounted, solid wedge, resilient seal, with a 2-inch square stem-operating nut, 200 psi operating pressure or higher, counterclockwise opening, inside screw, with O-ring seals.

   b) The Contractor shall provide to the Owner, at no additional cost, one gate valve wrench 6 foot long with "T" handle.

   c) Mechanical restraint joints shall be used unless otherwise indicated.

   d) When a valve is required near a fitting, such as a tee, the valve shall be secured with mechanical joint restraints to the fitting.

2. Markings: The name, monogram or initials of the manufacturer shall be legibly cast on the valve body. The make of valves furnished shall be easily identifiable by catalog numbers.

3. Valve Stems: All valves shall be furnished with valve stems made from 300 or 400 series stainless steel and shall be non-rising stems (NRS).

4. Lining: All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 6 mils. Epoxy linings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550.

5. Coating: All exterior ferrous surfaces, except finished or bearing surfaces, shall be factory coated with two coats of asphaltic varnish conforming to Federal Specifications TT-V-51c, or shall be epoxy coated as required above for interior surfaces.

F. Gate Valve Boxes: All gate valves shall be provided with a $5^{1}/_{4}$-inch inner-diameter shaft, 2-piece sliding extension type cast iron valve box. The gate valve box shall be Tyler Union 6855 Domestic Heavy Duty, or approved equal.

1. General:

   a) All boxes shall extend from the body of the valve to the finished grade.

   b) The vertical column of the box shall be designed so that the top section may be adjusted while in position.

   c) The cast iron lid shall be 5-1/4" Domestic Heavy Duty Drop Lid with a pentagon nut and the word "WATER" cast on the lid.

   d) For the concrete collar, the concrete shall conform to Section 02 of the Technical Provisions and the reinforcing steel shall conform to Section 03 of the Technical Provisions.

2. Extension stems: When the valve operating nut is more than four feet below the top of the valve box, stainless steel extension stems equal to TROY VALVE Stainless Steel Valve Extension Stems shall be provided. The top of the extension shall be 3 ½ to 4 feet below the top of the valve box.

3. Debris Cap:

   a) Each valve box shall have a debris cap designed to prevent debris such as dirt and sand from passing around the cap and down into the valve housing and installed just below the valve cover.

   b) The cap shall be held in place by a mechanism which will not damage the valve housing.

   c) The cap must withstand, without slippage, a minimum vertical force of 50 pounds at a loading rate of 1 inch/minute.

   d) The debris cap and bottom of valve cover shall be separated by a minimum of 1 inch and not to exceed 2 inches.

   e) The cap shall be manufactured with corrosive-resistant material and fit the valve box's 5¼" diameter shaft. Caps shall be debris cap model number DC455 or DC457 manufactured by SW Services, LLC or approved equal. The debris cap shall be installed according to the manufacturer's recommendations.

G. Combination Air Valve: The valve shall have the features of both an air release and an air/vacuum release valve. The valve shall have either a single or dual body with a large orifice. The valve shall be an ARI D-040, or approved equal.

1. General:

   a) Size range of the valve shall be from 1-inch to 2-inch, or as specified on the design plans.

   b) The body and all operating parts shall be made of high strength corrosion-resistant materials.

   c) Working pressure shall be a minimum of 250 psi.

   d) The valve shall have the ability to automatically release small pockets of air during normal operation.

   e) The valve shall have the ability to automatically discharge or admit large volumes of air during filling and draining.

   f) Utility marker shall conform to Section 01 of the Technical Provisions.

   g) Concrete shall conform to Section 02 of the Technical Provisions and reinforcing steel shall conform to Section 03 of the Technical Provisions.

2. ARV Vault:

   a) Diameter of the vault shall be 48-inches or as shown on the design plans.

   b) Vault shall be composed of precast reinforced manhole barrel sections and shall have a 28-day compressive strength of at least 3,000 psi.

   c) Minimum height of sections shall be 24 inches. If two or more manhole sections are used to construct the vault, the joints between precast manhole sections shall be sealed with Ram Nek bituminous rope type sealer, or equal.

   d) The sections shall be grouted to a smooth finish on the interior and exterior of the manhole.

   e) Grout for jointing shall be as specified in Section 02 of the Technical Provisions.

   f) All connections between pipe and manhole walls shall be sealed with non-shrinking grout.

g) The depth of the vault from interior floor to the underside of the access hatch shall not exceed 48 inches.

h) If depicted on the plans, the drain pipe shall be 4-inch SDR 35 pipe. The pipe material shall transition to 4-inch DI pipe at the outlet end (10-foot minimum length) and where bury depth is less than 1-foot. Install #8 steel mesh at outlet end anchored with a 4-inch DI flange adapter and 4-inch DI rectangular accessory bolt pack kit.

3. Vault Concrete Collar and Vault Lid:

a) Concrete collar shall be reinforced with #4 steel hoops centered horizontally and vertically.

b) Vault lid (access hatch cover) shall be a Halliday Series R1R Model R1R48, or approved equal.

c) Opening of the lid shall be over the larger area of the vault as shown on the detail.

d) The frame edge for the vault lid shall be coated with bituminous coating where in contact with the concrete vault for proper sealing.

e) Four (4) stainless steel lag-bolts with a minimum bolt diameter of 3/8-inch shall be used to mount the frame to the inside wall of the vault. An appropriate concrete anchoring system such as expanding lead lag-shields shall be used. The bolts shall be installed in an equally spaced, four quadrant pattern as shown on the plans or directed by the Owner's Representative.

f) The underside of the lid shall be insulated in cold climates, as shown on the design plans or directed by the Owner or Owner's Representative. The insulation can be field installed or can be factory installed by the manufacturer. Field installed insulation shall be completed using 2-inch polystyrene insulation board with appropriate compatible adhesive or an approved securing mechanism, as directed by the Owner's Representative.

4. ARV Inlet (Riser) and Outlet (Discharge) Piping:

a) Material of the inlet and outlet pipe shall be rigid and non-corrodible. Joining of dissimilar metals should be avoided. If approved by the Owner and show in the plans, dielectric unions may be installed, if dissimilar metals are used. The material of the inlet and outlet pipe shall be as specified on the design plans and detail drawings.

b) The pipe material from the tee/saddle or compression fitting elbow at the bottom of the vault, to the Schedule 80 PVC union shall be brass. The pipe material from the Schedule 80 PVC union to the outlet end of the gooseneck shall be galvanized steel. For the Horizontal Offset Option, the pipe material from the water main to the bottom compression fitting elbow in the vault shall be PE 4710. Appropriate reducers shall be used for the outlet or inlet of the ARV piping, as shown on the design plans and detail drawings.

c) No pipe, valve or fitting on the inlet or outlet line shall be smaller than the ARV inlet or outlet.

d) The stabilizing bracket for the riser piping shall be a Unistrut P1381 Angular Fitting, Unistrut P1000 1 5/8" Solid Channel and Unistrut Cush-A-Clamp, or approved equal.

e) Full port true union type ball valve and fittings shall match the material and size of the riser pipe.

f) Sample tap shall be non-threaded cross wheel style, NSF 61 approved. The Contractor shall provide a valve operating stem key for the sample tap to the operating utility.

g) The above grade outlet of the discharge line (air relief line) shall be a screened return bend as shown on the detail drawing. The screen shall be #24 mesh non-corrodible copper, bronze, or brass.

h) When the ARV is located directly above the water main connection, the connection shall be made with either a tee or a tapping saddle. The tee and reducer shall meet the requirements of TP 04.03.C. The saddle and corporation stop shall be meet the requirements of TP-05.

i) When the ARV is offset from the water main connection, the corporation stop, saddle, PE pipe and fittings shall meet the requirements of TP-05.

H. Blow-off Hydrant Assembly: Blow-off shall be non-freezing, self-draining type, with 6-inch or 4-inch MJ inlet, non-turning operating rod and shall open to the left (counter clockwise). The blow-off assembly shall be a Kupferle Foundry model 7600-4", or approved equal.

1. General:

a) All working parts shall be brass and shall operate with a 2-inch gate valve wrench.

b) When open, valve shall be completely unobstructed, and drain hole shall be covered.

c) Inlet shall be 6-inch or 4-inch FIP, as shown on the plans and details.

d) Outlet shall be 4-inch FIP.

e) Concrete shall conform to Section 02 of the Technical Provisions and reinforcing steel shall conform to Section 03 of the Technical Provisions.

2. Portable Discharge Riser: 4-inch aluminum piping and fittings, 4-inch camlock male to female NPT (quick connect), dimensions and configuration shown on the detail drawings. Portable discharge riser to be constructed by the Contractor and provided to the Owner.

3. Fire Hose and Quick Connect Adapter: 4-inch single jacket fire hose, 50 feet, minimum, 125 psi service pressure. Adapter: stainless steel 4-inch male camlock to male NPT (quick connect). Hose to be provided by the Contractor to the Owner.

4. Blow-off Valve Vault and Cover: Vault shall be reinforced concrete pipe, 24-inch inside diameter. Riser grade rings with tar sealer may be used. Frame and cover shall be heavy duty cast iron, concealed pickslots, gasketed, with Penta Head security bolts, centered over the valve box, stamped "WATER" on top of the lid, Neenah 1295B, or approved equal. Contractor shall provide a Penta Head Wrench and Socket to the Owner.

5. Drain Pipe: If depicted on the plans, the drain pipe shall be 4-inch SDR 35 pipe. The pipe material shall transition to 4-inch DI pipe at outlet end and where bury depth is less than 1-foot. The DI pipe shall be a minimum of 10 feet long. Install #8 steel mesh at outlet end anchored with a 4-inch DI flange adapter and 4-inch DI rectangular accessory bolt pack kit.

I. Tapping Sleeves: Tapping sleeves shall be stainless steel with mechanical joint seals and class 125 outlet flange, Mueller H-304SS, or approved equal.

J. Warning Tape and Tracer Wire: Warning Tape and Tracer Wire (including tracer wire access boxes and tracer wire splice kits) shall be in accordance with Section 01 of the Technical Provisions.

K. Markers and Bollards: Markers and Bollards shall be in accordance with Section 01 of the Technical Provisions.

L. Filter Fabric: Class A 6 oz. nonwoven or woven polypropylene or polyester fabric.

M. Fire Hydrants: Conform to AWWA C502.

1. New hydrants shall conform to the requirements of AWWA C502 (AWWA Standard for Dry Barrel Fire Hydrants).

2. Unless otherwise indicated, hydrants shall be equipped with two National Standard 2 ½-inch hose nozzles and one National Standard 4 ½-inch pumper nozzle.

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3. The hydrant inlet connection shall be sized for a 6-inch pipe. The hydrant valve shall open against line pressure and shall be no less than 4 ¼ -inches.
4. The bury depth shall be adequate to maintain the minimum cover over the pipe per TP-4.04.C.
5. The hydrant shall be designed so that all renewable parts can be changed without digging up the hydrant.
6. Hydrants shall be equipped with traffic safety flanges designed to break away in the event of horizontal impact.
7. The operating nut and nuts on each hydrant cap shall be 1 ½-inch National Standard pentagon nuts. Direction of opening shall be counterclockwise, as shown by an arrow cast on the hydrant.
8. Exterior shop coating of the hydrant top section shall be chrome yellow.
9. The hydrant shall have weep holes to allow the hydrant to drain, unless directed otherwise by the Owner's Representative.
10. Concrete shall conform to Section 02 of the Technical Provisions and reinforcing steel shall conform to Section 03 of the Technical Provisions.
11. Acceptable models: Mueller Super Centurion 250, Waterous (American Flow Control) WB-67, or approved equal.

TP - 04.04 PIPE CONSTRUCTION REQUIREMENTS:

Trenching, backfilling and compaction operations shall be performed as specified in Section 01 of the Technical Provisions. Pipe and fittings shall be installed in accordance with the manufacturer's printed specifications and instructions, to the standards of AWWA for installing the type of pipe used, and in accordance with this technical provision.

A. General:

1. Install water mains and appurtenances in the locations and of the sizes and materials shown on the plans and Bid Schedule.
2. Pipe, fittings, valves, and hydrants shall be carefully handled to avoid damage.
3. Contractor to provide staking in accordance with Section 01 of these Technical Provisions.
4. Locating existing utilities shall be the responsibility of the Contractor in coordination with a representative from the operating utility.
5. Existing water mains shall be properly abandoned in place and all facilities located at ground surface shall be removed and disposed of at the Contractor's expense.

B. Pipe Protection:

1. No pipe shall be laid when trench or weather conditions are unsuitable for such work.
2. Under no circumstances shall pipe be laid in water. Trenches shall be kept free from water at all times.
3. The interior of all pipe shall be thoroughly cleansed of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by use of plugs or other approved devices.
4. As the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous materials of every description.
5. Promptly remove all debris that enters the pipeline and swab the area with 1% hypochlorite solution.

6. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed with a water tight plug so that no trench water, rodents, earth, or other substances will enter the pipe or fittings.

C. Pipe Installation:

1. All pipe shall be laid to the depth shown on the plans, or at such depths as may be established by the Owner or Owner's Representative in order to connect the new pipe to the existing water mains.
2. Unless otherwise specified, the pipe shall be laid to a depth that will provide for a cover of at least 3 feet from the top of the pipe to finished grade.
3. Each section of pipe shall rest upon undisturbed earth, or compacted bedding materials, with recesses excavated to accommodate joints.
4. When trench bottom is soft and cannot support the pipe, a further depth and/or width shall be excavated and refilled to grade with stabilization and bedding material as specified in Section 01 of these Technical Provisions.
5. Joints with pipes of differing materials shall be made with appropriate adapters approved by the Owner or Owner's Representative, but in no case will threading of the PVC pipe wall be allowed.
6. Where required, PVC pipe shall be cut square using a powered cutoff saw, carpenter's fine tooth handsaw, or hacksaw. Once cut, the pipe shall be machine or hand beveled to give a one-half inch tapered end.

D. Pipe Deflection:

1. Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflecting the joints.
2. The amount of deflection at each pipe joint shall not exceed the manufacturer's printed recommended deflections.
3. When rubber gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wider on curves for this purpose.
4. Any pipe that has its grade or joint disturbed after laying shall be taken up and relayed.

E. Backfill and Acceptance:

1. The Contractor shall make every effort to backfill all excavation by the end of each workday.
2. Work covered by this section will not be accepted until the backfilling, compaction and testing connected with the work has been completed satisfactorily.
3. Any section of water main that is found to be defective in material, alignment or joints before acceptance shall be corrected to the satisfaction of the Owner's Representative.
4. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe without additional expense to the Owner.

F. Mechanical Joint Restraints: MJ Restraints shall be installed at all bends, caps, tees, crosses, valves, fire hydrants and flush hydrants (blowoff valve assemblies). Pipe joints adjacent to restrained bends and fittings shall be restrained in accordance with the plans and details.

1. General:

a) Mechanical joint restraints shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.

b) Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.

2. Special Anchoring Retainer Glands:

a) Install in accordance with manufacturer's recommendations.

b) Fully restraint all joints within 20 feet of a fitting with appropriate restraint. Owner or Owner's Representative may specify that an additional restraint be used for pipe sections near critical fittings.

G. Concrete Thrust Blocks:

1. Thrust Blocks:

a) Concrete thrust blocks shall be used on 2 inch PVC pipe, as shown in the plans.

b) Concrete thrust blocks shall not be used on any water pipe greater than 2 inches in diameter unless specified and approved by the Owner or Owner's Representative and shown on the plans or detail drawings.

c) When thrust blocking is approved by the Owner's Representative, concrete blocking shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to block weep holes or obstruct access to the joints of the pipe or fittings.

d) Concrete shall not come into direct contact with mechanical joint restraints, if necessary, polyethylene wrap shall be used as a barrier.

2. Concrete:

a) Concrete shall conform to Section 02 of the Technical Provisions and reinforcing steel shall conform to Section 03 of the Technical Provisions.

b) The concrete shall have minimum 28 day compression strength of 3,000 psi.

c) The concrete shall not cover nuts and bolts of joints or fittings.

d) Polyethylene wrap shall be placed on fitting bolts to prevent hardening of concrete on connections.

e) Under no circumstances shall concrete thrust blocks be allowed on vertical bends in lieu of mechanical restrained joints.

H. Warning Tape: Warning Tape shall be installed on all water mains in accordance with Section 01 of the Technical Provisions.

I. Tracer Wire: Tracer Wire (including tracer wire access boxes and tracer wire splice kits) shall be installed on all water mains in accordance with Section 01 of the Technical Provisions.

TP - 04.05 WATER AND SEWER LINE SEPARATION REQUIREMENTS:

Water lines located near sewers present conditions for serious potential cross contaminations. Protection from cross contamination can be provided by separation of the facilities and use of special piping materials. Water and sewer line separation requirements shall strictly adhere to the requirements set forth in Section 01 of these Technical Provisions.

TP - 04.06 INTERCONNECTIONS TO EXISTING MAINS:

A. Interconnections:

1. An interconnection is the connection of a new pipeline to an existing pipeline.

2. An interconnection includes excavation, backfill, compaction, tapping sleeve, adapters, mechanical joint restraints, random lengths of pipe and any other supplies and materials required.
3. Interconnections do not include connections within the new work or service connections. Only those connections of new water mains to existing water mains which require that the existing main be cut or tapped are considered interconnections.
4. Connections to existing valves, fittings, or pipe ends which have been plugged or capped are not considered interconnections. Removal of the plugs, caps, and thrust blocks is considered incidental to normal installation of the new pipe.
5. Shutoff of mains will not be permitted overnight, over weekends or on tribal or federal holidays.
6. Only start work when all the materials, equipment and labor are on site. Once work on the connection has commenced, it shall proceed continuously without interruption, and as rapidly as possible until completed.
7. Any joints not pressure tested for leakage shall be visually inspected under system pressure prior to backfilling. Visual inspection of joints shall be completed under system pressure in the presence of the Owner or Owner's Representative. Repair and retest any joint with leakage until no leakage is visible, at no cost to the Owner.

B. Tapping Permit and Schedule:

1. A tapping permit (if required) shall be obtained by the Contractor from the operating utility and all work shall be performed in conformance with approved tapping permit.
2. If a tapping permit cannot be obtained, the time and method of connection to existing water mains shall be approved by both the operating utility and by the Owner or Owner's Representative (when these two entities are not the same) prior to such connections.
3. The Contractor shall notify the Owner or Owner's Representative and operating utility at least two (2) working days in advance of any water service disruption due to shutting off any portion of the existing water main. Each connection with an existing water line shall be made at a time and under conditions which will least interfere with water service to customers affected thereby as authorized by the operating utility and as evidenced by an approved tapping permit. The Contractor shall coordinate with the Owner and operating utility to notify the residents affected by water shutoff of the time and day of shutoff a minimum of two (2) working days in advance.

C. Tapping into Existing Main:

1. Connections to existing mains shall be made as shown on the drawings.
2. If the connection is a dry connection, the tee used shall meet the requirements of TP-04.03C.
3. If the connection is a wet connection, a stainless steel tapping sleeve shall be used. Stainless steel tapping sleeves shall be equipped with a ¾ inch diameter test plug and internal gasket as specified in TP-04.03.I.
4. Tapping valves shall have ends and seat rings of sufficient size to permit the use of full size cutters of either the Mueller, Ford or Smith type tapping machines.
5. Tapping sleeve valves shall be flanged on one end to fit the tapping sleeve and a flange hub-end or mechanical joint on the other.
6. All connections shall be made in a neat and professional manner. Such connections shall be made to the satisfaction of the operating utility and to the Owner or Owner's Representative.
7. Proper tools and fittings to suit actual conditions encountered in each case shall be utilized. The cutting of pipe for inserting fittings or closure pieces shall be done in strict accordance with

recommendations of the pipe manufacturer and without damage to the pipe or coating, and so as to leave a smooth end at right angles to the axis of the pipe.

8. The interconnection shall be marked and shown in the record drawings.

D. Contamination and Disinfection:

1. Great care shall be taken to prevent pipeline contamination when cutting into and making connections with existing pipelines used for the conveyance or distribution of water for domestic or public use.
2. The Contractor shall cooperate with the operating utility in locating services, and shall conduct his/her operations in such a manner that no trench water, mud, or other contaminating substances are allowed to enter the connected line or lines at any time during the progress of the work.
3. Disinfection procedures for connecting to existing mains shall adhere to AWWA C651 Section 4.7, (Disinfection Procedures When Cutting Into or Repairing Existing Mains).
4. The interior of all pipe, fittings, and valves, installed in such connections, shall be swabbed or sprayed with a 1% hypochlorite solution before they are installed, as directed by the AWWA standard referenced above.
5. All fittings and appurtenances removed in the connection process shall remain the property of the operating utility unless specified otherwise.

E. Provisions for Asbestos-Cement Pipe:

1. If Asbestos-Cement (AC) Pipe is being replaced, the AC pipe shall be abandoned in place.
2. The project may include taps/cuts into the existing AC pipe. Other unexpected or unavoidable breaks into the existing AC pipe are possible.
3. The Contractor shall comply with all applicable Federal, State, Local, EPA, OSHA, and Arizona, Nevada, California and Utah Departments of Transportation regulations pertaining to exposure to and handling, containment, transport, and disposal of asbestos material.
4. If the bidding Contractor is not licensed to perform these services in the state the project is being constructed, the Contractor shall retain the services of a licensed Asbestos Abatement sub-contractor to perform said services.
5. Further, the Contractor/Sub-Contractor must utilize the services of a commercial hauler that is registered with the respective state's environmental regulatory agency to transport asbestos. The Contractor/Sub-Contractor must dispose of any asbestos waste material generated as a result of the construction project at a solid waste facility authorized for asbestos waste disposal.
6. The Contractor, per OSHA requirements, must train field personnel in the identification of asbestos containing material.
7. The Contractor must submit the following items with the bid:
   a) Name and license number of the Asbestos-Abatement Contractor that will be responsible for the work described above.
   b) References (including the owner's name, address and phone number) for at least five comparable projects performed by the Asbestos-Abatement contactor.
   c) A work plan describing work procedures, equipment to be used, transportation procedures and final disposal facility for asbestos material.
   d) A health and safety plan which includes air-monitoring procedures as required by OSHA.

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TP - 04.07 SETTING GATE VALVES AND BOXES:

A. General:

1. Install valves at locations indicated on the plans
2. Valve installation shall be as per these specifications and as shown on the detail drawings.
3. All valves, including gate valves, air release valves, and blow-off assemblies, shall be set, jointed and restrained to the pipe in the manner as set forth in the AWWA Standards for the type of connecting ends furnished.
4. Before installing the valve assembly, care shall be taken to see that all foreign material and objects are removed from the interior of the valve.

B. Setting Valves and Valve Boxes:

1. Valves and valve boxes shall be set plumb and valve boxes shall be placed over the valve or valve operator in such a manner that the valve box does not transmit shock or stress to the valve.
2. Support gate valves on a 4-inch concrete block set on compacted base during assembly and fully restrain the valve to the water main piping as shown on the detail drawings.
3. Center the valve box over the valve nut.
4. Backfill shall be placed and compacted around the valve box. The valve box shall be maintained plumb and centered over the valve nut during backfilling and compaction.
5. The valve shall be opened and closed to verify that all moving parts are in working order.
6. The cast iron valve box cover shall be set flush with elevated concrete collar or flush with the road surface.
7. Install a debris cap in the valve box meeting the requirements of TP 04.03.F.3 and as shown in the detail drawing.

C. Concrete Collar:

1. After installing the gate valve box, the Contractor shall properly compact the area around the gate valve box prior to installing the concrete collar to ensure that there is no settlement.
2. A 32-inch diameter OR a 24-inch square by 4-inch thick reinforced concrete pad shall be poured around each valve box as shown on the plan and detail drawings or instructed by the Owner or Owner's Representative.
3. A tracer wire access box shall be set in the concrete collar and next to the valve box with the tracer wire routed and connected as shown in the detail drawing.
4. Before the concrete has set, the Contractor shall neatly scribe in the concrete pad the size of the valve, material of pipe and orientation of the pipe with two arrows.

D. Valve Markers:

1. For valves outside of the right of way, the Contractor shall install two offset permanent Metal Marker Posts for all water main valves installed under this contract.
2. The marker posts shall be equidistant (4 feet typical) at a 45 degree angle from the valve to the main.
3. Set marker post with 36-inches of post above grade with label facing roadway and valve between roadway and post.

4. Stencil the size of the valve and the distance to the valve legibly on the aluminum cap. Dimensions and thickness shall meet requirements shown in applicable TP 01 Detail. Metal marker post shall meet the requirements of and be installed in accordance with Section 01 of these Technical Provisions.
5. For valves within the right of way, the Contractor shall install a Utility Line Marker to locate the valve. Utility line markers shall meet the requirements of and be installed in accordance with Section 01 of these Technical Provisions.

TP - 04.08 SETTING COMBINATION AIR VALVES AND VAULTS:

Combination air valves shall be installed in accordance with the manufacturer's printed specifications and instructions. The air valve vault shall be installed in accordance with the applicable sections of TP-01.

A. General:

1. The air release valve and vault shall meet the requirements of TP 04.03.G.
2. Install air release valves and vaults at locations indicated on the plans and as shown in the detail drawings.
3. All air release valves shall be set, jointed and restrained to the pipe in the manner as set forth in the AWWA Standards for the type of connecting ends furnished.
4. Before installing the valve assembly, care shall be taken to see that all foreign material and objects are removed from the interior of the valve.
5. Utility marker shall be installed as shown on the detail drawing and in accordance with TP-01.

B. Setting Vault:

1. Vault shall be set plumb and level on solid concrete masonry blocks and gravel base as shown on the detail drawings. The diameter of the gravel base shall be 6-feet minimum. Gravel shall be placed below the vault and in the vault to the depth shown in the detail drawings.
2. If a drain pipe is shown in the plans, the depth of the gravel below the vault shall be 6-inches minimum. If there is not a drain pipe is shown in the plans, the depth of the gravel below the vault shall be 12-inches minimum.
3. Manhole sections, and adjustment rings if required, shall be grouted in place when the manhole is constructed. The grout shall be spread evenly over the entire mating surface. The maximum number of adjustments rings shall be indicated on the plans. The jointing and sealing materials shall be approved by the Owner or Owner's Representative prior to installation.
4. Backfill shall be placed and compacted around the vault. The vault shall be maintained plumb during backfilling and compaction.
5. Penetrations in the vault walls shall be made as shown in the detail drawings. All vault penetrations shall be sealed with approved grout material.

C. Concrete Collar:

1. After installing the concrete vault, the Contractor shall compact the area around the vault prior to installing the concrete collar to ensure that there is no settlement.
2. A 12-inch wide by 6–inch thick (minimum) reinforced circular concrete pad shall be poured around the vault as shown on the plan and detail drawings or as instructed by the Owner or Owner's Representative.
3. The concrete collar shall have a minimum slope of 1/12 away from the vault.

4. The above grade galvanized outlet piping shall penetrate the concrete collar as shown on the detail drawing. The penetration shall be sealed with approved grout.

5. The vault lid shall be securely bolted to the inside wall of the vault per the manufacturer's recommendations. The lid shall be oriented, bolted and sealed in accordance with TP 04.03.G.3. The lid shall be set 4-inches above finished grade with the concrete collar sloping as shown on the detail drawing. A pad lock shall be provided with the lid and keyed as requested by the operating utility.

D. Setting Valve and Piping:

1. The water main line shall be tapped at the location shown on the plans or as instructed by the Owner or Owner's Representative.

2. The inlet line shall be connected to the water main using a water tight connection as shown on the plans. The Contractor shall use the approved connecting fittings including tees, reducers, service saddles, corp stops and piping. Mechanical restraints shall be used as necessary to secure the connection.

3. Where the air release valve and vault are offset horizontally from the water main, the horizontal sections of piping shall have a minimum of 1% slope upwards to allow for the upward movement of air from the water main.

4. The size of the air release valve and fittings, as well as the inlet and outlet piping for the valve shall be as sized by the Owner's Representative and as indicated on the plans.

5. The location and configuration of the air release valve and fittings, as well as the inlet and outlet piping for the valve shall be as indicated on the detail drawings. The riser piping assembly shall be located 12-inches to 18-inches from the vault wall.

6. The internal vault piping shall be supported with a rigid non-corrosive bracket assembly as shown in the detail drawings. This bracket shall be anchored to the internal concrete vault wall with the specified concrete anchor bolts and concrete anchoring system per TP 04.03.G.3.

7. Vinyl tape shall be wrapped around all galvanized steel pipe that is in contact with soil or concrete.

8. The ball valve, sample tap and air release valve shall be tested after installation to verify that all moving parts are in working order.

E. Drain Pipe:

1. The drain pipe shall only be installed if depicted on the plans (where the vault can drain to daylight).

2. The drain pipe shall be constructed to the alignment and length shown on the plans. The drain pipe shall be constructed as shown in the detail drawings.

3. Excavation, backfilling and compaction for the installation of the drain pipe shall meet the requirement of TP 01.

4. The inlet invert of the drain pipe shall be set at the top of the gravel in the vault. The drain pipe inlet edge shall be flush with the interior wall of the vault.

5. The outlet shall be screened per the detail drawings. The outlet screen shall be secured to the end of the drain pipe using the appropriate ductile iron fittings specified in TP 04.03.G.2.h. The outlet screen shall be wire brushed, sprayed with rust neutralizer and then coated with epoxy paint to protect the screen against corrosion.

6. Rip rap shall be installed for erosion protection around the drain pipe outlet.

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TP - 04.09 SETTING BLOW-OFF HYDRANT ASSEMBLIES AND VAULTS:

Blow-off hydrants shall be installed in accordance with the manufacturer's printed specifications and instructions. The vault shall be installed in accordance with the applicable sections of TP-01.

A. General:

1. The hydrant shall meet the requirements of TP 04.03.H.
2. Install blow-off hydrants and auxiliary gate valves at the locations indicated on the plans and as shown on the detail drawing.
3. Utility marker shall be installed as shown on the detail drawing and in accordance with TP-01.
4. The hydrant and auxiliary gate valve shall be tested upon completion.
5. The portable discharge riser shall be constructed per TP 04.03.H.2 and shall be provided to the Owner.

B. Auxiliary Gate Valve and Valve Box:

1. The auxiliary gate valve and valve box shall be installed in accordance with TP 04.07. The concrete collar around the auxiliary gate valve and valve box shall be installed in accordance with TP 04.07.C and the drawings.
2. The auxiliary gate valve and valve box shall be located adjacent to the blow-off hydrant per the detail.
3. The pipe length and material type between the blow-off hydrant and the auxiliary gate valve and between the auxiliary gate valve and the water main shall be as designated on the plans and details.
4. Fully restraint joints between the water main tee and the auxiliary gate valve, and between the auxiliary gate valve and the blow-off hydrant.
5. Under no condition shall the diameter of the auxiliary pipe and auxiliary gate valve be less than 4-inches for blow-off hydrants. The pipe and auxiliary valve size shall match that of the blow-off hydrant inlet, as shown on the drawings.
6. Tracer wire and tracer wire access box shall be installed in accordance with the detail drawing and the provisions of TP 01.
7. Rip rap consisting of a minimum 4-inch to 6-inch angular diameter shall be compacted around concrete collar. The rip rap shall be placed around the collar at the required distance and thickness provided in applicable detail. Filter fabric shall be installed between rip rap and native soil as shown in details.

C. Installing Blow-off Hydrant:

1. Blow-off Hydrants shall stand plumb and shall have their nozzles pointed vertically upwards. The hydrant shall be set centered within the concrete vault.
2. Hydrant shall be restrained to the auxiliary pipe according to the manufacturer's recommendation. Contractor shall provide the required bolts, nuts and gaskets for the mechanical joint connection (MJ DI Transition Accessory Pack with Gland) and shall torque the bolts according to manufacturer's recommendation.
3. The hydrants shall be set so that the top of the discharge riser is 12-inches max from the top of the vault cover.
4. The hydrant interior shall be free of all dirt or foreign matter before installation.

D. Hydrant Base:

1. Set hydrant on compacted gravel base and on solid concrete blocks as shown in the detail drawing.

2. A gravel seepage area (drain pit) shall be provided around the weep hole near the hydrant. Gravel shall be installed as per the detail drawing.

3. A suitable concrete thrust block shall be constructed at the base of the hydrant in accordance with the detail drawings. Once the hydrant is set, concrete shall be poured against undisturbed earth in such a manner that the weep hole is kept free from all concrete or mortar. If the weep hole is covered either partially or wholly, the hydrant shall be cleaned in place and the gravel and concrete removed and replaced with new gravel and concrete.

4. Filter fabric shall be placed 4-inches below the top of the gravel drain pit as shown on the detail drawing.

E. Setting Vault:

1. Vault shall be set plumb and level on solid concrete masonry blocks and gravel base as shown on the detail drawings. Gravel from the drain pit shall extend into the vault to the depth shown in the detail.

2. Penetrations in the vault walls (if depicted in the plans) shall be made as shown in the detail drawings. All vault penetrations shall be sealed with approved grout material.

3. Backfill shall be placed and compacted around the vault. The vault shall be maintained plumb during backfilling and compaction.

F. Concrete Collar:

1. After installing the concrete vault, the Contractor shall compact the area around the vault prior to installing the concrete collar to ensure that there is no settlement.

2. A 6-inch wide by 6–inch thick (minimum) reinforced circular concrete pad shall be poured around the blow-off vault as shown on the plan and detail drawings or instructed by the Owner or Owner's Representative.

3. The concrete collar shall have a minimum slope of 1/12 away from the vault.

4. The cast iron frame and cover shall be anchored to the concrete collar and installed per the manufacturer's recommendations. The base of the frame shall be set 2-inches above finished grade.

5. Rip rap consisting of a minimum 4-inch to 6-inch angular diameter shall be compacted around concrete collar. The rip rap shall be placed around the collar at the required distance and thickness provided in applicable detail. Filter fabric shall be installed between rip rap and native soil as shown in details.

G. Drain Pipe:

1. The drain pipe shall only be installed if depicted on the plans (where the vault can drain to daylight).

2. The drain pipe shall be constructed to the alignment and length shown on the plans. The drain pipe shall be constructed as shown in the detail drawings.

3. Excavation, backfilling and compaction for the installation of the drain pipe shall meet the requirement of TP 01.

4. The inlet invert of the drain pipe shall be set at the top of the gravel in the vault. The drain pipe inlet edge shall be flush with the interior wall of the vault.

5. The outlet shall be screened per the detail drawings. The outlet screen shall be secured to the end of the drain pipe using the appropriate ductile iron fittings specified in TP 04.03.H.5. The outlet screen shall be wire brushed, sprayed with rust neutralizer and then coated with epoxy paint to protect the screen against corrosion.

6. Rip rap shall be installed for erosion protection around the drain pipe outlet.

TP - 04.10 SETTING HYDRANTS:

A. General:

1. Install hydrants and auxiliary valves at the locations indicated on the plans.
2. The hydrant shall meet the requirements of TP 04.03.M. It shall be the Contractor's responsibility to order the correct bury depth hydrant or to inform the Owner or Owner's Representative of the necessity for risers when the need becomes apparent.
3. Hydrant installation shall be as shown on the detail drawing. All hydrants shall be tagged or covered until fully operational.

B. Auxiliary Gate Valve and Valve Box:

1. An auxiliary gate valve and valve box shall be located adjacent to the hydrant per the detail drawing.
2. The pipe length and material type between the fire hydrant and the auxiliary gate valve and between the auxiliary gate valve and the main shall be as designated on the details and plans.
3. Fully restraint joints between the tee and the auxiliary gate valve, and between the auxiliary gate valve and the hydrant.
4. Under no condition shall the pipe and valve diameter be less than 6-inch for fire hydrants.

C. Installing Hydrant:

1. Hydrants shall stand plumb and shall have the pumper nozzles oriented perpendicular to the street or in the direction approved by the Owner or Owner's Representative.
2. The hydrants shall be set so that the bury depth indicator on the hydrant barrel is at final grade.
3. Set hydrant with the breakaway traffic flange at an elevation of 2-inches above finished grade. The hydrant interior shall be free of all dirt or foreign matter before installation.
4. The Contractor shall use a hydrant operating wrench to turn the nozzle cap, pin and lug type hose couplings and hydrant operating nut. The Contractor shall replace any components they damage due to using improper tools.

D. Hydrant Base:

1. Set hydrant on compacted base.
2. A gravel seepage area (drain pit) shall be provided around the weep hole near the hydrant. Gravel shall be installed as per the detail drawing. Place gravel from 18-inches below to 6-inches above the weep hole opening.
3. A suitable concrete thrust block shall be constructed at the base of each hydrant in accordance with the plans and details. Once the hydrant is set, concrete shall be poured against undisturbed earth in such a manner that the weep hole is kept free from all concrete or mortar. If the weep hole is covered either partially or wholly, the hydrant shall be removed and cleaned and the gravel and concrete removed and replaced with new gravel and concrete.
4. Filter fabric shall be placed above the gravel drain pit as shown on the detail drawing.

TP - 04.11 POLYETHYLENE WRAPPING:

Where called for in the plans and specifications or directed by the Owner or Owner's Representative, pipe (ductile iron), valves, and fittings shall be encased in a polyethylene protective wrapping referred to hereafter as poly-wrap.

A. Materials: The poly-wrap shall be of virgin polyethylene, not less than 8 mils in thickness, formed into tubes or sheets as may be required. Naturally pigmented material may be used where exposure to ultra violet light will be less than 48 hours. Otherwise the material shall be pigmented with 2 to 2 1/2 percent of well dispersed carbon black with stabilizers.

The poly-wrap shall be secured as specified below with 2 inches wide pressure sensitive plastic tape not less than 10 mils thick. Tape shall be Scotchrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex, or approved equal. The minimum tube sizes for each pipe diameters are indicated in the table below:

Polywrap Flat Tube Widths		
Nominal Pipe Diameter (inches)	**Tube Widths with push-on joints (inches)**	**Tube Widths with mechanical joints (inches)**
4	14	16
6	17	20
8	21	24
10	25	27
12	29	30

B. Installation:

1. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections.
2. With the pipe suspended from the center, the tube shall be slipped over the spigot end and bunched up between the point of support and the spigot end.
3. After the pipe is installed into the bell of the adjacent pipe, the pipe shall be lowered to the trench bottom and the supporting sling removed from the center of the pipe.
4. The pipe shall then be raised at the bell end enough to allow the tube to be slipped along the full length of the barrel with enough left at each end to overlap the adjoining pipe about 1 foot.
5. A shallow bell hole must be made at each joint to facilitate installation of the polywrap.
6. Pull the bunched-up polywrap from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place with one circumferential turn of tape plus enough overlap to assure firm adhesion.
7. Slip the end of the polywrap from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Tape polywrap in place.
8. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe, and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.
9. Repair any rips, punctures or other damage to the tube with the adhesive tape or pieces of tube material secured with tape.
10. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

TP - 04.12 PRESSURE TESTING:

Pressure testing shall be performed in accordance with these specifications. Use the Pressure Test Form at the end of this section. All water main pipe shall be pressure tested for leaks, including 2-inch pipe that is considered a water main. All pipelines shall be tested for water tightness up to the individual building service meter.

A. Concrete Thrust Blocking: Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the pressure tests shall not be made until at least 48 hours after installation of the concrete thrust blocking, unless otherwise approved by the Owner or Owner's Representative.

B. Equipment and Scheduling:

1. Contractor shall provide all necessary equipment, including but not limited to, an appropriate pump, water container, water meter, pressure gauge, valve, and hydrant or corporation stop connection, and shall perform all work required in connection with the tests.
2. Contractor shall coordinate with the Owner and Owner's Representative so they may witness the entire duration of each pressure test.
3. Prior to requesting the Owner or Owner's Representative to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have previously successfully performed the test to verify that the test section will pass.
4. The Contractor shall notify the Owner or Owner's Representative a minimum of two (2) working days in advance of the date that the Contractor plans to perform the pressure tests.
5. The test equipment shall be provided by the Contractor and is subject to inspection by the Owner or Owner's Representative.

C. Procedure: Arrangements for water used in pipeline testing and payment for the water shall be coordinated with the operating utility.

1. Test Preparation:

a) Pressure gauges used in testing shall be liquid filled and graduated at a maximum in 5 psi increments.

b) Two gauges will be used simultaneously for verification of the gauges' functionality with one gauge placed at the highest point and one at lowest point of the section being tested.

c) Prior to the test, the pipeline will be pressured to 10 psi above the test pressure, and then the pressure will be decreased to the test pressure so that gauge responsiveness can be observed.

d) Each section tested shall be slowly filled with water, with care being taken to expel all air from the mains and service lines, if installed.

e) If necessary, the pipes shall be tapped at high points to vent the air.

f) The test pressure shall be 150 psi (measured at the lowest point of elevation in the test section).

g) No section shall be tested that is greater than 2,500 feet in length or that has greater than 25 psi pressure change due to elevation.

h) In no case shall the test pressure be allowed to exceed the design pressure for pipe, appurtenances or thrust restraints.

i) The test shall be conducted in such a manner that existing lines and service user's plumbing is not damaged. Damage caused by testing shall be corrected at the expense of the Contractor.

j) All connections, blow offs, hydrants, house services up to the meter yoke, and valves shall be tested with the main as far as is practicable.

k) Air testing of water mains shall not be allowed.

l) Verify that all fire hydrant lead valves and main valves within the test section are open.

m) The test shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption.

2. Performing Test:

   a) The test section shall be slowly filled, at a velocity below 1 ft/s with potable water and all air shall be vented from the line. Install corporation stops at high points, if necessary, to facilitate air removal, and cap off after successful completion of the test.

   b) Pressurize the main to 150 psi as measured at the lowest elevation along the test section.

   c) The test shall have a minimum duration of two hours with the two hour period beginning when the test pressure is attained and the pump ceases operation.

   d) Any time the test pressure drops 5 psi, the pressure shall be restored to full test pressure and the quantity of water used shall be recorded.

   e) The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter with a sweep unit hand registering 1 gallon per revolution.

   f) At the conclusion of the test period, the Contractor shall pump the test section to full test pressure and record the total water used during the test.

3. Method of Water Measurement:

   a) Supply a means of accurate water measurement that is compatible with the pressurizing equipment (e.g. pump and hoses) such as water meter or water container with gradations. The measuring equipment must meet the approved submittal.

   b) The Contractor shall keep a record of all pressure tests.

   c) Minimum information recorded at the time of the test shall include the contract number, contractor name, date, time, stationing or other description of the test section, length and diameter of the test section, total allowable leakage, leakage detected, pass or fail indication and printed name of recorder.

   d) Copies of field pressure tests records shall be submitted to the Owner to show compliance with these requirements before payment is requested.

   e) Add total amount of water required to re-pressurize the line during and at the end of the test and compare with the allowable leakage as calculated in the Pressure Test Form.

   f) Allowable maximum leakage is 0.04 gallons per inch diameter per 24 hours per coupling.

   g) Visible leakage will not be allowed.

   h) All leaks shall be repaired and additional tests conducted until leakages are less than the allowable maximum. All repairs shall be made in a manner approved by the Owner and shall be at the expense of the Contractor.

   i) Disinfection and leak testing may be conducted concurrently.

TP - 04.13 FLUSHING & DISINFECTION OF MAINS:

A. Flushing before Disinfection:

1. Unless the Owner or Owner's Representative approves the Tablet Disinfection Method, the mains shall be flushed prior to disinfection.

2. Flush with potable water to provide 3 volumetric exchanges in the pipeline at a minimum velocity of 3 feet per second.

3. Pig line after flushing if sediment or debris is still visible in the discharge.

B. General:

1. The water mains, fittings and any existing facilities affected by the work shall be disinfected in accordance with AWWA C-651 (AWWA Standard for Disinfecting Water Mains) with water containing a minimum of 25 mg/l of chlorine.

2. This concentration may be obtained by installing temporary gas chlorination equipment, by introduction of a calcium hypochlorite (HTH) solution at several points, or by inserting soluble chlorine tablets in the pipeline as it is laid.

C. Disinfection Methods:

1. Tablet Method:

   a) This method is allowed only with Owner or Owner's Representative concurrence that storage, handling and installation of pipe were completed such that the pipe interior remained dry, clean and void of sediment and debris.

   b) Introduce tablets or granules to produce a free chlorine concentration of 25 mg/l during pipeline installation.

   c) If tablets are used, only those containing pure calcium hypochlorite will be allowed. Tablets containing any kind of stabilizer are prohibited.

   d) Since some stabilizers contain known or suspected carcinogens the Owner or Owner's Representative may require a certification of purity.

   e) Tablets shall be fastened to the top of the pipe with an NSF 61 approved adhesive such as Dow 732. The number of tablets required is given by Table 2, AWWA C-651.

2. Continuous Feed Method:

   a) Feed a chlorine solution into water entering the main such that the water will have a 25-mg/l free chlorine concentration.

   b) Continue feeding until the entire pipeline to be disinfected is filled with the chlorinated water.

   c) At the end of the 24-hours, there must be at least 10-mg/l free chlorine residual as evidenced by residual tests taken at approximately 1,200 foot intervals along the main.

3. Slug Method:

   a) Feed a chlorine solution into water entering the main such that the water will have a 100-mg/l free chlorine concentration.

   b) Apply the solution continuously and sufficiently to ensure that a column of water with 100 mg/l free chlorine residual is formed in the pipe.

   c) Ensure that all parts of the main and its appurtenances are exposed to the column for at least 3 hours.

   d) Check the residual of the column at 1,200 foot intervals along the main. If it drops below 50 mg/l, inject additional chlorine solution into the entire column such that its residual is raised to 100 mg/l.

   For the Continuous Feed & Slug Test Methods, ensure that the chlorine solution is introduced within 10-feet of the end of the section being disinfected and for all cases is being withdrawn or wasted from the most extreme point relative to the point of water introduction. If branches exist, ensure that the chlorinated solution reaches all portions of the branches.

D. Flushing after Disinfection:

1. After at least 24 hours contact time with the disinfection solution, the line shall be thoroughly flushed.
2. Flush chlorinated water in an environmentally safe manner. In no case shall direct disposal to surface water be permitted.
3. Check the chlorine residual at the time of disposal.
4. If disposal to a community sewer system is available, neutralize the chlorine residual if the free residual is above 10 mg/l.
5. If disposal is to the ground surface or ditch, neutralize chlorine residual if free residual is > 1 mg/l.
6. Flushing shall continue until all visible debris has been removed and the chlorine concentration is the same as in the existing system, or not more than 0.4 mg/l in a new or unchlorinated system.

E. Bacteriological Testing:

1. After disinfection and flushing, but before the water main is placed into service, the Contractor shall collect two bacteriological samples, 24 hours apart, at the service farthest from the water source for each system or independent extension.
2. The samples shall be forwarded to a State or EPA certified laboratory for water testing and analysis. The laboratory fees, shipping fees, etc. shall be paid for by the Contractor.
3. If the results are negative, the system may be put into service.
4. If either of the samples are positive, the system shall be disinfected again and a samples resubmitted for testing. This shall be repeated until negative results are obtained.
5. Contractor shall provide the Owner or Owner's Representative with documentation of results within 24 hours of laboratory results. Successful (negative) bacteriological test results and the required chlorine residual at the connection point to the existing system will be required prior to acceptance and beneficial use.

TP - 04.14 CLEANUP:

Upon completion of the work, the entire site shall be cleared of all debris, and the ground surface shall be finished to smooth and uniform slopes. Cleanup shall be considered an incidental item and no additional payment shall be made for it. All fences, clotheslines, gravel driveways or other obstructions removed during construction shall be left in a condition at least equal to their condition prior to construction.

TP - 04.15 RECORD DRAWINGS:

Record Drawings shall meet the requirements of TP 01 and the Supplementary Conditions of the contract.

TP - 04.16 METHOD OF MEASUREMENT AND BASIS FOR PAYMENT:

All payments will be based on completed work performed in strict accordance with the plans and specifications, and the respective prices and payment shall constitute full compensation for all work completed, including incidentals. No separate payment will be made for thrust blocks, excavation, trenching, compaction and backfilling or other incidental items of work required under this section, and all such costs pertinent to these items shall be included in the applicable unit prices.

A. Water Pipe: Water pipe shall be measured in linear feet along the centerline of the pipe, including fittings, for each of the various sizes of water pipe installed. Payment for water pipe shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, bedding, stabilization

material, compaction, backfilling, pipe installation, fittings, thrust blocks, mechanical joint restraints, water main warning tape, water main tracer wire, tracer wire access box, hydrostatic pressure testing, disinfection, flushing, bacteriological testing, record drawings, final grading, seeding and final cleanup.

B. Gate Valves: Payment for water main gate valves shall be measured each for the various sizes of gate valves installed. Payment for valves shall be at the contract unit price shown in the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, related valves boxes, materials, and incidentals required for a complete installation, including excavation, gate valves, valve box, debris cap, concrete block, mechanical joint restraints, reinforced concrete pad, tracer wire access box, rip rap, marker posts, compaction, backfilling, record drawings, and final cleanup.

C. Fire Hydrants: Payment for hydrants shall be at the contract unit price shown in the Bid Schedule for each type of hydrant shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, tee or tapping sleeve connection to the main, mechanical joint restraints, auxiliary piping, gate valve and box, reinforced concrete pad, tracer wire access box, rip rap, hydrant, thrust block, seepage gravel, concrete blocks, filter fabric, compaction, backfilling, record drawings, and final cleanup.

D. Interconnections: Payment for interconnections shall be at the contract price shown in the Bid Schedule. Payment shall be full compensation for excavation, fittings, tapping sleeves, adapters, thrust blocks, mechanical restrained joints, markers, compaction, backfilling and any other supplies and materials.

E. Water and Sewer Main Crossings: All costs associated with completion of water and sewer main crossings shall be merged with other bid items and will not be considered a separate item for payment.

F. Combination Air Release and Vacuum Valve and Vault: Payment for combination air release and vacuum valves shall be measured each for various sizes of valves installed. Payment for combination air valves shall be at the contract unit price shown in the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, connection to water main, connection fittings, piping, combination air and vacuum valve, ball valve, sample tap, union, pipe support, screened gooseneck, seepage gravel, concrete vault, reinforced concrete collar, frame and cover, drain pipe and screen, drain pipe outlet erosion protection, bollards, compaction, backfilling, record drawings, and final cleanup.

G. Blow-off Hydrant Assembly: Payment for blow-off assembly shall be at the contract unit price shown in the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, tee or tapping sleeve connection to the main, mechanical joint restraints, auxiliary piping, gate valve and box, reinforced concrete collars, tracer wire, tracer wire access box, rip rap, seepage gravel, concrete blocks, thrust block, filter fabric, blow-off valve, RCP vault, CI frame and locking cover, penta head wrench and socket, portable discharge riser, fire hose, utility marker, compaction, backfilling, record drawings, and final cleanup.

H. Testing: No separate payment will be made for pressure testing, disinfection, flushing, and bacteriological testing. All costs associated with completion of all required testing shall be merged with other bid items and will not be considered a separate item for payment.

INCORPORATED INTO THE CONTRACT

PRESSURE TEST FORM: METHOD AND RECORD

(Water Pressure Pipes)

Project: _____ Owner: _____

Location: _____ Date: _____

Project #: _____

Contractor: _____

Inspector: _____

Tester: _____

Test Section Area: _____

Test Section Location: From Station: _____ To Station: _____

(I) CALCULATE ALLOWABLE LEAKAGE (for 2 hour test at 150 psi for PVC):

$$L = \frac{N \times D}{300}$$

L = Allowable leakage: _____ gallons

D = Diameter of pipe: _____ inches

N = Number of joints in test section: _____

(II) CONDUCT AIR VOLUME TEST:

1. Pressurize line to 150 psi
2. Remove volume of water equal to amount of allowable leakage
3. Recheck pressure to assure a significant change (10 psi min.) from 150 psi.

(III) CONDUCT PRESSURE TEST:

1. Re-pressurize line to 150 psi
2. Add water as necessary to maintain pressure between 140 and 150 psi for test period (2 hours)
3. Upon completion of test period add water to increase the pressure back to 150 psi
4. Measure total volume of water added in steps 2 & 3. ***If the volume of water added exceeds allowable leakage, the test failed.***

INCORPORATED INTO THE CONTRACT

Time	Air Volume Test			Pressure Test			Pass Y/N	Owner Witness Signature
	Initial Pressure (psi)	H_2O removed (gal)	Final Pressure (psi)	Initial Pressure (psi)	Final Pressure (psi)	Total H_2O Added (gal)		
	step 2.1	step 2.2	step 2.3	step 3.3	step 3.3	steps 3.2–3.4		

REMARKS:

_____

_____

_____

"I CERTIFY THE ABOVE REFERENCED SECTION OF WATER MAIN HAS BEEN PRESSURE TESTED AND PASSED IN ACCORDANCE WITH THE PROVISIONS OF THIS SPECIFICATION."

_____

Contractor's Representative Date

_____

Owner's Representative or Inspector Date

INCORPORATED INTO THE CONTRACT

SUBMITTAL REVIEW FORM, SECTION 04

WATER TRANSMISSION AND DISTRIBUTION MAIN

	DATE	INITIALS	Submittal No.	
Received by ENGINEER:			Project No.	
Received by OWNER:			Contract No.	

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
04.03B1	PVC Pipe		
04.03B2	DI Pipe		
04.03C	DI Fittings (Bends, Tees)		
04.03D	Pipe Restraint		
04.03E	Gate Valve		
04.03F	Gate Valve Box & Lid		
04.03F2 04.03F3	Extension Stem & Debris Cap		
04.03G	Combination Air Release Valve Assembly		
04.03G2, G3, G4	ARV Vault, Cover, Fittings, Valves, Bracket & Piping		
04.03H	Blow-off Assembly		
04.03H2, H3, H4 & H5	Blow-off Vault, Cover, Portable Discharge Riser, Hose, Drain Pipe		
04.03I	Tapping Sleeve		

INCORPORATED INTO THE CONTRACT

04.03L	Filter Fabric		
04.03M	Hydrant		
04.11	Poly-wrap		
04.10	Pressure Testing Method & Equip		
04.12	Pressure Test Results		
04.13.C	Disinfection Method		
04.13.E	Water Testing Lab & Bacteriological Results		
04.06	Method of Connection to Existing Water Main		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 05 – WATER SERVICE LINES

TP-05.01 SCOPE:

Furnish all labor, materials, equipment, and incidentals as required, and perform all operations in connection with the complete installation of water service lines, in strict accordance with the applicable plans, details and these Technical Provisions. All permits, permissions, or other authorizations required by the tribal or municipal utility authority for tapping and connection are the responsibility and to the cost of the Contractor.

TP-05.02 GENERAL:

New service line locations are identified on the plans. Water service lines shall be installed as shown on the detail drawing and connected to the existing building water service line stub-out within five (5) feet of the building. Contractor shall verify the location, size, and type of service line stub-out. Service line staking and staking for new water main tap and meter box shall be performed by the Contractor and approved by the Owner or Owner's Representative. Locating existing lines and valves shall be the responsibility of the Contractor in coordination with a representative from the operating utility. Existing water service lines will be properly abandoned in place and all facilities located at ground surface shall be removed and disposed of at the Contractor's expense. Trench excavation and backfilling operations shall be performed as specified in Technical Provision 01 (TP-01).

Contractor shall contact each resident or business to verify the time that water service will be disconnected during service line tie-in. Connection to existing service or utilities, or other work that requires the temporary shutdown of any existing services shall be planned and coordinated with the operating utility.

Pipe joints and fitting installation shall be in accordance with the manufacturer's recommendations. The work will not be accepted until satisfactory backfilling, compaction and cleanup is complete. If the work does not meet the specified requirements of this section, the Contractor shall remove and replace at the Contractor's expense. The Contractor shall leave each premise in a neat and orderly condition, restoring it as near as possible to its original condition and to the approval of the Owner or Owners' Representative.

TP-05.03 WATER SERVICE LINE MATERIALS:

Materials shall be inspected to verify that they meet these specifications and match the approved submittals. Materials not meeting these requirements shall not be permitted to be installed. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes and regulations, and these specifications.

The unloading, handling, and storage of the pipe and materials shall be conducted in a safe manner. Inspect all materials prior to installation to ensure that they are in new condition. Inspect pipe and fittings for defects. Plastic pipes with scratches, gouges, grooves or discoloration shall be rejected. Remove all materials from site that are defective, damaged, used, unsound, or that otherwise do not meet the specifications.

Each length of pipe used shall be clearly marked with the following: Manufacturer, Nominal Pipe Size, PE or PVC Classification, ASTM Designation and Pipe Class.

A. Polyethylene (PE) Pipe: All polyethylene (PE) pipe and fittings furnished under this specification shall be NSF 61 and AWWA approved for potable water service line, shall conform to ASTM D2239, shall conform to all applicable provisions and requirements of the latest revision of AWWA C901. PE pipe must be 200 psi minimum pressure rated, PE4710 or equal, and shall have a Plastic Pipe Institute (PPI) recommended long term Hydrostatic Design Stress (HDS) of at least 1,000 psi at a temperature of 73ºF (23ºC). Specific pipe sizing and dimension ratio (DR) are provided in the drawings and/or Bid Schedule.

B. PE Pipe Fittings: Brass fittings for the PE pipe shall be designed to prevent collapsing and pullout. Fittings shall use a compression ring, or pack joint, with stainless steel stiffeners, to make a watertight

connection. Fittings shall not contain lead and shall be Mueller Insta-tite, Ford (Ultra-tite, Pack Joint, or Grip Joint), or equal as approved by the Owner or Owner's Representative. All brass fittings shall have the letter "NL" cast into the main body signifying NO LEAD for proper identification.

C. PVC Pipe and Fittings (2-inch): PVC pipe shall be SDR 21 (200 psi). PVC pipe shall meet the requirements of NSF 14. Each joint of pipe shall carry the NSF seal of approval for pipes for potable water. Pipe shall conform to ASTM D-2241 and ASTM D-1784. Rubber coupling rings shall conform to ASTM D-1869.

D. Service Saddles: Water service saddles or clamps, shall be of stainless steel, bronze, or brass construction and of a design that will prevent collapsing of the PVC main line. Service saddles or clamps shall comply with the latest versions of AWWA C605 and C800. Saddles shall be Mueller BR 2 S (for all types of water mains) or BR 2 B (not allowed for PVC mains) Series double strap type, Mueller SS Series stainless steel service saddles (for all types of water mains), Ford FS202 Series double strap type (for all types of water mains), Ford FS303 Series stainless steel service saddles (for all types of water mains), or approved equal, for the size of pipe tapped. Threads shall be IPT.

E. Corporation Stops: Corporation stops shall be brass with IPT inlet and an Insta-tite, Grip Joint, Ultra-tite, or Pack Joint outlet. Corporation stops shall be lead free and be equal to Mueller H-15028 or Ford FB1000-4 per the latest version of AWWA C800.

F. Curb Stops and Boxes: Curb stops shall be brass, Mueller Mark II Oriseal or Ford ball valve curb stop or approved equal. Curb stops shall have IPS to PE Insta-tite (Mueller), Ultra-tite (Ford), Pack Joint (Ford), or Grip Joint (Ford) end connections, a solid tee head roadway, and quarter turn stops. Curb stop valves must comply with the latest version of AWWA C800. Boxes shall be 1-1/4-inch diameter Arch Pattern in cast iron, Mueller, Ford, or approved equal. They shall have a 48-inch minimum box extension length with a 40-inch stationary rod and a one piece locking top.

G. Water Meter and Box Combination:

1. Coppersetter: Ford 70 Series, or equal, lead-free coppersetter with cartridge style dual check valve and angle ball valve stop; 5/8-inch by 3/4-inch or approved equal shall be utilized. Adequate brace bars to support the meter in a horizontal position in a rigid manner shall be provided. Where an Individual PRV is required, a horizontal tandem style lead-free coppersetter with cartridge style dual check valve and angle ball valve stop; 5/8-inch by 3/4-inch or approved equal shall be installed.

2. Individual Pressure Reducing Valve (PRV): If required, or as shown on the plans, PRVs shall be lead-free and NSF-certified. Individual PRVs shall be Zurn-Wilkins Model NR3XL or approved equal. The PRV shall only be installed if indicated on the plans.

3. Water Meter: The water meter shall be a sealed register magnetic drive water meter with nutating disc, positive displacement, magnetic, or ultrasonic lead-free meter. The meter shall be Badgermeter Model 25, Sensus iPerl, Neptune T10 series, Kamstrup Ultrasonic water meter, or equal as indicated on the project plans and as approved by Owner and noted on the Bid Schedule.

4. Meter Box and Cover: Boxes in traffic areas shall be wire reinforced concrete with steel diamond plate or cast iron covers with interlocked sections. Boxes and covers in non-traffic areas shall be wire reinforced concrete. All sections of all boxes shall be nested or otherwise interlocked to prevent lateral movement. Sufficient sections shall be installed to provide a walled enclosure for a minimum depth of 6 inches below the angle valve. Minimum cover opening dimensions shall be 9-inches by 14-inches. Pea gravel or 3/4 inch crushed rock shall be placed inside the meter can below the water meter to a minimum depth of three (3) inches as shown on the drawings. The meter box shall be installed on bricks or masonry block on top of the prepared subsurface.

H. Tracer Wire, Tracer Wire Access Point, and Warning Tape: Shall be installed per the requirements of TP-01.

I. Pipe Hangers: Shall be made of material compatible with piping material. Shall be of sufficient strength to support pipe at full capacity. Shall not affect pipe integrity by abrading, cutting or bending of pipe.

J. Pipe Insulation: Pipe insulation shall be closed cell, pre-slit foam insulation properly sized for pipe and fittings.

TP-05.04 SERVICE SADDLE AND CORPORATION STOP INSTALLATION:

A water service saddle shall be installed at the water main with a corporation stop, without disruption of the main service. Each water service line connection to an existing water main shall be live tapped through the corporation stop with an approved tapping machine, unless otherwise approved by the Owner or Owner's Representative in writing. Dry taps are only permitted during new water main installation, prior to disinfection. Contractor shall take the necessary precautions to prevent damage to the water main during the tapping process.

TP-05.05 WATER SERVICE LINE INSTALLATION:

All water service line components shall be disinfected, by spraying or swabbing with a chlorine solution containing a minimum of 50 mg/L of chlorine. The components shall be disinfected just prior to installation.

A. Water Service Lines

1. Water service lines shall be installed per ASTM D2774 (PE) or AWWA C605-05 (PVC).
2. PE pipe shall be installed with sufficient slack for thermal expansion and contraction.
3. All water service lines shall have a minimum cover of 36 inches, or as directed by the Owner or Owner's Representative.
4. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or foreign substances will enter the pipes or fittings.
5. Splices are not allowed on the water service line without approval from the Owner or Owner's Representative.
6. Compression couplings shall be used for all connections.
7. For connections beneath the home, install pipe hangers at a maximum spacing of 2-feet apart for all horizontal PE pipe beneath the home. Install pipe insulation at locations shown on the plans.
8. If no connection is made to the building stub out, cap the new water service line within 5-feet of the proposed building with a water tight plug. A piece of No. 3 rebar, 1-foot in length shall be installed to mark the service line terminus. Bury the rebar 6-inches below ground surface. Embed a 2x4 post (or stake) near the service line terminus extending a minimum of 6-inches above the ground.
9. Install Tracer Wire and Warning Tape along the water service lines from the water main to the meter box and to the building, or as shown on the drawings. Tracer wire shall be installed and tested in accordance with TP 01.

B. Curb Stop and Box

1. Curb stops shall be supplied and installed at the locations shown on the plans. The curb stop shall be installed according to the manufacturer's recommendations.
2. Set curb stop on a solid concrete block 2-inches thick by 8-inches wide by 16-inches long. Concrete block shall be set on undisturbed earth. Install stationary rod on the curb stop.
3. Set the top of the curb box flush with finished grade elevation.
4. Support curb box during backfilling operation to prevent movement and maintain a vertical (plumb) position.

C. Water Meter and Box

1. The water meter and box shall be installed as shown on the detail drawing.
2. The meter box shall be installed on top of a gravel base and bricks or masonry blocks as indicated in the detail drawing.
3. The meter box shall be set 1/2 inch above the finished grade of the site or adjacent pavement surface.
4. The meter box shall be supported during backfill to ensure final setting of the meter box is plumb.

TP-05.06 RECORD DRAWINGS:

The requirements of Technical Provision 01 must be met. Failure to properly identify these items will result in the Contractor having to uncover pipe at Contractor's expense to verify their location. The record drawings shall become the property of the Owner after contract completion. Properly reference, record and stake water main tap locations to allow for ready relocation.

TP-05.07 PRESSURE TESTING AND FLUSHING:

Water service lines, joints and meter installation shall be tested by applying mainline pressure to the service line before backfilling and observing leaks in the presence of the Owner's Representative. No visible leakage will be allowed. If a new water main is pressure tested, the water service lines can be tested at the same time and pressure as the water main. Provision shall be made to prevent pressurizing of interior home plumbing during the test. Repair all visible leaks and retest the line until successfully completed, at the Contractor's expense.

After installation, the water service line, meter, and valves shall be thoroughly flushed for a minimum of 15 minutes. Flushing shall be completed prior to connecting to the house or existing service line. If a restricted flow, or leak, is observed, the Contractor shall correct the identified problem prior to backfilling. Contractor shall test the chlorine residual of the flushed water and provide the reading to the Owner's Representative so it can be compared to the minimum required by the operating utility and EPA.

TP-05.08 WATER SERVICE AND SEWER CROSSINGS:

Where water and sewer lines cross, the requirements of TP-01 must be met.

TP-05.09 MEASUREMENT AND PAYMENT:

A. Water Service Lines: Water service lines shall be measured in linear feet along the centerline of the pipe. Payment for the water service lines shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, bedding, stabilization material, pipe installation, backfilling, compaction, seeding, disinfection, hydrostatic testing, flushing, and final cleanup.

B. Service Line Connection: Cost for the water service line connection shall include the water main tap, water service saddle, and corporation stop. Each water service line connection shall be measured such that a water main tap and connection to the corresponding building stub-out or plugged line as required shall be counted as a total of one each. Payment for these connections shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, water main tap, saddle, corporation stop, building stub-out connection or line termination and plugging, applicable tapping fees, backfilling, compaction, and final cleanup.

C. Curb Stop: Curb stop shall be measured as each. Payment for the curb stop shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, curb stop, curb box and stationary rod, fittings, backfilling, compaction, and final cleanup.

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D. Water Meter and Box Combination: Water meter and box shall be measured as each. Payment for the water meter and box shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, copper-setter, water meter, water meter box with lid, fittings, gravel, backfilling, compaction, and final cleanup.

E. Water Meter, PRV, and Box Combination: Water meter, pressure reducing valve (PRV) and box shall be measured as each. Payment for the water meter, PRV, and box shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, copper-setter, water meter, PRV, meter box , fittings, backfilling, compaction, and final cleanup.

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SUBMITTAL REVIEW FORM
SECTION 05 – WATER SERVICE LINES

	DATE	INITIALS		
Received by ENGINEER:			Submittal No.	
Received by OWNER:			Project No.	
			Contract No.	

TP	Specification	Description (Indicate Type, Model No. Manufacturer, etc.)	Action by Owner
05.03.A	PE Pipe		
05.03.B	PE Pipe Fittings		
05.03.C	PVC Pipe & Fittings		
05.03.D	Service Saddles		
05.03.E	Corporation Stops		
05.03.F	Curb Stops & Boxes		
05.03.G.1	Coppersetter		
05.03.G.2	Pressure Reducing Valve		
05.03.G.3	Water Meter		
05.03.G.4	Meter Box and Cover		
5.03.I & J	Pipe Hangers and Pipe Insulation		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

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TECHNICAL PROVISIONS

SECTION 06 - GRAVITY SANITARY SEWERS

TP - 06.01 SCOPE:

The work covered by this section consists of furnishing all plant, labor, equipment, materials and incidentals, in connection with the construction of gravity sewer mains, manholes and appurtenances, in accordance with the plans and specifications.

TP - 06.02 GENERAL:

All facilities shall be constructed in the locations to the grades and of the sizes shown on the plans. Locating existing utilities shall be the responsibility of the Contractor in coordination with a representative from the operating utility. Excavation, trenching, backfilling, compaction and any needed dewatering shall be completed in accordance with Section 01 of the Technical Provisions, unless specifically altered under other requirements of this specification section.

Any section of sewer that is found defective in material, alignment, grade or joint shall be corrected so as to meet these plans and specifications. If the work does not meet the specified requirements of this section, the Contractor shall remove and replace at the Contractor's expense.

TP - 06.03 MATERIALS:

Materials shall be inspected to verify that they meet these specifications and match the approved submittals. Materials not meeting these requirements shall not be permitted to be installed. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes and regulations, and these specifications.

The unloading, handling, and storage of the pipe and materials shall be conducted in a safe manner. Inspect all materials prior to installation to ensure that they are in new condition. Inspect pipe and fittings for defects. Plastic pipe with scratches, gouges, or grooves shall be rejected. Plastic pipes with discoloration shall be rejected. Remove all materials from site that are discolored, defective, damaged, used, unsound, or that otherwise do not meet the specifications.

A. Pipe, Joints and Fittings:

1. PVC Gravity Sewer Pipe: Sewer pipe shall be PVC and shall conform to all requirements of product standard ASTM D3034 for pipe diameters up to 15 inches and ASTM F679 for 18-inch to 48-inch diameter sewer mains.

    a) Sewer pipe shall meet the pipe compound requirements of ASTM D1784 and shall be made with PVC 1120 resin, Type I, Grade I. Pipe stiffness shall meet ASTM D2412.

    b) Pipe shall be nominal size, SDR-35.

    c) Joints shall be furnished with one end belled. The joint shall be integral bell and spigot with a Rieber rubber gasket. The integral bell shall meet ASTM D3212. The gaskets shall be as recommended by the pipe manufacturer and shall meet ASTM F477. Lubricants used for the joint installation shall meet the requirements of the pipe manufacturer.

    d) Each length of pipe shall be clearly marked with the following: Manufacturer, Nominal Pipe Size, PVC Cell Classification, Type PSM PVC Sewer Pipe, ASTM Designation and Pipe Class.

2. Ductile Iron Pipe: All ductile iron pipe shall be in accordance with AWWA C151 and shall be in 18 to 20 foot lengths with single rubber gasket (push-on) joints in accordance with AWWA C111.

a) All 8-inch pipe will be minimum Class 50 in accordance with AWWA C150.

b) Each length of pipe shall be clearly marked with the following: Manufacturer, Nominal Pipe Size, ASTM Designation and Pipe Class.

3. Fittings: Fittings for gravity sewer pipe, including but not limited to wyes, tees, saddles, bends, crosses, sleeves, plugs, caps, reducers, and glands, shall be the same material as the sewer main being connected. Saddles fastened to pipe with external bands are not acceptable on new pipe. All of the fittings listed above, other than wyes, shall require approval from the Owner and Owner's Representative and shall only be installed when shown on the plans.

a) PVC fittings shall conform to PVC gravity sewer pipe requirements provided in this section.

b) Ductile iron fittings shall conform to the requirements of AWWA C110 with the joints meeting the requirements of AWWA C111.

B. Manholes:

1. General: All concrete used for cast in place shall conform to Section 02 of these Technical Provisions. Concrete and reinforcement shall conform to ASTM C478. Reinforcing steel shall also conform to Section 03 of these Technical Provisions.

2. Lines and Grades: All manhole locations shall be as shown on the plans unless field changes are necessary and approved by the Owner or Owner's Representative.

a) Sewer line cut stakes shall be provided by the Contractor, at each manhole and at the midpoint between each manhole at a minimum.

b) A minimum of 2 offset stakes shall be provided for each cut stake. Further information on staking is found in Section 01 of these Technical Provisions.

3. Manhole Frames and Covers: Frames and covers shall be grey cast iron casting and shall conform to plans and details in all essentials of design.

a) The cover shall have a lifting pocket and shall not be vented.

b) Castings shall conform to ASTM A-48, Class 30 and shall maintain AASHTO HS-20 traffic loading requirements.

c) The bearing surfaces of the frames and covers shall be machined and the cover shall seat firmly onto the frame without rocking.

d) Combined weight of frame and cover shall be 280 lbs minimum.

e) Covers shall be the types and shall be imprinted as shown on the plans or standard details.

f) The manhole and covers shall be set as shown on the plans or as directed by the Owner.

g) Frames and covers shall be Neenah R-1595, Jensen Model A-1024 or approved equal. The manhole lid shall be cast with the word "SANITARY SEWER".

h) Manhole inserts shall be installed in each manhole. The inserts shall be manufactured from ultra-high density polyethylene meeting the requirements of ASTM D-1248, Class A, Category 5 with a minimum uniform thickness of 1/8". The lift strap shall be made of a woven polypropylene web. Manhole inserts shall manufactured by Parson Environmental, Sealing Systems, Inc., or approved equal.

4. Steps:

a) Steps shall be cast iron or 1/2-inch Grade 60, steel reinforced copolymer polypropylene plastic not less than 12 inches in width.

b) If the polypropylene steps are utilized, care shall be taken to install them exactly according to the manufacturer's recommendations. All steps must be installed by manufacturer.

c) Steps shall be centered over the manhole outlet (unless otherwise shown on the plans or requested by the Owner), spaced 16 inches apart and aligned to form a continuous ladder.

5. Adjustment/Grade Rings:

a) General:

i. Adjustment/grade rings shall be made of concrete, HDPE or approved equal and shall be H25 traffic rated.

ii. Ring sealant shall provide a watertight seal.

b) Concrete:

i. Concrete grade rings shall be reinforced.

ii. Concrete grade rings shall be provided by the same manufacturer of the manholes for which they are being installed.

c) HDPE:

i. Adjustment rings shall be available in a variety of thicknesses.

ii. Adjustment rings shall be corrosion proof, and shall be resistant to UV, heat and hydrogen sulfide gas.

iii. Adjustment rings shall be available in slope rings to allow for easy adjustments to any grade.

iv. Adjustment rings shall be composed of high density polyethylene and shall be Ladtech Systems or approved equal

6. Manhole Bases:

a) Precast bases with precast channels shall be pre-approved by the Owner or Owner's Representative. The Contractor shall submit detail drawings showing the size, placement, and spacing of reinforcing bars for both pre-cast and cast-in-place manhole bases.

b) Bottom manhole sections shall have integral precast base or floor slabs.

c) Bases shall be 8 inches thick and bedded on 8 inches of compacted gravel meeting the requirements of TP 01.

d) Cast-in-place bases may be accepted on a site specific basis and as approved by the Owner or Owner's Representative.

e) Cast-in-place base slabs shall be constructed of reinforced Class A concrete formed, poured and vibrated as a monolithic pour onto an 8" gravel base.

f) Concrete for cast-in-place manhole bases shall be batched from a concrete batch plant and shall meet or exceed the compressive strength of the barrel and cone sections. On-site, field mixed concrete shall not be allowed. Cast-in-place manhole base bench and channel shall receive a smooth trowel finish.

7. Standard Manholes:

a) Standard manholes are those which have a depth, measured from the invert of the outlet pipe to the top of the cover, greater than 6 feet.

b) Standard manholes shall be constructed with a 4-foot inside diameter and 5-inch thick precast concrete sections and shall be constructed as shown on the detail drawing.

c) Cone sections shall be eccentric, 5-inch thick, precast concrete.

d) The base slab for standard manholes shall be 8- inches thick for manholes up to 13 feet deep and 12-inches thick for manholes between 13 feet and 20 feet deep. For standard manholes deeper than 20 feet deep, structural calculations are required to determine the base thickness.

8. Shallow Manholes:

a) Shallow manholes shall have a depth of 6 feet or less.

b) They shall be constructed with a 4-foot inside diameter and a 5-inch thick precast concrete section.

c) Shallow manholes shall have an 8-inch thick reinforced concrete flat top cover and base slab. They shall be constructed as shown on the detail drawings.

9. Drop Manholes:

a) Manholes shall have drop piping provided for sewer entrances at an elevation of 24 inches or more above the manhole invert.

b) Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.

c) Drop manholes should be constructed with an outside drop connection in accordance with the details.

d) As shown in the detail, the entire outside drop connection piping on the exterior of the manhole shall be encased in ¾" crushed rock.

10. Diversion Manholes:

a) Diversion manholes shall have a depth of 6 feet or less and shall be constructed with a 4-foot inside diameter and a 5-inch thick precast concrete section.

b) They shall have 8-inch thick reinforced concrete cover and base slabs.

c) Diversion manholes shall be constructed as shown on the detail drawings.

d) Each diversion manhole shall be provided with a fiberglass gate frame and gate. The fiberglass gate frame shall have a thickness of 3/16-inch. The gate frame shall have a channel that is ¼-inch. The fiberglass gate shall be ¼-inch thick. The gate frame and gate shall be constructed as shown on the detail drawings.

11. Manhole Coating: Coating shall only be applied at the manhole locations shown on the plans.

a) The inner surface of the new manhole sections and rings shall be lined with solvent free, 100% solids epoxy product as manufactured by Raven Lining Systems, Oklahoma, or approved equal.

b) The coating shall include a prime coat – 8 mils of AquataPoxy A-10 and a top coat of 100-125 mils of Raven 405. Total Dry Film thickness of epoxy coating system shall be a minimum of 105 mils.

c) Surface preparation, application methods and safety measures shall follow the manufacturer's recommendation.

12. Joints: Joints between precast manhole sections elements shall be sealed with a flexible gasket equal to Ram-Nek, ConSeal, or equal resin sealant, and grouted.

13. Waterstops:

a) All pipe penetrations through the manhole shall be equipped with waterstop devices conforming to ASTM C923.

b) Waterstop devices shall be equal to Kor-N-Seal 106-406 Series manufactured by Trelleborg, PSX: Positive Seal manufactured by Press-Seal Gasket Corporation, Z-Lok Connector manufactured by A-Lok Products, or Newby Waterstops by Newby Rubber Inc.

c) All penetrations shall then be grouted to provide a watertight penetration.

C. Sewer Main Cleanouts:

1. The cleanouts shall be constructed of the same pipe material and size as the sewer main, with a reinforced concrete collar, and cast iron frame and cover.

2. The frame and cover to be furnished on cleanouts shall be a Neenah R 1791-A, Star Pipe Product VB-0029 or approved equal. Lids shall be furnished standard with concealed, watertight pickhole, sealed with gasket, and fastened with stainless steel bolts.

3. All concrete for sewer main cleanouts shall have a 28 day compressive strength of 3,000 psi and be in accordance with Section 02 of these Technical Provisions.

D. Warning Tape: Warning tape shall be installed in accordance with Section 01 of the Technical Provisions.

E. Markers and Bollards: Marker and bollards shall be installed in accordance with Section 01 of these Technical Provisions.

TP - 06.04 TRENCH EXCAVATION AND BACKFILL:

Trenching and backfilling operations shall be performed as specified in Section 01 of these Technical Provisions.

TP - 06.05 WATER AND SEWER LINE SEPARATION REQUIREMENTS:

Water and sewer pipeline separation shall be maintained in accordance with Section 01 of these Technical Provisions.

TP - 06.06 INSTALLATION OF GRAVITY SEWER LINES:

Pipe joints and fitting installation shall be in accordance with the manufacturer's recommendation.

A. Trenches:

1. Excavation, trenching and backfill shall meet the requirements of Section 01 of these Technical Provisions.

2. The bottom of the trench shall be shaped to give uniform support to the pipe.

3. Trenches shall be kept free from water and the pipe shall not be laid when conditions of the trench or weather are unsuitable for such work.

4. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substances will enter the pipe.

5. If the maximum width of the trench at the top of the pipe specified in Section 01 of these Technical Provisions is exceeded for any reason other than at the direction of the Owner or Owner's Representative, the Contractor shall install such concrete cradling, encasement, gravel base or other bedding as may be required to satisfactorily support the added load of the backfill.

B. Pipe Laying:

1. Installation of pipe and fittings, including joint lubrication and assembly shall be in accordance with the manufacturer's recommendations.

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2. Pipe laying shall proceed upgrade (from lowest elevation to highest elevation), with the spigot end pointing in the direction of the flow (bell pointing upstream).
3. Each pipe shall be laid true to line and grade as shown on the plans, and in such a manner as to form a close concentric joint with the adjoining pipe. Ensure that vertical alignment does not deviate from 0.05% or 0.1 feet, whichever is less, from the design grade show in the plans.
4. The grade between manholes and cleanouts shall be uniform.
5. As the work progresses, the interior of the sewer pipe shall be cleared of all dirt and extraneous materials of every description.
6. Warning tape shall be installed along the sewer main between the manholes and cleanouts.
7. All sewer main line stub-outs shall be plugged. A PVC cap shall be solvent welded to the main line stub out. A piece of No. 3 rebar, 1-foot in length shall be installed to mark the main line stub out. Bury the rebar 6 inches below ground surface. A PE marker painted green shall also be installed at this same location.

TP - 06.07 INSTALLATION OF MANHOLES:

A. General:

1. Manholes shall be installed at the locations and elevations shown on the site plans.
2. Bases, walls and cones shall conform to the plans and details.
3. Manholes shall be installed so that the walls are vertically plumb.

B. Manhole Channel:

1. The manhole shall be positioned such that the pipes intersect in the center of the manhole circle. The invert channels will be formed directly in the concrete.
2. Manhole invert channels shall be smooth and semi-circular in shape, conforming to the inside of the adjacent sewer pipe section.
3. The invert shall be finished smoothly with a semi-circular cross section. Flat-bottomed inverts shall not be acceptable. Inverts with humps, low spots, or roughness of finish which will catch solid materials will not be acceptable. Inverts shall not be brush finished.
4. A minimum invert elevation drop of one-tenth of a foot (0.1 feet) from the entrance to the outlet shall be provided in all manholes where there is a change in direction or change in grade.
5. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. S-curves will not be acceptable.
6. Changes in sizes and grade of the channels shall be made gradually and evenly.
7. For those manholes where the sewer pipe does not change grade or direction the invert may be constructed by laying a full section of sewer pipe through the manhole. The top half of the pipe shall be removed after the concrete sets. Concrete bench shall be to the spring-line of the pipe.

C. Manhole Benches:

1. The floor of the manhole outside the channels (benches) shall be smooth and shall be sloped no less than ½ inch per foot (4 percent) and a max of 2 inches per foot (16 percent).
2. No lateral sewer, service connection, or drop manhole pipe shall discharge onto the surface of the bench.

D. Manhole Sections:

1. Joints between precast manhole sections shall be sealed with "Ram Nek" bituminous rope type sealer or equal.
2. Install joint sealants around entire circumference of each manhole joint.
3. Place sealant on the lower horizontal surface of the joint. Ensure that a watertight seal is provided at the joint.
4. The sections shall then be grouted to a smooth finish on the interior and exterior of the manhole. Grout for jointing shall be as specified in Section 02 of these Technical Provisions. Grouting joint of the manhole exterior shall be completed after joint sealant seals the joint completely. Manhole testing for water tightness may be completed prior to grouting the manhole exterior.
5. Contractor shall obtain approval from the Owner prior to using tape as a substitute for grout. Tape shall be Viscotaq or equal.
6. Manhole sections and adjustment rings, if required, shall be grouted in place when the manhole is constructed. The grout shall be spread evenly over the entire mating surface.
7. The jointing and sealing materials shall be approved by the Owner or Owner's Representative prior to installation.
8. For shallow manholes, install top slab section with the opening over the outlet of the manhole.

E. Adjustment/Grade Rings:

1. The maximum number of adjustment/grade rings shall be (3) or as indicated on the plans. Manholes in traffic areas shall have at least one adjustment ring.
2. All adjustment ring joints shall be sealed and watertight. For HDPE adjustment rings, install joint sealants in all joints between adjustment rings. For concrete adjustment rings, grout in place on the inside and outside when the manhole is constructed.
3. The total thickness of adjustment rings shall not exceed 18 inches. Maximum spacing between the top of the manhole cover and the first step shall be 28 inches. This spacing can be reduced by having the manhole manufacturer add another step closer to the top of the cone, if shown in the drawings. Steps shall not be added in the field by the Contractor.
4. No cracked or damaged adjustment rings shall be installed.

F. Frame, Cover and Collar:

1. The manhole frames and covers shall be set to the elevations shown on the plans.
2. In roadways, the top of the frame and cover shall be even with the road wearing surface.
3. A 42-inch diameter reinforced concrete collar shall be installed on the frame, cover, and the adjustment rings.
4. The tops of all manholes shall have a concrete collar of the dimensions shown in the details. The collar shall cover the thickness of the ring and the top joint with the first grade ring.
5. In unimproved areas, the collar shall extend from the top of the cover to the bottom of the lowest adjustment ring. The surface of the concrete collar shall have a smooth finish.

G. Drop Manholes:

1. Type and location of drop manholes are shown on the plans and shall be constructed in accordance with the details.

2. Install an outside manhole drop where the invert of the inlet pipe is more than 24-inches higher than the invert of the outlet pipe.
3. Use the same material that is used for the sewer main pipe to construct the drop piping.
4. The exterior piping of the drop manhole shall be supported/encased by ¾" crushed rock at 100% relative compaction. The encasement material shall be carefully placed to avoid damage to the piping or fittings and to the integrity of the joints.

H. Pipe to Manhole Connections:

1. Install sanitary sewer main pipe to manhole using approved gasket per manufacturer's recommendations.
2. All connections between sewer pipe and manhole walls shall be made using approved water stops and be sealed with non-shrinking grout in such a manner to make the manholes water tight.
3. Manholes shall not be acceptable if any evidence of infiltration into them is found. The Contractor shall take whatever actions are necessary, at his expense, to ensure that the manholes are completely watertight.

TP - 06.08 INSTALLATION OF SEWER MAIN CLEANOUTS:

Where indicated on the plans, a cleanout shall be furnished and installed by the Contractor in lieu of a manhole. The cleanout shall be constructed as shown on the detail drawings. Excavation, backfill and compaction shall meet the requirements of TP 01. When identified in the plans, the sewer main cleanout may be installed with a single long sweep 90 degree fitting in lieu of the two 45 degree fittings.

TP - 06.09 CONNECTION TO EXISTING MANHOLES:

Connection of newly constructed sewer mains to existing manholes shall be of either the drop or at-grade type as indicated in the plans and listed on the Bid Schedule. If connecting to an existing manhole, Contractor shall core drill the new penetration into the wall of the existing manhole and shall reshape the existing channel and bench wall to accommodate the new flow line. Reconstruction of manhole bases and inverts, all necessary piping, and associated work required to complete the connection shall comply with the provisions of this Technical Provision.

TP - 06.10 MANHOLE ABANDONMENT:

Manholes designated to be abandoned shall be removed a minimum of three (3) feet below the finished surface. Frame and cover castings shall be carefully removed and delivered to the Owner. Prior to backfilling, pipe connected to the manhole shall be plugged or sealed as approved by Owner or Owner's Representative. Removed portions of the manhole may be crushed and included as backfill to fill the remaining manhole. No crushed manhole debris shall be allowed in the final three (3) feet below finished grade. Backfilling and compaction shall be in accordance with TP-01 of the Technical Specifications and final backfill shall be brought up to surrounding grade.

TP - 06.11 SEWER MAIN AND MANHOLE TESTING:

A. Sewer Main Testing General:

1. General:
   a) Sewer main testing shall be done after the trenches are backfilled and final grading is finished.
   b) Contractor shall furnish all materials, labor and equipment to perform the required tests. All tests shall be performed in the presence of the Owner's Representative.

c) All sections of sewer not passing the tests shall be replaced in accordance with Owner's Representative approved methods. Repairs and retesting shall be performed at the Contractor's expense. Retests shall be performed until tests pass the requirements.

2. Sewer Main Flushing:

a) The Contractor shall flush all sewer lines before testing to remove sand, silt and other foreign material which might have entered the pipe during construction.

b) Water used for flushing shall be domestic quality or as approved by the Owner or Owner's Representative and shall be coordinated with the operating utility.

c) All equipment and water for the flushing shall be furnished by the Contractor.

d) The Contractor shall dispose of all water and foreign matter after flushing in an approved manner.

B. Sewer Main Alignment: Lamping shall be performed by the Contractor in the presence of the Owner or Owner's Representative using mirrors to observe the pipe reflection from the surface. The ground surface from where the lamping takes place shall be properly shored or benched for personnel safety. Any deviation from true line or grade may be cause for rejection of the line. Deviations exceeding 0.1 feet from the true line or grade which prevents water from draining by gravity from the sewer system, including manholes, shall be corrected such that the facilities meet these specifications and plans. For horizontal alignment, a deviation allowance of 0.1 feet inside the pipe may be accepted by the Owner or Owner's Representative.

C. Sewer Main Water Tightness: Tests for water tightness in the gravity sewer mains shall be made by the Contractor in a manner approved by and in the presence of the Owner or Owner's Representative. Testing for water tightness in gravity sewer mains may be accomplished by either of the following two methods:

1. Low Pressure Air Test: Testing shall conducted in accordance with ASTM F-1417. Testing gauge for the air test shall have a minimum division of 0.1 psi. No one shall enter a manhole when a line into it is pressurized.

a) Test Requirements & Setup:

i. Plug all pipe outlets with test plugs capable of holding under the test pressures. Install plugs and brace as necessary to ensure that the plugs will not blow out when the main is under pressure.

ii. Test each newly installed section of gravity sewer line between manholes.

iii. Slowly introduce air pressure to approximately 4.0 psig. Never exceed a pressure of 9.0 psig. Do not enter manhole once pipe is pressurized.

iv. Allow pressure to stabilize for at least five (5) minutes.

v. Adjust pressure to 3.5 psig or the increased test pressure as determined below if groundwater is present. Start the test.

b) Test Procedure

i. Determine the test duration for a sewer section with a single pipe size from the table below:

Low Pressure Air Test – Test Times	
Sewer Main Diameter (inches)	**Test Time (Minutes/100 Feet of Sewer)**
4	0.3
6	0.7
8	1.2
10	1.5

12	1.8
24	3.6

ii. Record the drop in pressure during the test period. If the air pressure has dropped more than 1.0 psig during the test period, the line is presumed to have failed. If the 1.0 psig air pressure drop has not occurred during the test period, the test shall be discontinued, and the line will be accepted.

iii. If the line fails, determine the source of the air leakage, make corrections and retest. The Contractor has the option to test the section in incremental stages until the leaks are isolated. After the leaks are repaired, retest the entire section between manholes.

iv. Individual service lines shall be tested by plugging the service line termination prior to connecting to the home or building, and plugging sewer cleanouts, and then testing concurrently with main section to which it is connected.

2. Exfiltration/Infiltration:

a) All equipment and water for these tests shall be furnished by the Contractor. This test will be made after the line has been completely backfilled.

b) Infiltration testing shall be completed under existing ground water conditions.

c) Exfiltration testing shall be conducted under an internal pipeline test pressure generated by a water level at least 4 feet above the highest elevation of the sewer main crown to be tested.

d) The test shall be run for a minimum of a four hour period.

e) The sewer and manhole connections shall not leak under either external or internal water pressure in excess of 0.158 gallons per hour per 100 feet of pipe per inch of diameter of pipe. A suitable meter or method of measuring the quantity of water used is necessary.

f) Leakage by either infiltration or exfiltration greater than specified above shall be corrected by the Contractor at his expense.

D. Deflection Test: The maximum allowable deflection (reduction in vertical inside diameter) for PVC pipe shall be five percent (5%). However, up to seven and one half percent (7½ %) may be allowed 30 days after final backfilling. Deflection testing is required in all cases between all manholes. All locations with excessive deflection shall be excavated and repaired by re-bedding or replacement of the pipe. Acceptable methods of deflection testing include use of properly sized go-no-go mandrels or deflectometer. Acceptable mandrel dimensions for SDR 35 PVC pipe are included in the following table. To be considered successful, the mandrel shall pass through the entire length of sewer main in one smooth pass without additional mechanical force. Deflection testing is not required for ductile iron sewer mains.

Sewer Main Diameter (inches)	Madrel O.D. (inches)
6	5.31
8	7.09
10	8.84
12	10.51
15	12.86

E. Video Inspection: If required by the Contract and included in the Bid Schedule, the Contractor shall provide the Owner with a post construction video inspection record of the new sewer pipeline. The video shall clearly show all joints, seals, connecting pipes, and manholes. Video inspection shall be paid by the Owner as a pay item separate from pipe installation, flushing, and other testing requirements. The video

shall be provided on any of the following media (DVD, USB Flashdrive, SD Card or MicroSD Card). The video format shall be viewable on Windows Media Player.

F. Manhole Testing:

1. General:

a) Tests for water tightness of manhole shall be made by the Contractor in a manner approved by and in the presence of the Owner or Owner's Representative.

b) Existing manholes to which a new main is connected do not need to be tested.

c) All newly-constructed manholes shall be tested for watertightness. New manholes shall be tested immediately after assembly and prior to backfilling.

d) If the manhole fails the initial test, necessary repairs shall be made and the manhole shall be retested.

e) All lift holes shall be plugged with an approved non-shrink grout.

f) Pipes entering the manhole shall be plugged, taking care to securely brace the plug.

g) Care must be taken not to break any seals during backfill operations. If the Owner suspects seals broken during backfilling, he shall require a second test after backfilling.

h) The Contractor shall be responsible for cost of the retest and repairs if second test fails.

i) One of the following methods shall be used; either vacuum or hydrostatic testing.

2. Vacuum Testing:

a) Vacuum testing should be conducted in accordance with ASTM C-1244 (Vacuum Test for Concrete Manholes), except as modified below.

b) The vacuum test head shall be installed per the manufacturer's recommendations.

c) A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches.

d) The manhole shall pass if the time is greater than 60 seconds for 48-inch diameter, 75 seconds for 60-inch, and 90 seconds for 72-inch diameter manholes.

3. Hydrostatic Testing:

a) Hydrostatic testing shall be conducted in accordance with ASTM C-969 except as modified below.

b) The mains into and out of the manhole shall be plugged with a suitable device such as a tethered pneumatic plug.

c) The manhole shall be filled with water to the ring.

d) After a period of at least one hour to allow for concrete absorption and to allow the water level to stabilize, the manhole shall be refilled and the water level shall be checked.

e) The hydrostatic test shall then begin and shall be administered for a period of 4 hours.

f) If the water level is found to drop more than 1 inch per foot of depth of the manhole over this 1 hour duration, then the leakage shall be considered excessive and the Contractor shall be required to make all necessary repairs and retest the manhole.

g) The exterior of the manhole shall be inspected during this period for visible evidence of leakage.

h) Visible moisture, sweating, or beads of water on the exterior of the manhole shall not be

considered leakage, but any water running across the concrete surface will be considered leakage and shall be repaired to the satisfaction of the Owner's Representative regardless of the volume of water lost during the test.

TP - 06.12 CLEANUP:

Upon completion of the work, the entire site shall be cleared of all debris, and the ground surface shall be finished to smooth and uniform slopes. All fences, clotheslines, gravel driveways or other obstructions removed during construction shall be left in a condition at least equal to their condition prior to construction. Cleanup shall be considered an incidental item and no additional payment shall be made for it, but rather its costs shall be merged with the applicable pay item irregardless of whether cleanup is specifically included in the measurement and payment section. Seeding shall be completed in accordance with Section 01 of these Technical Provisions.

TP - 06.13 RECORD DRAWINGS:

The Contractor shall be responsible for keeping accurate records of all installed items under this section of the specifications, and indicating revisions of the Owner furnished construction drawings in sufficient detail to be accepted by the Owner or Owner's Representative for record drawings. Sufficient detail under this contract means that the Contractor shall take accurate measurements and record them on the drawings to provide the minimum information of at least two swing ties and distances to permanent objects for all manholes and cleanouts; the beginning and end of any stabilization material placed; the beginning, end, and depth of rock encountered; the beginning, end, and depth of any encasement installed; and the location and depth of any other utilities encountered. Also to be noted on the plans is the final elevation of all manhole lids, inverts, and the ground immediately adjacent to the manhole lid and the distance and angles between the manholes. Further information on record drawings is contained in TP-01 and the Supplementary Conditions.

The recording of the as-built information is considered an integral part of the progress of this construction and shall be reviewed with the Owner or Owner's Representative in determining progress under this contract.

TP - 06.14 MEASUREMENT AND PAYMENT:

A. Gravity Sewer Main: Gravity sewer main shall be measured in linear feet along the centerline of the pipe, center to center of the manhole without deduction for fittings or diameter of manholes, for each of the various sizes and types of pipe installed. Payment for sewer pipe shall be at the contract unit price for the various sizes and types of sewer main installed as shown on the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, testing (alignment, water tightness and deflection), and incidentals required for a complete installation, including but not limited to excavation, bedding, stabilization material, laying and jointing pipe, exfiltration/infiltration testing or air testing, supplying water, plugging, measuring, flushing, backfilling, record drawings, and final cleanup.

B. Standard Manholes: Standard manholes shall have a depth greater than 6 feet when measured from the invert of the outlet pipe to the top of the cover, and shall be measured each. Payment shall be at the contract unit price for the various depths of manholes installed as shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, material, testing and incidentals required for a complete installation, including but not limited to excavation, concrete, frame and cover, steps, adjustment of height, invert forming, connection to sewer lines, backfilling, record drawings, and final cleanup.

C. Shallow Manholes: Shallow manholes shall have a depth of 6 feet or less when measured from the invert of the outlet pipe to the top of the cover, and shall be measured each. Payment shall be at the contract unit price shown on the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, testing and incidentals required for a complete installation, including but not limited to excavation, concrete, frame and cover, steps, adjustment of height, invert forming, connection to sewer lines, backfilling, record drawings, and final cleanup.

D. Drop Manholes: Drop manholes shall be measured each. Payment shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, material, testing and incidentals required for a complete installation, including but not limited to excavation, crushed rock, frame and cover, steps, adjustment of height, invert forming, drop pipe, connection to manhole, connection to sewer line, backfilling, record drawings, and final cleanup.

E. Diversion Manholes: Diversion manholes shall be measured each. Payment shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, material, testing and incidentals required for a complete installation, including but not limited to excavation, concrete, frame and cover, gate frame and gates, steps, adjustment of height, invert forming, connection to sewer line, backfilling, record drawings, and final cleanup.

F. Sewer Main Cleanouts: Sewer main cleanouts installed at the terminal end of a sewer main shall be measured each. Payment shall be at the contract unit price on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, material, and incidentals required for a complete installation, including but not limited to excavation, concrete, frame and cover, fittings, backfilling, record drawings, and final cleanup.

G. Connection to Existing Manhole: Connections to existing manholes shall be measured each. Payment shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, material, and incidentals required for a complete installation, including but not limited to excavation, cutting into the existing manhole, grouting, fittings, removing the existing invert, pouring and forming a new invert, backfilling, record drawings, and final cleanup.

H. Manhole Abandonment: Abandonments of manholes shall be measured each. Payment shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, material, and incidentals required for a complete abandonment, including the removal of the top section, plugging connecting sewer pipes, backfilling the manhole, and compacting the soil to prevent subsidence and to bring it to the same level as the surrounding grade, record drawings, and final cleanup.

I. Sewer Video Inspection: Post construction sewer video inspection shall be measured in linear feet along the centerline of the televised pipe. Payment for sewer video inspection shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, video records, and incidentals required for a complete inspection. Recordings shall be provided on the specified media and in the specified format.

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SUBMITTAL REVIEW FORM
SECTION 06 - SANITARY SEWER

DATE INITIALS Submittal No. _____

Received by ENGINEER: _____ _____ Project No. _____

Received by OWNER: Contract No.

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
06.03.A.1	PVC Sewer Pipe		
06.03.A.2	Ductile Iron Pipe		
06.03.A.3	Fittings		
06.03.B	Manholes (Base, Riser, Cone)		
06.03.B.3 & B.5	Manhole Frame, Cover, Adjustment/Grade Rings		
06.03.B.4	Manhole Steps		
06.03.B.12	Waterstops		
06.03.B.11	Manhole Jointing & Sealing Materials		
06.03.C	Sewer Main Cleanouts		
06.11	Sewer Main Testing (Alignment, Deflection, Watertightness, Video)		
06.11	Manhole Testing (Vacuum/Hydrostatic)		

	Signature	Date
CONTRACTOR:		
OWNER		

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TECHNICAL SPECIFICATIONS

SECTION 07 - SEWER SERVICE LINES

TP - 07.01 SCOPE:

The work covered under this section consists of furnishing all equipment, labor, materials, and incidentals necessary for the complete installation of a sewer service line and accessories, in strict accordance with the applicable drawings, the provisions of ASTM D2321 (latest revision), and these Technical Provisions.

TP - 07.02 GENERAL:

The Contractor shall provide all labor, equipment, and materials required to install the residential sewer service line indicated on the site layout plans. Installation shall include necessary fittings for connection to the building sewer stub-out, tapping of the sewer main and installation of the wye fitting or wye saddle as required. Contractor shall verify the location, size, and type of building sewer service line stub-out. Service line staking and staking for new sewer main tap shall be performed by the Contractor and approved by the Owner or Owner's Representative. Locating existing utilities shall be the responsibility of the Contractor in coordination with a representative from the operating utility. Existing sewer service lines will be properly abandoned in place and all facilities located at ground surface shall be removed and disposed of at the Contractor's expense.

All permits, permissions or other authorizations required by the tribal or municipal utility authority for tapping and connection are the responsibility and cost of the Contractor. Contractor shall contact each resident or business to verify the time that sewer service will be disconnected during service line tie-in. Connection to existing service or utilities, or other work that requires the temporary shutdown of any existing services shall be planned and coordinated with the operating utility. Excavation, trenching, backfilling, compaction and any needed dewatering shall be completed in accordance with Section 01 of the Technical Provisions, unless specifically altered under other requirements of this specification section.

Pipe joints and fitting installation shall be in accordance with the manufacturer's recommendations. The work will not be accepted until satisfactory backfilling, compaction and cleanup is complete. Final grading should prevent surface water runoff from pooling around installed facilities. If the work does not meet the specified requirements of this section, the Contractor shall remove and replace at the Contractor's expense. The Contractor shall leave each premise in a neat and orderly condition, restoring it as near as possible to its original condition and to the approval of the Owner or Owners' Representative.

TP - 07.03 MATERIALS:

Materials shall be inspected to verify that they meet these specifications and match the approved submittals. Materials not meeting these requirements shall not be permitted to be installed. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes and regulations, and these specifications.

The unloading, handling, and storage of the pipe and materials shall be conducted in a safe manner. Inspect all materials prior to installation to ensure that they are in new condition. Inspect pipe and fittings for defects. Plastic pipes with scratches, gouges, grooves or discoloration shall be rejected. Remove all materials from site that are defective, damaged, used, unsound, or that otherwise do not meet the specifications.

A. Pipe and Fittings: All pipe and fittings required for completion of the sewer service line installation shall meet the requirements of the latest revision of ASTM D 3034.

   1. All service line piping shall be 4 inches PVC unless otherwise directed. Pipe shall be nominal size, SDR-35, 0.120 inch minimum wall thickness.

   2. Joints shall be bell-ended conforming to ASTM D 3212. All joints and connections in the pipe shall be watertight. Use elastomeric gaskets conforming to ASTM F477. Lubricants used for the joint

installation shall meet the requirements of the pipe manufacturer.

3. The standard pipe length shall be 20 feet. Each length of pipe shall be clearly marked with the following: Manufacturer, Nominal Pipe Size, PVC Cell Classification, Type PSM PVC Sewer Pipe, ASTM Designation and Pipe Class.

4. Rigid couplers shall be used for all connections, such as PVC fittings, shielded Fernco fittings, or approved equal. Non-rigid couplers equal to Fernco may be used for the first connection from the home to the sewer service line if approved by the Owner or Owner's Representative.

B. Cleanouts: Double service line (two-way) cleanout piping and fittings shall be 4-inch diameter PVC pipe matching the chosen septic drain piping material. The cleanout piping and cap shall be threaded.

1. The cleanouts shall be installed with a brass hex socket plug equal to Tyler A Low Square Head cleanout plug. The cleanout ferrule shall be a Tyler 4-3 ½ or approved equal.

2. The poly seal foam wrapped around the cleanout ferrule shall be Sill Seal underlayment foam or approved equal.

3. The double service line cleanout shall be installed in a 20-inch x 40-inch x 4-inch concrete pad (collar) as shown in the detail drawings. The wire mesh used for the concrete pad shall be ASTM approved W 1.4 (1/8 inch) wire mesh on 6 inch centers.

C. Sewer Saddles:

1. For connecting to existing PVC sewers, sewer saddles shall be PVC conforming to ASTM 3034, water tight with a gasket as manufactured by Royal Building Products (saddle wyes with locating ring and gasket), GPK Products, or approved equal.

2. For connecting to vitrified clay, concrete, or asbestos-cement sewer pipe, a neoprene rubber boot with stainless steel bands shall be used.

3. Saddles and fittings shall be of a "wye" configuration. "Tee" saddles and fittings shall not be allowed.

D. Pipe Hangers:

1. Shall be made of material compatible with the piping material.

2. Shall be of sufficient strength to support pipe at full capacity.

3. Shall not affect pipe integrity by abrading, cutting or bending of pipe.

TP - 07.04 INSTALLATION:

Verify that dimensions and elevations are as indicated on the plans.

A. Sewer Service Line: Sewer service lines shall be furnished and installed by the Contractor from the sewer main to the point of connection as shown on the plans or as directed by the Owner or Owner's Representative.

1. Connection to Building:

a) Sewer service lines shall be connected to the building stub out sewer drain with approved fittings or rigid couplers which shall be installed in accordance with the manufacturer's recommendation.

b) If clamps/bands are required on the couplers, they shall be at a minimum 300 series stainless steel. All stainless steel bands shall be wrapped in PVC tape.

c) For connecting beneath the home, place pipe hangers at a maximum distance of 4 feet apart for horizontal PVC pipe.

d) Minimum cover over solid sewer pipe shall be 12-inches or as approved and shown on the plans.

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2. Pipe Slope and Bends:

   a) The grade from the building to the sewer main connection shall be uniform.

   b) Minimum slope shall be ¼-inch per foot or 2%. Maximum slope shall be ½-inch per foot or 4%.

   c) Any changes or deviations in line alignment shall be made with bends not exceeding an angle of 45 degrees and shall obtain approval from the Owner or Owner's Representative prior to making change.

   d) Connections to existing building drains which result in a change of direction of the line by more than 45 degrees requires the installation of a two way cleanout at that location.

   e) There shall be no 90-degree bend fittings in the sewer service line between the building and the sewer main.

3. Pipe Installation Requirements:

   a) Installation of pipe, including joint lubrication and assembly, pipe bending, and joint deflection shall be in accordance with the manufacturer's recommendations and ASTM D2321.

   b) Sewer service lines and connections must be constructed with maximum joint deflection not to exceed the manufacturer's recommendations and in no case shall exceed one (1) inch per foot in any joint. Larger changes in direction must be made by use of standard 1/16 or greater bends.

   c) Spigot end of pipe shall be pointed in the direction of flow (bell pointing upstream).

   d) When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or foreign substances will enter the pipes or fittings.

4. Warning Tape:

   a) Warning tape shall be installed along the sewer service line from the sewer main wye to the two way cleanout connection.

   b) Warning tape shall be installed in accordance with the provisions of TP 01.

5. No Building Connection:

   a) In cases where the sewer service line is not connected to the building, a PVC cap shall be solvent welded to the service line terminus within 5 feet of the proposed building.

   b) A piece of No. 3 rebar, 1-foot in length shall be installed to mark the service line terminus, as shown on the detail drawings. Bury the rebar 6 inches below ground surface.

   c) A PE marker painted green shall also be installed at this same location.

B. Cleanouts: Sewer service line cleanouts shall be installed at the locations indicated in the plans and in the manner indicated on the detail drawings. Required fittings shall be in conformance with the provisions of TP-07.03.

1. Locations:

   a) A two-way cleanout shall be installed within ten (10) feet of the building or as shown on the plans.

   b) Additional service line clean-outs shall also be two-way cleanouts and shall be installed for each series of bends totaling 90 degrees, at 100 foot intervals, or as directed by the Owner or Owner's Representative or shown on the plans.

   c) Fittings shall not be greater than 45 degrees (1/8 bend) on lines carrying untreated sewage.

   d) Cleanout shall allow for rodding/snaking the sewer line both towards the building and towards the sewer main.

2. Cleanout Configuration:

   a) Install wyes in the sewer service line to construct the cleanout and connect risers of the same material from the wye to the ground surface.

   b) Attach a no-hub iron body tapped, clean-out adapter, and threaded brass plug to the end of the riser.

   c) The cleanout shall be extended so that the top face of the threaded plug is at the finished grade of the concrete pad.

   d) Non-setting pipe-thread sealant shall be used on the plug threads, such as Teflon T Plus 2 or equal.

   e) A single layer of sill seal foam shall be wrapped around the iron body cleanout adapter between the exterior of the adapter and the concrete pad to protect against tightening from concrete expansion.

3. Concrete Pad/Collar:

   a) The concrete used shall meet the requirements of TP 02.

   b) The concrete pad shall be constructed around the cleanout at the ground surface per the detail.

   c) This concrete pad shall be reinforced with welded wire mesh with a minimum of ½-inch concrete over the mesh.

   d) Pour concrete collars on two-way cleanouts after the final site grading is complete to match finished grade.

C. Sewer Main Connection: Sewer service line connections to sewer main lines shall be made in accordance with the detail drawings and as shown on the plans, or as indicated by the Owner or Owner's Representative. The Contractor shall connect the service line to the sewer main with the appropriate sized sewer wye fitting or sewer wye saddle as shown on the detail drawings.

The time and method of connection to existing sewer mains shall be approved by the Owner or Owner's Representative prior to such connection. In no case shall a tapping method be approved that does not provide for a water tight connection to the sewer main. Any damage to sewer mains or property incurred during the tapping process shall be repaired by the Contractor at his own expense and in a method approved by the Owner or Owner's Representative.

1. Connections to New Sewer Mains:

   a) The Contractor shall furnish and install new 4-inch wye fitting branches on new sanitary sewer mains as shown in the plans.

   b) Verify the branch wye is no more than 45 degrees from horizontal.

   c) Install solvent weld cap or a plug in the wye and leave in place until service line construction begins.

   d) Install riser at an angle equal to or less than 45 degrees measured from horizontal. A single length of lateral pipe should be used for the riser section whenever possible.

   e) Extend sewer service line riser from sanitary wye to an elevation that will allow for a service line to be laid at specific approved grades.

   f) Proper compaction shall be provided beneath the riser and lateral connection to minimize or eliminate settlement from the resulting loading at this connection.

   g) In situations where sewer service lines are installed with the installation of new sewer main, the sewer service lines shall be included with the sewer main pressure testing. The individual service

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lines shall be tested by plugging the service line termination point prior to connecting to the building and plugging sewer cleanouts and then testing concurrently with the sewer main section to which it is connected. The sewer service line can also be tested to a stub-out plug right before the new two way cleanout closest to the building.

2. Connections to Existing Sewer Mains:

   a) Connection to existing sewer mains shall be made with approved saddles and installed in accordance with the manufacturer's recommendation.

   b) Rotate the saddle no more than 45 degrees from horizontal.

   c) The saddle shall be fastened with a minimum of two (2) stainless steel clamps/bands using stainless steel connectors or equal for the approved saddle. All stainless steel bands shall be wrapped in PVC tape.

   d) Install riser at an angle equal to or less than 45 degrees measured from horizontal.

   e) Extend sewer service line riser from sanitary wye to an elevation that will allow for a service line to be laid at specific approved grades.

   f) Proper compaction shall be provided beneath the riser and lateral connection to minimize or eliminate settlement from the resulting loading at this connection.

TP - 07.05 WATER AND SEWER CROSSINGS:

Separation distances between sewer service lines and water lines shall meet the requirements of TP 01.

A. All water and sewer service lines within five (5) feet of the house will be considered as part of the building plumbing.

B. For new construction, all water and sewer service lines shall have a 10 foot minimum horizontal separation. This can best be accomplished by having the water and sewer service lines exit the house 10 feet apart or from different sides of the house.

If the 10 foot separation cannot be maintained, the service lines may be laid closer together than 10 feet if all of the following conditions are met:

A. Prior written approval is obtained from the Owner or Owner's Representative.

B. The top of the water service line is at least 12 inches above the bottom of the sewer service line.

C. The water and sewer lines are continuous with no joints until the 10 foot separation requirement is met.

TP - 07.06 RECORDS DRAWINGS:

The requirements of Technical Provision 01 must be met. Failure to properly identify the required items will result in the Contractor having to uncover pipe at Contractor’s expense to verify their location. The record drawings shall become the property of the Owner after contract completion. In addition to the requirements of TP-01, the drawings shall include the following at a minimum:

A. Tapping point at sewer main (sewer wye fitting or wye saddle)

B. Intersection point with other utilities

C. Location of cleanouts

D. Location of bends

E. Point of connection to the building stub-out

F. Each underground installed facility

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TP - 07.07 MEASUREMENT AND PAYMENT - SEWER SERVICE LINES:

A. Sewer Service Lines: PVC sewer service pipe shall be measured in lineal feet along the centerline of the pipe, including fittings. Payment for sewer service lines shall be at the contract unit price shown in the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation; including, excavation, bedding, stabilization material, compaction, pipe installation, sewer wye or sewer saddle, connections to the sewer service cleanout, fittings, warning tape, trench backfilling, record drawings, and final clean-up.

B. Cleanouts: Payment for the two-way cleanouts shall be at the unit bid price as stated in the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials and incidentals required for complete installation; including excavation, backfill, compaction, pipe installation, fittings, connections, foam, reinforced concrete pad, record drawings, and final cleanup.

INCORPORATED INTO THE CONTRACT

SUBMITTAL REVIEW FORM, SECTION 07- SEWER SERVICE LINES

	DATE	INITIALS	Submittal No.	
Received by ENGINEER:			Project No.	
Received by OWNER:			Contract No.	

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
07.03.B	PVC Sewer Pipe & Fittings		
07.03.C	Cleanout, Fittings, Cap, Foam, Mesh, Concrete		
07.03.D	Sewer Main Saddle or Wye and Fittings		
	Permits (if required)		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 11 - ROADWAY, RAILROAD, AND SPECIAL UTILITY CROSSINGS

TP - 11.01 SCOPE OF WORK:

Specifications included herein are intended to support requirements of Section 01 of these Technical Provisions where road, railroad, and special utility crossings are necessary for the installation of sanitation facilities under this contract.

Construction shall comply in all respects to the requirements of any permit incorporated into this contract. Copies of applicable permits obtained by the Owner shall be included in the Appendix to these Technical Provisions. The Contractor shall meet all requirements and conditions of these permits with respect to materials, equipment, notification and timing. At least two days notice shall be given to the Owner or Owner's Representative and permit grantor before work is done on any crossing. Any permits not previously obtained by the Owner shall be the responsibility of the Contractor.

Requirements of the permit or permits shall control if contradictions exist between Technical Provisions and such permits. All work within the right-of-way of roads shall be performed in accordance with the "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects FP-14 – Division 600". At least two (2) weeks prior to performing the crossing, the Contractor shall submit a signed and dated traffic control plan showing how they intend to safely control traffic in the area of the crossing for review and approval by the Owner and the respective road authority. For road crossings, the Contractor shall have at least one lane open to traffic at all times unless otherwise required by traffic control plan.

The work to be completed under these Technical Provisions includes the furnishing of all labor, materials, transportation, tools, supplies and appurtenances necessary to complete the crossings in accordance with the indicated requirements.

TP - 11.02 ROADWAY CROSSINGS:

Where so indicated on the plans, main pipeline crossings of highways, railroads, canals, and other structures shall be made by installation of a steel pipe casing under the structure as shown on the plans. The casing pipe shall be installed where indicated on the plans and at the locations designated by the Owner. Casing pipe 8-inches in diameter and larger shall be Grade A steel pipe with a minimum wall thickness of 0.375 inches and shall meet ASTM A-53 or ASTM A-120 (Welded and Seamless Steel Pipe). Steel pipe shall conform to: ASTM A53 Grade B, Type E or S; ASTM A 139 Grade B; ASTM A 106 Grade B or C; API 5L Grade B or Grades X42 to X56.

The casing pipe for water service lines and sewer service lines shall be standard weight galvanized steel pipe conforming to ASTM A-120 (Welded and Seamless Steel Pipe). Crossings for water service lines and water mains shall be a minimum of four (4) feet below the surface of the roadway and two (2) feet below other structures and canal inverts unless otherwise shown on the plans.

The method of installing the carrier pipe within the steel casing shall be approved by the Owner. Pipe within casings shall be installed in the encasement pipe as shown on the plans providing suitable spacers that will prevent disturbance of the assembled joints. Redwood and cedar wood casing spacers will not be allowed. The casing spacers shall be installed per manufacturer's specifications. Casing spacers shall be boltless and non-metallic as manufactured by GPT, Calpico or approved equal. After the carrier pipe is installed in the casing and tested, both ends of the encasement shall be sealed to prevent the entrance of foreign objects into the casing. Casing end seals shall be manufactured by GPT, Calpico or approved equal. All water and sewer lines installed within the casing pipe shall be installed with mechanical restrained joints on every pipe joint within the casing pipe.

A. Open Cut Crossings:

1. Unpaved Roads: Excavation and backfilling of unpaved roads shall be done in accordance to Technical Provision Section 01.

2. Paved Roads: Excavation and backfilling of paved roads shall be done in accordance to Technical Provision Section 01. The lean concrete backfill shall meet the requirements of the Federal Highway Administration Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-14, Section 614-Lean Concrete Backfill

B. Bored Road Crossing: Where only bored road crossing shall be permitted as indicated on the plans, the Contractor shall furnish all equipment, material, and labor required to complete the installation. Boring methods which involve jetting or washing techniques are not allowed. Alternate methods of road boring must be approved in writing by the applicable permit granting authority or right-of-way authority and the Owner or Owner's Representative. The use of water under pressure jetting or puddling shall not be permitted to facilitate boring, pushing, or jacking operations.

Maintain alignment of the borehole such that all grades and alignment of the pipeline are as shown in the plans. Failure to maintain such grades and alignment will result in rejection of the crossing for payment. Such operations shall be scheduled so that it may be completed from start to finish without delay and in accordance with appropriate permits and the standards.

When the casing pipe is to be installed by boring, the casing shall be kept on line and grade by suitable guide rails in the approach pit. The deviation from line and grade of the casing pipe shall provide installation of the carrier pipe within the following allowances:

Lines	Horizontal Deviation	Vertical Deviation
Water Line	1.0 ft per 100 feet (1.0%)	1.0 ft per 100 ft (1.0%)
Sewer Line	1.0 ft per 100 feet (l.0%)	0.1 ft per 50 ft (0.2%)

Deviations will be determined from the line and grade approved by the Owner. The casing pipe for all crossings shall be installed in a manner that will allow for the installation of the carrier pipe in a straight line without contacting the walls of the casing. Casings for the carrier pipe shall be installed prior to the installation of pipe within 100 feet of the crossing for the main or service line under construction.

If excessive voids or too large a bored hole is produced during casing or pipeline installations, or if it is necessary to abandon a bored or tunneled hole, prompt remedial action shall be taken by the Contractor. All voids or abandoned holes caused by boring or jacking are to be filled by pressure grouting. The grout material shall be as specified by the permit granting authority or right-of-way authority and approved by the Owner or Owner's Representative. The hole diameter shall not exceed the outside diameter of the casing pipe (including coating) by more than two (2) inches on casings with an inside diameter greater than twelve (12) inches.

TP - 11.03 ROADWAY RESTORATION:

Road restoration shall be done in accordance with Section 01 of these Technical Provisions.

TP - 11.04 BARRICADES, GUARDS AND SAFETY PROVISIONS:

The Contractor shall be responsible for erecting and maintaining adequate barricades, construction signs, torches, red lanterns, flagmen, and guards, as required, during the progress of the construction work and until it is safe to resume use of the roadway. Rules and regulations of the permit granting authority or right-of-way authority regarding safety provisions shall be observed. All work within the right-of-way of roads shall be performed in accordance with the latest edition of the Manual on Uniformed Traffic Control Devices (MUTCD). Work within right-of-ways and traffic control plans shall comply with all applicable provisions of Section 01 of the Technical Provisions in addition to those indicated under provisions of this Section.

INCORPORATED INTO THE CONTRACT

TP - 11.05 RAILROAD AND SPECIAL UTILITY CROSSINGS:

Railroads and other specialized utility crossings shall comply with all requirements of the permits indicated. Pipeline alignment and grades shall be maintained as shown on the plans. The Contractor shall be responsible for compliance with all requirements of special crossing permits applicable to this project. Copies of such permits shall be included in the Appendix of these specifications. If no special crossing permits are appended, and such crossings are indicated on the plans, crossings will comply with all applicable provisions of Section 01 of these Technical Provisions in addition to those indicated under other provisions of this Section. At least two (2) days of notice shall be given to the Owner or Owner's Representative and right-of-way authority or permit granting authority before work is done on any crossing.

TP - 11.06 CLEANUP:

Upon completion of the work, the entire site shall be cleared of all debris, and the ground surface shall be finished to smooth and uniform slopes. Cleanup shall be considered an incidental item and no additional payment shall be made for it. All of the right-of-way area and structures shall be left in a condition at least equal to their condition prior to construction.

TP - 11.07 MEASUREMENT AND PAYMENT:

Payment for bored roadway, open cut roadway, railroad or special utility crossings shall be measured in linear feet along the centerline of the casing. Payment shall be full compensation for all materials, equipment, labor, and incidentals for a complete installation including, but not limited to, boring, asphalt cutting, excavation, encasement and carrier pipe, carrier pipe connection fittings and joint restraints, blocking/casing spacers, backfilling, paved and gravel roadway restoration, barricades, guards and safety provisions, traffic control plan, cleanup, and record drawings. Such payment shall also be full compensation for all required certificates of insurance, development of approved traffic control plans and implementation of traffic control.

INCORPORATED INTO THE CONTRACT

SUBMITTAL REVIEW FORM

SECTION 11 – ROADWAY, RAILROAD, AND SPECIAL UTILITY CROSSINGS

	DATE	INITIALS		
			Submittal No.	
Received by ENGINEER:			Project No.	
Received by OWNER:			Contract No.	

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
11.01	Permits		
11.02	Boring Method		
11.02	Casing		
11.02	Casing Spacers		
11.02	Casing Seal		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 12 - NON-AGGREGATE SEWAGE DISPOSAL SYSTEMS

TP - 12.01 SCOPE:

The work covered by these specifications includes the furnishing of all labor, tools, equipment, material, and performing all operations necessary to construct non-aggregate type individual sewage disposal facilities (septic tank & chambered drainfield systems) at the indicated homesite and as shown in the site plan. This work includes connection to building drain, service cleanouts, septic tank, distribution box, drainfield chambers, abandonment of existing septic tank(s), fittings, and appurtenances in accordance with these specification and applicable plans.

TP - 12.02 GENERAL:

The individual sewage disposal systems and related facilities shall be constructed at the locations and of the sizes shown on the plans or site drawings. Field changes in location and orientation may be required as directed by the Owner or Owner's Representative at the time of construction, but shall not alter the total area of drainfield required. Excavation, trenching, backfilling, compaction, and any needed dewatering shall be completed in accordance with Technical Provision 01, unless specifically altered under other requirements of this specification section.

Pipe joints and fitting installation shall be in accordance with the manufacturer's recommendations. All pipes and joints shall be approved by the Owner or Owner's Representative prior to backfilling. The work will not be accepted until satisfactory backfilling, compaction, and cleanup is complete. Final grading should prevent surface water runoff from pooling around installed facilities. If the work does not meet the specified requirements of this section, the Contractor shall remove and replace at the Contractor's expense. The Contractor shall leave each premise in a neat and orderly condition, restoring it as near as possible to its original condition and to the approval of the Owner or Owners' Representative.

TP - 12.03 MATERIALS:

Inspect all materials to verify that they meet these specifications and match the approved submittals. Remove all materials not meeting these requirements. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes and regulations and these specifications.

The unloading, handling and storage of the pipe and materials shall be conducted in a safe manner. Inspect all materials prior to installation to ensure that they are in new condition. Inspect pipe and fittings for defects. Plastic pipes with scratches, gouges, grooves, or discoloration shall be rejected. Remove all materials from site that are defective, damaged, used, unsound or that otherwise do not meet the specifications.

A. Pipe and Fittings: Solid pipe and fittings utilized for septic tank and drainfield construction including sewer service line (from building to septic tank), cleanouts, distribution piping (from septic tank to drainfield chambers), observation ports, and appurtenances shall meet the following:

   1. 4-inch diameter PVC SDR 35 pipe with pipe and fittings conforming to ASTM D3034 or Schedule 40 PVC pipe with pipe and fittings conforming to ASTM D1785.

   2. Gasketed joints shall be bell-ended and conform to ASTM D3212. All joints and connections in the pipe shall be watertight. Use elastomeric gaskets conforming to ASTM F477. Lubricants used for the joint installation shall meet the requirements of the pipe manufacturer.

   3. The standard pipe length shall be 20 feet. Each length of pipe shall be clearly marked with the following: manufacturer, nominal pipe size, PVC cell classification, type PSM PVC sewer pipe, ASTM designation and pipe class.

   4. Rigid couplers shall be used for all connections, such as PVC fittings, shielded Fernco fittings, or

approved equal. Non-rigid couplers equal to Fernco may be used for the first connection from the home to the sewer service line if approved by the Owner or Owner's Representative.

B. Cleanouts: Double service line (two-way) cleanout piping and fittings shall be 4-inch diameter PVC pipe matching the chosen septic drain piping material. The cleanout piping and cap shall be threaded.

1. The cleanouts shall be installed with a brass hex socket plug equal to Tyler A Low Square Head cleanout plug. The cleanout ferrule shall be a Tyler 4-3 ½ or approved equal.
2. The poly seal foam wrapped around the cleanout ferrule shall be Sill Seal underlayment foam or approved equal.
3. The double service line cleanout shall be installed in a 20-inch x 40-inch x 4-inch concrete pad (collar) as shown in the detail drawings. The wire mesh used for the concrete pad shall be ASTM approved W 1.4 (1/8 inch) wire mesh.

C. Septic Tank: Septic tank shall be dual compartment with a minimum of 1,000 gallon liquid capacity as measured below the invert of the outlet. The actual size of the septic tank shall be as shown on the plans and in the Bid Schedule.

1. The tank shall be constructed of precast, reinforced concrete of sufficient strength to withstand hauling and handling stresses, and shall meet all state and local regulations for the state and localities for which it is installed. The steel reinforcement shall meet the requirements of TP 03.
2. Septic tank shall be water-tight and shall have a 28 day compressive strength of at least 3,000 psi.
3. Chipped and honey combed tanks shall not be approved and will be rejected if delivered and installed. The tank shall be free of excessive cracking. Cracks in the concrete which, in the opinion of the Owner or Owner's Representative could lead to leakage and/or premature failure, shall be sealed by the Contractor, at no extra cost, using approved materials. Tanks with cracks visible on both sides or cracks where metal or synthetic fiber reinforcement is visible, shall be rejected.
4. The dimensions of the septic tank shall be labeled on the detail or the plans. Minimum wall thickness shall be 3-inches. Minimum distance between inlet and outlet of the tank shall be six (6) feet. The minimum width of the tank shall be three (3) feet. The longest dimension shall be parallel to the direction of flow, unless otherwise noted on the plans. The effective length shall be greater than two (2) and less than four (4) times the effective width.
5. The septic tank shall be of monolithic construction below the liquid line. Tank shall be cast as one piece with a lid cast as the top of the tank. If tank is cast as a clamshell, with two pieces, then the joints below the liquid line shall be interlocking V-notch, shiplap or tongue and groove. All joints shall be sealed with an epoxy based sealing compound or Ram-Nek flexible gasket or equal to prevent water infiltration or exfiltration. All joints below the liquid level shall be tested prior to backfilling and shall not have any leaks.
6. The bottom of the outlet invert of the tank, for a baffle or a sanitary tee shall be at least two (2) inches lower than the bottom of the inlet invert of the tank. Install tank with the tank inlet (higher invert penetration) facing towards the building and the tank outlet (lower invert penetration) to the drainfield. A minimum of one (1) inch of clear space shall be provided between the top of the baffles or tees and the underside of the tank.
7. Tanks buried at depths exceeding 48-inches shall have a traffic rated, extra reinforced, tank lid.
8. If noted in the contract documents or site plan, some sites may require installation of a special low profile septic tank. These tanks shall comply with all provisions for a standard tank but shall require a bury depth of no greater than 48 inches. Final fabrication dimensions and details of the structure shall be approved by the Owner or Owner's Representative in writing prior to fabrication and installation.

D. Effluent Filter: Effluent filters shall have a minimum diameter of 4 inch and a maximum filtration size of 1/16 inch.

1. The filters shall be designed for a maximum daily flow of 1,000 gallons per day or greater. The effluent filters shall be equal to Zable A-100 (1,200 gpd), Tuff Tite EF 6 (1,500 gpd), or approved equal. If larger capacity filters are needed for a specific site, the required size shall be as shown in the plans and in the fee schedule.

2. The effluent filter shall have a handle to facilitate removal of the filter for maintenance and replacement. The handle shall be placed within 12 inches of the top of the riser for accessibility.

E. Septic Tank Risers: Risers, a minimum of 24-inches in diameter, must be installed to provide access to the inlet of the septic tank for pumping/maintenance purposes and to the outlet of the septic tank to access the effluent filter.

1. Risers shall be corrugated HDPE with a 24 inches HDPE UV protected heavy duty cover and stainless steel locking screws, or equal. Risers shall have a water tight connection to the tank.

2. Risers shall have a printed warning label with information regarding the hazards present when entering a tank affixed by the Contractor. These labels may be supplied by the manufacturer and shall be affixed to the inside and outside of the riser covers.

3. The riser system shall be installed with a safety screen device within the riser such as the Polylok 3008 SSPIPE Safety Screen or approved equal. The Contractor shall provide one (1) extra safety screen to the Tribe for each septic tank installed.

4. Where risers are required to be more than 42-inches in height, the risers shall be made of concrete, such as concrete grade rings, with approved water tight seals to the tank and an approved compatible riser cover or approved equal. Prior approval shall be obtained from the Owner or Owner's Representative.

F. Distribution Boxes: Distribution boxes and covers shall be constructed in general conformance with the configuration indicated in the detail drawings with discharge hole locations as required to maintain design elevations.

1. Boxes shall be fabricated from pre-cast concrete with a separate outlet for each drainfield lateral. Boxes shall have a minimum wall thickness of 1.5 inches and a 28 day compressive strength of 3,000 psi.

2. Concrete boxes shall be manufactured by a fabricator routinely involved in construction of distribution boxes and shall contain sufficient interior steel reinforcing sufficient to facilitate hauling and handling stresses.

3. Chipped and honey combed boxes shall not be approved.

4. Boxes shall have at least the same amount of outlet openings as the number of laterals (rows) in the drainfield.

5. Invert elevations of each outlet shall be equal to each other.

6. All outlets shall be at a minimum 1-inch lower than the inlet.

7. Each outlet shall be fitted with a speed leveler, as manufactured by Tuf-Tite or equal to facilitate equal distribution of effluent to each drainfield lateral.

G. Distribution Box Risers: Distribution box risers shall be installed to provide access to the distribution box from the ground surface.

1. Risers shall be at least the same dimensions as the distribution box and shall be attached to the distribution box to provide a watertight connection.

2. Risers shall be corrugated HDPE with a Polylok 24" HDPE heavy cover, part # 3008-HD, with stainless steel locking screws or approved equal. Or may be made of concrete, such as concrete grade rings, with approved water tight seals to the box and an approved compatible riser cover or approved equal.

3. The distribution box cover shall have an effective locking device which meets the Owner or Owner's Representative's approval.

H. Manufactured Chambers:

1. Drainfield chamber sections shall be constructed of high strength polyethylene plastic.

2. Chambers shall be high capacity chambers equal to INFILTRATOR Quick4 Plus High Capacity Chambers (34 inches wide x 53 inches long x 14 inches high), ADS Arc 36 HC Chambers (34.5 inches wide x 63inches long x 16 inches high), or approved equal.

3. A minimum loading rating of AASHTO H-10 shall be required for wheel load protection.

I. Filter Fabric: Should filter fabric soil protection be recommended by the chamber manufacturer as an integral part of the drainfield installation and noted in the plans:

1. The fabric material shall be a synthetic geotextile material specifically intended for drainfield use as manufactured by Hancor, Inc. or approved equal.

2. Fabric shall be approved by the Owner or Owner's Representative.

J. Pea Gravel: Pea gravel shall be clean washed pea gravel between 1/8" to ¼" inches in diameter.

K. Gravel: Gravel for the base bedding of the septic tank and distribution box shall be clean, hard, durable and free of fines, coal, clay or other soft fragments and shall meet the approval of the Owner or Owner's Representative. Gravel shall vary in size from 3/4-inch to 1-1/2-inch.

L. Paint: Paint used for all exposed PVC material shall be an epoxy or enamel UV protectant paint that bonds well with PVC and is green in color, such as Krylon spray paint, or equal.

M. Pipe Hangers: Pipe hangers shall be made of material compatible with piping material and shall be of sufficient strength to support pipe at full capacity. Pipe hangers shall not affect pipe integrity by abrading, cutting or bending pipe.

TP - 12.04 INSTALLATION:

Verify that dimensions, elevations and slopes are as indicated on the plans. Required separation distances shall be maintained for all of the on-site wastewater treatment system components as presented in the detail or as required by the localities in which they are installed. During and after construction, the Contractor shall avoid driving over the septic tank, distribution box, drainfield chambers, or any other component of the on-site treatment facility.

A. Sewer Service Line: Sewer service lines shall be furnished and installed by the Contractor from the septic tank to the point of connection as shown on the plans or as directed by the Owner or Owner's Representative.

1. Connection to Building:

a) Sewer service lines shall be connected to the building stub out sewer drain with approved fittings or rigid couplers which shall be installed in accordance with the manufacturer's recommendation.

b) If clamps/bands are required on the couplers, they shall be at a minimum 300 series stainless steel. All stainless steel bands shall be wrapped in PVC tape.

c) For connecting beneath the home, place pipe hangers at a maximum distance of four (4) feet apart

for horizontal PVC pipe.

d) Minimum cover over solid sewer pipe shall be 12 inches or as approved and shown on the plans.

2. Pipe Slope and Bends:

a) All 4-inch PVC piping from the building stub out sewer drain to the septic tank shall be laid at a minimum grade of 2% or 1/4-inch per foot and maximum grade of 4% or1/2-inch per foot.

b) From the septic tank to the distribution box and the distribution box to the drainfield, the four (4) inch PVC pipe shall be laid at a minimum grade of 1% or 1/8-inch per foot).

c) Any changes or deviations in line alignment shall be made with bends not exceeding an angle of 45 degrees and shall obtain approval from the Owner or Owner's Representative prior to making change.

d) Connections to existing building drains which result in a change of direction of the line by more than 45 degrees requires the installation of a two way cleanout at that location.

e) There shall be no 90-degree bends in the pipe between the building and the septic tank.

3. Pipe Installation Requirements:

a) Installation of pipe, including joint lubrication and assembly, solvent welding, pipe bending and joint deflection shall be in accordance with the manufacturer's recommendations.

b) Sewer service lines and connections must be constructed with maximum joint deflection not to exceed the manufacturer's recommendations and in no case shall exceed 1 inch per foot in any joint. Larger changes in direction must be made by use of standard 1/16 or greater bends.

4. No Building Connection:

a) In cases where the sewer service line is not connected to the building, a PVC cap of like material shall be solvent welded to the service line terminus within 5 feet of the proposed building.

b) A piece of No. 3 rebar, 1-foot in length shall be installed to mark the service line terminus, as shown on the detail drawings. Bury the rebar 6 inches below ground surface.

c) A PE marker painted green shall also be installed at this same location.

B. Cleanouts: Sewer service line cleanouts shall be installed at the locations indicated in the plans and in the manner indicated on the detail drawings. All required fittings shall be in conformance with the provisions of TP-12.03.

1. Locations:

a) A two-way cleanout shall be installed within ten feet of the building or as shown on the plans.

b) Additional service line clean-outs shall also be two-way cleanouts and shall be installed for each series of bends totaling 90 degrees, at 100 foot intervals, or as directed by the Owner or Owner's Representative or shown on the plans.

c) Fittings shall not be greater than 45 degrees (1/8 bend) on lines carrying untreated sewage.

d) Cleanout shall allow for rodding/snaking the sewer line both towards the building and towards the septic tank.

2. Cleanout Configuration:

a) Install wyes in the sewer service line to construct the cleanout and connect risers of the same material from the wye to the ground surface.

b) Attach a no-hub iron body tapped, clean-out adapter, and threaded brass plug to the end of the

riser.

c) The cleanout shall be extended so that the top face of the threaded plug is at the finished grade of the concrete pad.

d) Pipe-thread sealant shall be used on the plug threads, such as Teflon T Plus 2 or equal.

e) A single layer of sill seal foam shall be wrapped around the iron body cleanout adapter between the exterior of the adapter and the concrete pad to protect against tightening from concrete expansion.

3. Concrete Pad/Collar:

a) The concrete used shall meet the requirements of TP 02.

b) The concrete pad shall be constructed around the cleanout at the ground surface per the detail.

c) This concrete pad shall be reinforced with welded wire mesh with a minimum of ½-inch concrete over the mesh.

d) Pour concrete pad on two-way cleanouts after the final site grading is complete to match finished grade unless directed otherwise by the Owner or Owner's Representative.

C. Septic Tank: The septic tank shall be installed at the location and elevation shown in the drawings. Install tank in accordance with the manufacturer's recommendations. The septic tank shall be installed no closer than 10 feet from the building.

1. Setting Tank:

a) Excavation shall be the minimum required to provide proper bedding and placement of the tank.

b) Prior to setting the tank, all rocks and other foreign material which might damage the tank upon placement shall be removed from the excavation.

c) The Contractor shall set the tank on a 6-inch thick, minimum, bed of sand or gravel to facilitate leveling the tank. The base bedding shall be compacted to 95% Modified Proctor Density.

d) The base bedding shall present a smooth, uniform and level surface.

e) Seal the tank inlet and outlet with temporary plugs until connections are made to the inlet and outlet lines.

2. Sealed Joints:

a) Seal all joints between inlet piping, outlet piping, and risers as approved by the Owner or Owner's Representative.

b) The sewer service line shall be sealed with a rubber gasket (boot-type fitting) or masonry grouted at connection points to the inlet and discharge openings of the septic tank to prevent ground water infiltration. Grout shall conform to TP-02.

3. Backfilling Tank:

a) Prior to backfilling, the tank elevation shall be checked at all corners to assure that placement is level and is set at the appropriate depth.

b) Backfill in 12 inch layers and thoroughly compact in a manner that will not produce undue strain on the tank.

c) Final backfill material shall be mounded 6 inches above the natural ground surface to allow for settlement.

d) Do not exceed 48-inches of cover unless tank is designed for a deeper bury depth and approval is

obtained from the Owner or Owner's Representative. Tanks buried at depths exceeding 48-inches shall have a traffic rated, extra reinforced tank lid.

4. Groundwater:
   a) If groundwater is present, dewater in accordance with TP 01, as needed.
   b) All work in setting the tank shall be done under dry conditions.
   c) In these conditions, the septic tank may need be filled with water to prevent flotation of the tank.
5. Effluent Filter: An effluent filter shall be installed on the septic tank outlet piping in a sanitary tee/baffle.

D. Effluent Filter:

1. Install effluent filter in conformance to the manufacturer's installation instructions.
2. Center and secure the filter assembly under the outlet manhole opening of the septic tank. Solvent weld tee/baffle to four (4) inch PVC tank outlet pipe to house the filter, as necessary. Extend piping a minimum of 12 inches beyond the outside of the septic tank before connecting to the distribution box.
3. Install filter handle and extend handle to within 12-inches of the top of the access riser for ease of accessibility.

E. Septic Tank Risers: The Contractor shall install the approved covered risers for the inlet and outlet of the septic tank.

1. The top of the riser covers shall be set at least six (6) inches above finished grade.
2. All septic tank risers shall be connected to the top of the tank with a Ram-Nek flexible gasket or equal water-tight material and grouted to the top of the tank, to eliminate water infiltration.
3. A ¼-inch minimum diameter nylon or poly-rope shall be attached to the septic tank concrete access covers/lids. Connect end of the rope to a hook inside of the tank riser within 24 inches of the top of the riser to facilitate the removal of the concrete access covers/lids inside the risers. The rope shall extend to 12 inches above grade.
4. The safety screen device shall be installed on each riser in accordance with the manufacturer's recommendation.
5. The stainless steel screws on the riser covers shall be secured tightly.

F. Distribution Box: Distribution box shall be placed at the location indicated in the plans and detail drawings.

1. The box shall be set on a six (6) inch minimum bed of gravel to facilitate leveling the box.
2. The distribution box shall be installed such that the inlet and outlet openings of the distribution box meet the required minimum of 1% slope between the septic tank and the drainfield.
3. In some cases this will require the top of the distribution box to be buried below grade. If the top is buried below grade, install risers as stated in TP-12.04.G. Otherwise, the distribution box shall be installed such that the top of the distribution box is between one (1) and six (6) inches above finished grade.
4. The distribution box shall be installed level to assure that equal distribution is provided to each drainfield lateral. Equal distribution shall be checked by the Contractor in the presence of the Owner's Representative by filling the box with water to indicate equal overflow to the drainfield.
5. The speed levelers shall be adjusted as needed to obtain equal flow to each drainfield lateral. Any

unused outlet openings shall be left sealed or shall be grouted as directed by the Owner's Representative.

G. Distribution Box Riser: If the top of the distribution box is buried below grade, then distribution box risers (extension collars) shall be installed to provide an access cover to the buried distribution box.

1. The distribution box riser shall be connected to the top of the box with a Ram-Nek flexible gasket or equal and grouted to the top of the box to provide a water tight connection.

2. The top of the riser shall be set between one (1) and six (3) inches above finished grade.

H. Chamber Drainfield: Chamber drainfields shall be constructed in accordance with the detail and plans. The plans shall indicate the size and number of chambers required for the designed drainfield area.

1. Excavation:

a) Trenches for installation of the chamber sections shall be excavated to the elevation, width, length and direction as indicated by plans and the Owner or Owner's Representative.

b) Excavation shall not be allowed when the moisture content of the soil is greater than the plastic limit (when rolling a sample between the hands forms a wire) If the soil crumbles, then soil preparation may proceed. Excavation or construction shall not be allowed when the occurrence of rain, snow or frost is such that the quality of construction may be impaired.

c) All smeared or compacted surfaces of the bottom or side walls shall be raked to a depth of three (3) inches.

d) Loose material, including stones and debris shall be removed before the infiltration chambers are placed in the trench.

e) Avoid walking in the excavated trench to prevent compaction and loss of soil structure.

2. Chambers:

a) Place the chamber sections in the trench and connect in accordance with the manufacturer's installation instructions.

b) Chamber sections shall be maintained at a level grade throughout the entire length. Chamber sections shall be checked with a construction level upon placement to preclude high or low sections.

c) The header pipe shall be level.

d) Distribution piping to and between chamber trenches shall be connected in accordance with the chamber manufacturer's recommendations.

e) End caps shall be installed at the end of each drainfield lateral as recommended by the chamber manufacturer.

f) Each row of leaching chambers shall contain a splash plate on the native soil within the leaching chamber where the effluent pipe enters the chamber to prevent erosion. This splash plate may be an HDPE splash plate made by the manufacturer of the leaching chamber, a concrete block, or a patio block, as approved by the Owner's Representative. Splash pad used shall be at minimum 2 inches by 8 inches by 16 inches, or approved equal.

g) Place filter fabric over the chambers prior to backfilling in accordance with TP-12.04.I.

3. Backfilling:

a) Before backfilling, the system shall be inspected by the Owner or Owner's Representative.

b) Backfill material shall be free of organic and other potentially clogging material and hand placed

to a point three (3) inches above the highest chamber perforation.

c) Place and pack down soil at chamber interlocking joints. Backfill to cover the louvers. Backfill shall be packed down by walking along the edges of the trench to assure structural support of the chambers.

d) The remaining backfill material may be mechanically placed.

e) A minimum cover of 12 inches is required or as recommended by the manufacturer.

f) Trench backfill material shall be mounded six (6) inches above the natural ground surface to allow for settlement and to divert away runoff water.

g) After the system is covered, the site should be seeded in accordance with TP-01 to prevent erosion.

I. Filter Fabric: Filter fabric shall be installed in accordance with chamber manufacturer's recommendations. Filter fabric shall be installed directly on top of (draped over) the chambers prior to initial backfill. Use soil to hold the filter fabric in place and then backfill in accordance with TP-12.04.H.

J. Observation Ports: Observation ports shall be constructed of solid four (4) inch PVC pipe and shall installed at the end of each chamber leg or as indicated on the plans.

1. The pipe shall be installed through the knockout ports on the chambers using couplings to keep the pipe from dropping into the chamber and preventing the removal of the pipe.
2. The riser shall extend between 18 inches and 24 inches above ground surface.
3. PVC slip-on gasketed caps shall be installed on each riser as shown in the detail.
4. Observation pipe and caps shall be painted with two (2) coats of epoxy green spray paint for UV protection.

K. Inspection: The installed sewage disposal system shall be inspected by the Owner or Owner's Representative in accordance with this TP-12.

1. The Contractor shall provide the Owner or Owner's Representative with a minimum of 24 hour notice on the need for inspection prior to final backfill of the septic tank and drainfield installation.
2. The sewer service lines, septic tank, distribution box and drainfield shall remain uncovered until inspected and approved by the Owner or his/her representative.
3. Backfill prior to such approval will be cause for rejection of the construction for payment until disputed sections are uncovered for inspection purposes.
4. All such re-excavation shall be at the sole expense of the Contractor.

L. Septic Tank Abandonment: Old, unused, or deteriorated septic tanks that have been determined by the Owner or Owner's Representative to be disconnected and abandoned, shall be abandoned according to the following method:

1. The tank(s) shall have the liquid and solids/sludge pumped by a septic pump truck so that the tank is left empty. The removed materials shall be disposed of properly according to state and federal requirements.
2. Remove and dispose of tank cover, risers, inspection pipes and any tank interior pumps as directed by the Owner's Representative. The interior pipes and plumbing may be left in the tank for abandonment.
3. The tank shall then be crushed in place and filled with its own crushed debris. Contractor shall ensure that the bottom of the tank is breached to prevent the holding of any liquid.

4. The crushed tank shall then be backfilled with suitable, compactable, soil material, to fill the voids left by the tank.
5. The backfilled soil shall be properly compacted to prevent subsidence and to bring the backfilled area to the same level as the surrounding grade.

M. Drainfield Abandonment: Drainfield chambers and piping shall be abandoned by removing the observation pipes and distribution boxes to a minimum of 12-inches below grade and filling the pipe and hole with suitable, compactible soil material. The remaining chambers and components of the system shall be abandoned in place. Septic lines must be cut and capped to prevent flow into the field once it is abandoned.

TP - 12.05 RECORD DRAWINGS:

Record drawings shall be furnished for individual sewage disposal systems and shall include two swing ties from permanent structures or facilities to each of the following:

A. Inspection/access ports on the septic tank (Risers)

B. All cleanouts

C. All bends and elbows

D. Distribution box

E. Location of the drainfield header and observation ports

F. Abandoned septic tanks

G. Intersections with other utilities

TP - 12.06 WATER AND SEWER CROSSINGS:

Water and sewer crossings must meet the requirements set forth in TP 01.

TP - 12.07 MEASUREMENT AND PAYMENT:

All measurements and payments will be based on completed and accepted work performed in strict accordance with the drawings and specifications and the respective prices and payment shall constitute full compensation for all work complete, including incidentals. No separate payment will be made for testing, excavation, trenching, and backfilling or for other items of work covered under this section of the specifications and all such costs pertinent to these items shall be included in the applicable unit prices.

A. Sewer Service Line: The solid gravity PVC pipe shall be measured in lineal feet along the centerline of the pipe including fittings. Payment shall be at the unit price. Payment shall be full compensation for furnishing all labor, equipment, materials and incidentals required for complete installation, including excavation, bedding, backfill, compaction, pipe installation, fittings, all connections, as-built drawings, and final cleanup.

B. Cleanouts: Payment for the two-way cleanouts shall be at the unit price as stated in the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials and incidentals required for complete installation; including excavation, backfill, compaction, pipe installation, fittings, connections, foam, reinforced concrete pad, as-built drawings, and final cleanup.

C. Septic Tanks: Payment for septic tanks shall be at the unit price as stated on the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for complete installation; including excavation, setting, leveling, backfilling, effluent filter, as-built drawings, and final clean-up.

D. Septic Tank Risers: Payment for septic tank risers shall be at the unit price shown on the Bid Schedule, and based on actual feet (measure vertically) installed, including one septic tank cover for each riser. Payment shall be full compensation for all materials, labor, and equipment required for a complete installation including: the water tight connection to the septic tank, rope for the concrete tank lids/covers, backfilling, and compaction around the risers. No separate payment for the covers shall be made.

E. Riser Safety Screens: Payment for septic/pump tank riser safety screens shall be at the unit price shown on the Bid Schedule. Payment shall be full compensation for all materials, labor, and equipment required for a complete installation.

F. Distribution Boxes: Payment for distribution boxes shall be at the contract unit price shown on the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for complete installation; including, excavation, connections to the sewer service line and drainfield piping, as-builts, and final clean-up.

G. Distribution Box Risers: Payment for distribution box risers shall be at the unit price shown on the Bid Schedule, and based on actual feet (measure vertically) installed, including one distribution box cover for each riser. Payment shall be full compensation for all materials, labor, equipment and incidentals required for a complete installation including: riser, cover, the water tight connection to the distribution box, backfilling, compaction, as-builts, and final clean up around the risers.

H. Chamber Drainfields: Payment for chamber drainfields shall be made on a linear foot basis measured to the nearest foot and includes costs for the installation of manufactured chambers, end pieces, splash pads/solid blocks, filter fabric (if required), observation pipes with UV paint and all required piping and fittings. Compensation shall include all labor, equipment, materials, and incidentals required for complete installation; including excavation, backfilling, compaction, final grading, seeding, as-builts, and final clean-up.

I. Water and Sewer Crossings - Sewer service lines: All costs associated with completion of water and sewer crossings shall be merged with other fee items and will not be considered a separate item for payment. No additional payment will be made for installation of ductile iron sewer pipe associated with water and sewer crossings.

J. Septic Tank Abandonment: Payment for abandonment of the existing septic tank shall be at the contract unit price measured each and shall be full compensation for pumping and crushing the existing tank, backfilling the void left by the tank, and compacting the soil to prevent subsidence and to bring it to the same level as the surrounding grade.

If the existing septic tank is any material other than concrete, the Contractor shall be paid at the contract unit price measured each to pump and remove the existing septic tank. The Contractor shall be responsible for all costs associated with the removal, including, but not limited to transporting and disposing of the septic tank at a State licensed and approved waste disposal site located off the particular reservation where the work is to be performed. The payment shall also be full compensation for backfilling the void with soil from the designated area, and compaction to prevent subsidence and to bring it to the same level as the surrounding grade.

K. Drainfield Abandonment: Payment for abandonment of the existing drainfield shall be at the contract unit price measured each and shall be full compensation for removing the observation pipes and distribution boxes below grade, backfilling the void left by the pipes, and compacting the soil to prevent subsidence and to bring it to the same level as the surrounding grade.

INCORPORATED INTO THE CONTRACT

SUBMITTAL REVIEW FORM, SECTION 12 – NON-AGGREGATE SEWAGE DISPOSAL SYSTEMS

DATE INITIALS Submittal No.

Received by ENGINEER: _____ _____ Project No. _____

Received by OWNER: Contract No.

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
12.03.A	PVC Sewer Pipe & Fittings		
12.03.B	Cleanout, Fittings, Cap, Foam, Mesh, Concrete		
12.03.C	Septic Tank		
12.03.D	Effluent Filter		
12.03.E	Septic Tank Riser, Safety Screen & Riser		
12.03.F 12.03.G	Distribution Box and Risers		
12.03.H	Drainfield Chambers		
12.03.I 12.03.L	Filter fabric (if required) Paint		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 16 - SINGLE RESIDENCE EFFLUENT LIFT STATION

TP - 16.01 SCOPE:

The work covered by this section includes the furnishing of all labor, tools, equipment, materials, and performing all operations in connection with the installation and construction of an individual (single residence) effluent lift station system composed of two separate tanks (septic tank and pump tank), with pump and controls, effluent discharge piping, service force line, and all connecting piping and incidental construction operations necessary to place the sewage disposal system in a fully operational condition.

TP - 16.02 GENERAL:

The individual effluent lift station system, service force line and related facilities shall be constructed at the locations and of the sizes shown on the drawings. The Owner or Owner's Representative may direct field changes in location and orientation at the time of construction. Excavation, trenching, backfilling, compaction and any needed dewatering shall be completed in accordance with Section 01 of the Technical Provisions, unless specifically altered under other requirements of this specification section.

Installation and operation of pipes, tanks, effluent pump system, controls and service force line shall be verified and approved prior to acceptance. Pipe joints and fitting installation shall be in accordance with the manufacturer's recommendations. All pipes and joints shall be approved by the Owner or Owner's Representative prior to backfilling. The work will not be accepted until satisfactory backfilling, compaction and cleanup is complete. Final grading should prevent surface water runoff from pooling around installed facilities. If the work does not meet the specified requirements of this section, the Contractor shall remove and replace the facilities at no additional cost. The Contractor shall leave each premise in a neat and orderly condition, restoring it as near as possible to its original condition and to the approval of the Owners' Representative.

TP - 16.03 MATERIALS:

All materials shall be inspected to verify that they meet these specifications and match the approved submittals. Remove all materials not meeting these requirements. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes, regulations and these specifications.

A. General: The unloading, handling and storage of the pipe and materials shall be conducted in a safe manner. Inspect all materials prior to installation to ensure that they are in new condition. Inspect pipe and fittings for defects. Plastic pipes with scratches, gouges, grooves or discoloration shall be rejected. Remove all materials from the site that are defective, damaged, used, unsound or that otherwise do not meet the specifications.

B. Pipe and Fittings: Solid pipe and fittings utilized from the building stub-out to the inlet of the septic tank and inlet of the pump tank shall be either 4-inch diameter PVC SDR 35 pipe with pipe and fittings conforming to ASTM D3034 or Schedule 40 PVC pipe with pipe and fittings conforming to ASTM D1785.

1. Gasketed joints shall be bell-ended and conform to ASTM D3212. All joints and connections in the pipe shall be watertight. Use elastomeric gaskets conforming to ASTM F477. Lubricants used for the joint installation shall meet the requirements of the pipe manufacturer.
2. Each length of pipe shall be clearly marked with the following: manufacturer, nominal pipe size, PVC cell classification, type PSM PVC sewer pipe, ASTM designation and pipe class.
3. Rigid couplers shall be used for all connections, such as PVC fittings, shielded Fernco fittings, or approved equal. Non-rigid couplers equal to Fernco may be used for the first connection from the home to the sewer service line if approved by the Owner or Owner's Representative.

C. Cleanouts: Double service line (two-way) cleanout piping and fittings shall be 4-inch diameter PVC pipe matching the chosen septic drain piping material. The cleanout piping and cap shall be threaded.

1. The cleanouts shall be installed with a brass hex socket plug equal to Tyler A Low Square Head cleanout plug. The cleanout ferrule shall be a Tyler 4-3 ½ or approved equal.
2. The poly seal foam wrapped around the cleanout ferrule shall be Sill Seal underlayment foam or approved equal.
3. The double service line cleanout shall be installed in a 20-inch x 40-inch x 4-inch concrete pad (collar) as shown in the detail drawings. The wire mesh used for the concrete pad shall be ASTM approved W 1.4 (1/8 inch) wire mesh.

D. Septic Tank: Septic tank shall be dual compartment with a minimum of 1,000 gallon liquid capacity as measured below the invert of the outlet. The actual size of the septic tank shall be as shown on the plans and in the Bid Schedule.

1. The tank shall be constructed of precast, reinforced concrete of sufficient strength to withstand hauling and handling stresses and shall meet all state and local regulations for the state and localities for which it is installed. The steel reinforcement shall meet the requirements of TP 03.
2. Septic tank shall be water-tight and shall have a 28-day compressive strength of at least 3,000 psi.
3. Chipped and honey combed tanks shall not be approved and will be rejected if delivered and installed. The tank shall be free of excessive cracking. Cracks in the concrete which, in the opinion of the Owner or Owner's Representative could lead to leakage and/or premature failure, shall be sealed by the Contractor, at no extra cost, using approved materials. Tanks with cracks visible on both sides or cracks where metal or synthetic fiber reinforcement is visible, shall be rejected.
4. The dimensions of the septic tank shall be labeled on the drawings. Minimum wall thickness shall be three-inches (3"). Minimum distance between inlet and outlet of the tank shall be six-feet (6'). The minimum width of the tank shall be three-feet (3'). The longest dimension shall be parallel to the direction of flow, unless otherwise noted on the plans. The effective length shall be greater than two (2) and less than four (4) times the effective width.
5. The septic tank shall be of monolithic construction below the liquid line. Tank shall be cast as one piece with a lid cast as the top of the tank. If tank is cast as a clamshell, with two pieces, then the joints below the liquid line shall be interlocking V-notch, shiplap or tongue and groove. All joints shall be sealed with an epoxy based sealing compound or Ram-Nek flexible gasket or equal to prevent water infiltration or exfiltration. All joints below the liquid level shall be tested prior to backfilling and shall not have any leaks.
6. The bottom of the outlet invert of the tank, for a baffle or a sanitary tee shall be at least 2-inches (2") lower than the bottom of the inlet invert of the tank. Install tank with the tank inlet (higher invert penetration) facing towards the building and the tank outlet (lower invert penetration) facing toward the pump tank. A minimum of 1-inch (1") of clear space shall be provided between the top of the baffles or tees and the underside of the tank.
7. Tanks buried at depths exceeding 48-inches shall have a traffic rated, extra reinforced, tank lid.
8. If noted on the site plan, some sites may require installation of a special low profile septic tank. These tanks shall comply with all provisions for a standard tank but shall require a bury depth of no greater than 48-inches. Final fabrication dimensions and details of the structure shall be approved by the Owner or Owner's Representative in writing prior to fabrication and installation.

E. Effluent Filter: Effluent filters shall have a minimum diameter of 4-inches (4") and a maximum filtration size of 1/16-inch.

1. The filters shall be designed for a maximum daily flow of 1,000-gallons per day or greater. The effluent filters shall be equal to Zable A-100 (1,200 gpd), Tuff Tite EF 6 (1,500 gpd), or approved equal. If larger capacity filters are needed for a specific site, the required size shall be as shown in the plans and in the Bid Schedule.
2. The effluent filter shall have a handle to facilitate removal of the filter for maintenance and replacement. The handle shall be placed within 12" of the top of the riser for accessibility.

F. Pump Tank: Pump tank shall be a minimum of 250 gallon liquid capacity. The actual size of the pump tank shall be as shown on the plans and in the Bid Schedule.

1. The tank shall be constructed of precast, reinforced concrete of sufficient strength to withstand hauling and handling stresses and shall meet all state and local regulations for the state and localities for which it is installed. The steel reinforcement shall meet the requirements of TP 03.
2. Chipped and honey combed tanks shall not be approved and will be rejected if delivered and installed. The tank shall be free of excessive cracking. Cracks in the concrete which, in the opinion of the Owner or Owner's Representative could lead to leakage and/or premature failure, shall be sealed by the Contractor, at no extra cost, using approved materials. Tanks with cracks visible on both sides or cracks where metal or synthetic fiber reinforcement is visible, shall be rejected.
3. The pump tank shall be water-tight and shall have a 28-day compressive strength of at least 3,000 psi.
4. Tanks buried at depths exceeding 48-inches shall have a traffic rated, extra reinforced, tank lid.
5. If noted in the plans, some sites may require installation of a special low profile pump tank. These tanks shall comply with all provisions for a standard tank but shall require a bury depth of no greater than 48-inches. Final fabrication dimensions and details of the structure shall be approved by the Owner or Owner's Representative in writing prior to fabrication and installation.

G. Gravel: Gravel for the base bedding of the septic tank and pump tank shall be clean, hard, durable and free of fines, coal, clay or other soft fragments and shall meet the approval of the Owner or Owner's Representative. Gravel shall vary in size from 3/4-inch to 1-1/2-inch.

H. Effluent Pump: The effluent pump shall be sized for each site by the Owner's Representative. Effluent pump size and specifications for horse power, flow capacity, total dynamic head, and discharge outlet size are shown on the plans.

1. Effluent Pump:
   a) Effluent pump brands shall be equal to a Peabody-Barnes, Meyers, Goulds or Liberty.
   b) The pump shall have a discharge outlet that matches the specified diameter of the effluent discharge line (pump tank piping) and the effluent service force line (from tank to sewer main).
   c) The pump motor shall have a built-in thermal overload protection with automatic reset.
   d) A stainless steel chain shall be provided for pulling the pump out of the pump tank.
2. Power Supply:
   a) The power supply shall be 120/240 volt, single phase, 3-wire service from a properly sized 1/2 pole breaker off the lighting panel in the residence on a separate, dedicated circuit.
   b) The entire system shall be installed in accordance with state and local codes.
   c) All wire shall be sized in accordance with the latest issue of the National Electric Code.
   d) All materials shall be new and UL listed as applicable and shall meet NEC code and safety requirements.

INCORPORATED INTO THE CONTRACT

I. Controls: The pump supplier shall furnish a control and alarm system compatible with the pump furnished under this contract.

1. Enclosure:

a) Pump control equipment shall be housed in a weatherproof enclosure equal to a NEMA Type 4 enclosure and mounted at the location shown on the plans or as specified by the Owner or Owner's Representative. The enclosure shall have a locking hasp.

b) The NEMA Type 4 Enclosure shall house a load switching motor contactor with door mounted heavy duty HAND-OFF-AUTO (HOA) switch and a service disconnect mechanism.

2. Floats:

a) Two direct acting mercury-free float switches shall be furnished for mounting in the effluent pump tank. These floats shall serve to detect ON-OFF control levels for the pump.

b) Terminal blocks shall be provided for connection of ON-OFF level control floats.

3. Alarm System:

a) An alarm system, on a circuit separate from the pump, shall be provided and installed near the residence in the location shown on the plans or as selected by the Owner or Owner's Representative and the homeowner.

b) The alarm system shall consist of a direct acting mercury-free float switch, 24-volt control transformer, for mounting in the pump chamber, red alarm light, horn, push-to-test alarm button, and a horn silence switch.

c) The alarm system shall be a Tank Alert® 1 or approved equal.

d) Upon the occurrence of an alarm condition, the high alarm sensor will close its circuit, thus energizing the red alarm light and sounding the horn or buzzer.

e) A silencing switch shall be provided to silence the audible alarm once it has been activated. The red alarm light shall remain energized as long as the silencing switch is in the "silence" position. The high alarm sensor shall continue to show as alarm condition until the operating condition has returned to normal and the silencing switch has been returned to its "normal" position".

f) The control panel meeting the above criteria shall be equal to a Rhombus Technology panel, Series 112 or approved equal.

J. Electrical Cable: Electrical cable shall be Type UF direct bury 12/2 wire with ground to provide power to the effluent pump and Type UF direct bury 14/2 wire to provide power to the float switches.

1. If necessary, the underground cable shall be increased in size to limit voltage drop from power source to pump motor to two (2) percent or in accordance with pump manufacturer's recommendations.

2. Conduit used shall be rigid, non-metallic, water-tight, heat and corrosion resistant Schedule 40 PVC, appropriate for running electrical wiring above or below ground.

K. Effluent Discharge Line: (*Piping within Pump Tank*) Use Schedule 80 PVC piping, check valves, union, true-union ball valve, wye and fittings throughout the pump tank and riser assembly, as illustrated in the drawing and detail. This includes the piping from the pump discharge outlet to the tank exterior.

1. Once outside the pump tank, a compatible transition adapter/compression fitting shall be provided to join the Schedule 80 PVC piping to the PE service force line piping.

2. Specified check valve(s), union, true-union ball valve (shutoff) and wye fitting shall be included in the effluent discharge line piping as shown in the plans and details.

3. Pipe size of effluent discharge line to be designed per site and system conditions. The pipe and fitting sizes are shown on plans and Bid Schedule.

L. Check Valve & Ball Valve: True-union check valves and true-union ball valves shall be suitable for contact with septic tank effluent and shall be compatible with solvent weld PVC material.

1. The valves shall be the same size as the effluent discharge line.
2. The check valves installed shall be appropriate for vertical or horizontal installation as shown on the plans. The check valve shall be either a ball or swing check valve, as noted on the plans.
3. The check valves and ball valve shall be of true-union configuration so that they may be replaced when/if necessary without having to cut and splice the piping.

M. Septic Tank and Pump Tank Risers: Risers, a minimum of 24-inches in diameter, must be installed to provide access to the inlet of the septic tank for pumping/maintenance purposes, to the outlet of the septic tank for easy access the effluent filter, and to the opening of the pump tank that allows access to the effluent pump and effluent discharge piping system.

1. Risers shall be corrugated HDPE with a 24" HDPE UV protected heavy duty cover and stainless steel locking screws, or equal. Risers shall have a water tight connection to the tanks.
2. Risers shall have a printed warning label with information regarding the hazards present when entering a tank affixed by the Contractor or supplied by the manufacturer. This label shall be affixed to the inside and outside of the riser covers.
3. The riser system shall be installed with a safety screen device within the riser such as the Polylok 3008 SSPIPE Safety Screen or approved equal. The Contractor shall provide one (1) extra safety screen to the Tribe for each septic tank or pump tank installed.
4. Where risers are required to be more than 42-inches in height, the risers shall be made of concrete, such as concrete grade rings, with approved water tight seals to the tank and an approved compatible riser cover or approved equal. Prior approval shall be obtained from the Owner or Owner's Representative.

N. Service Force Line: (*Piping outside pump tank, from tank outlet to sewer main*) Sewer force line piping which is installed outside of the pump tank shall be AWWA C906 PE 4710 pipe.

1. HDPE pipe to be installed in accordance with TP 28.
2. The pipe diameter size will be sized by the Owner's Representative for each specific site and shall be as noted on the plans.
3. PE to PE Joints shall be joined by proper compression fittings equal to A.Y. McDonald Series 4760 or shall be butt fused or flanged with back-up rings and SAE Grade 3 bolts, equal to Victaulic Style 995 with internal stainless steel stiffener.
4. PE to PVC transitions shall use compression fittings manufactured by A.Y. McDonald, Ford Meter Box, Mueller or equal.

O. Saddles & Fittings:

1. Connecting to Gravity Sewer Mains:

a) For connections to gravity sewer mains (PVC, Vitrified Clay, Concrete, AC, etc.) the service force line shall be connected to the main using rigid, non-corrosive, water tight wye saddles that are compatible between the PE service force line and the gravity sewer main material and size.

b) Wye saddles shall be equal to Cascade Waterworks stainless steel wye saddle or Royal Building Products PVC saddle wyes with locating ring and gasket.

c) Compatible water tight fittings shall be used to transition from the PE service force line to the saddle wye size opening and material type.

2. Connecting to Sewer Force Mains:

a) For connections to sewer force mains (PVC C900, HDPE, etc.): The service force line shall be connected to the main using rigid, non-corrosive, water tight service saddles that are compatible between the PE service force line and the sewer force main material and size.

b) For connecting to PVC Pipe: Service saddles shall be stainless steel double bolt (or single bolt such as Ford Style FS300) saddle clamp equal to Smith-Blair 372 or Cascade Style CSC2 for Ford Style FS202.

c) For connecting to HDPE C906 Pipe: Use stainless steel double bolt saddle clamps equal to Smith-Blair 372 or Ford FSP323 with spring washers.

i. Fittings shall be bronze compression style equal to A.Y. McDonald or Ford.

ii. Saddle tap or tapping sleeve shall be compatible with the existing sewer main pipe material and sized to ensure a secure, watertight connection.

P. Corporation Stops: Corporation stops with pack joint connections shall be used when connecting to a sewer force main unless otherwise specified. Connections shall be non-flare for all pipe types. For PE service line use corporation stops manufactured by A.Y. McDonald, Ford Meter Box, Mueller or equal.

Q. Tracer Wire & Box: Tracer wire and tracer wire access box shall meet the material specifications listed in TP 01.

R. Warning Tape: Warning tape shall meet the material specifications listed in TP 01. Warning tape shall be GREEN in color with "CAUTION-BURIED SEWER LINE BELOW" continuously printed on it.

S. Paint: Paint used for all exposed PVC material shall be an epoxy or enamel UV protectant paint that bonds well with PVC and is white in color, such as Krylon spray paint, or equal.

T. Pipe Hangers: Pipe hangers shall be made of material compatible with piping material and shall be of sufficient strength to support pipe at full capacity. Pipe hangers shall not affect pipe integrity by abrading, cutting or bending pipe.

U. Expanding Foam Sealant: Foam shall be a polyurethane-based foam sealant that expands to take the shape of voids to form a durable, airtight and water resistant bond. The foam shall be UL classified, rated for interior and exterior use, adhere to metal and plastic materials and shall cure in a rigid form. Foam shall be used to seal all conduit penetrations into the control panel and pump chamber.

TP - 16.04 INSTALLATION:

Verify that dimensions, elevations, and slopes are as indicated on the plans. Required separation distances shall be maintained for all on-site wastewater treatment system components as presented in the detail or as required by the localities in which they are installed. During and after construction, the Contractor shall avoid driving over the septic tank, pump tank or any other component of the on-site treatment facility.

A. Sewer Service Line: Sewer service lines shall be furnished and installed by the Contractor from the septic tank to the point of connection as shown on the plans or as directed by the Owner or Owner's Representative.

1. Connection to Building:

a) Sewer service lines shall be connected to the building stub out sewer drain with approved fittings or rigid couplers which shall be installed in accordance with the manufacturer's recommendation.

b) If clamps/bands are required on the couplers, they shall be at a minimum 300 series stainless steel.

All stainless steel bands shall be wrapped in PVC tape.

c) For connecting beneath the home, place pipe hangers at a maximum distance of 4 feet apart for horizontal PVC pipe.

d) Minimum cover over solid sewer pipe shall be 12-inches or as approved and shown on the plans.

2. Pipe Slope and Bends:

a) All 4-inch PVC piping from the building stub out sewer drain to the septic tank shall be laid at a minimum grade of 2% (1/4-inch per foot) and maximum grade of 4% (1/2-inch per foot).

b) From the septic tank to the pump tank, the 4-inch PVC pipe shall be laid at a minimum grade of 1% (1/8-inch per foot).

c) Any changes or deviations in line alignment shall be made with bends not exceeding an angle of 45-degrees and shall be approved in advance by the Owner or Owner's Representative.

d) Connections to existing building drains which result in a change of direction of the line by more than 45-degrees requires the installation of a two way cleanout at that location.

e) There shall be no 90-degree bends in the pipe between the building and the septic tank.

3. Pipe Installation Requirements:

a) Installation of pipe, including joint lubrication and assembly, solvent welding, pipe bending and joint deflection shall be in accordance with the manufacturer's recommendations.

b) Sewer service lines and connections must be constructed with maximum joint deflection not to exceed the manufacturer's recommendations and in no case shall exceed 1-inch per foot in any joint. Larger changes in direction must be made by use of standard 1/16 or greater bends.

c) Sewer service lines shall not be installed as vertical risers.

4. No Building Connection:

a) In cases where the sewer service line is not connected to the building, a PVC or like material cap shall be solvent welded to the service line terminus within 5 feet of the proposed building.

b) A piece of No. 3 rebar, 1-foot in length shall be installed to mark the service line terminus, as shown on the detail drawings. Bury the rebar 6-inches below ground surface.

c) An HDPE marker painted green shall also be installed at this same location.

B. Cleanouts: Sewer service line cleanouts shall be installed at the locations indicated in the plans and in the manner indicated on the detail drawings. All required fittings shall be in conformance with the provisions of TP-16.03. Two-way cleanout detail drawings are located in the TP 07 Details (Detail 7A).

1. Locations:

a) A two-way cleanout shall be installed within ten feet of the building or as shown on the plans.

b) Additional service line clean-outs shall also be two-way cleanouts and shall be installed, at 100-foot intervals, or as directed by the Owner or Owner's Representative or as shown on the plans for each series of bends totaling or exceeding 90-degrees.

c) Fittings shall not be greater than 45-degrees (1/8 bend) on lines carrying untreated sewage.

d) Cleanouts shall allow for bi-directional rodding/snaking of the sewer line both towards the building and towards the septic tank.

2. Cleanout Configuration:

   a) Install wyes in the sewer service line to construct the cleanout and connect risers of the same material from the wye to the ground surface as illustrated on the design drawings.

   b) Attach a no-hub iron body tapped, clean-out adapter and threaded brass plug to the end of the riser as illustrated on the design drawings.

   c) The cleanout shall be extended so that the top face of the threaded plug is at the finished grade of the concrete pad as illustrated on the design drawings.

   d) Pipe-thread sealant shall be used on the plug threads, such as Teflon T Plus 2 or equal.

   e) A single layer of sill seal foam shall be wrapped around the iron body cleanout adapter between the exterior of the adapter and the concrete pad to protect against tightening from concrete expansion.

3. Concrete Pad/Collar:

   a) The concrete used shall meet the requirements of TP 02.

   b) The concrete pad shall be constructed around the cleanout at the ground surface per the design drawing detail.

   c) The concrete pad shall be reinforced with welded wire mesh with a minimum of ½-inch concrete over the mesh.

   d) Pour concrete pad on two-way cleanouts after the final site grading is complete to match finished grade.

C. Septic Tank: The septic tank shall be installed at the location and elevation shown in the plans and detail drawings. Install tank in accordance with the manufacturer's recommendations. The septic tank shall be installed no closer than 10 feet from the building.

1. Setting Tank:

   a) Excavation shall be the minimum required to provide proper bedding and placement of the tank.

   b) Prior to setting the tank, all rocks and other foreign material which might damage the tank upon placement shall be removed from the excavation.

   c) The Contractor shall set the tank on a 6-inch thick (minimum) bed of sand or gravel to facilitate leveling the tank. The base bedding shall be compacted to 85% Standard Proctor Density.

   d) The base bedding shall present a smooth, uniform and level surface.

   e) Seal the tank inlet and outlet with temporary plugs until connections are made to the inlet and outlet lines.

2. Sealed Joints:

   a) Seal all joints between inlet piping, outlet piping and risers, as approved by the Owner's Representative.

   b) The sewer service line shall be sealed with a rubber gasket (boot-type fitting) or masonry grouted at connection points to the inlet and discharge openings of the septic tank to prevent ground water infiltration. Grout shall conform to Section 02 of the Technical Provisions.

3. Backfilling Tank:

   a) Prior to backfilling, the tank elevation shall be checked at all corners to assure that placement is level and at the appropriate depth.

b) Backfill in 12-inch layers and thoroughly compact in a manner that will not produce undue strain on the tank.

c) Final backfill material shall be mounded 6-inches above the natural ground surface to allow for settlement.

d) Do not exceed 48-inch cover unless tank is designed for a deeper bury depth and approval is obtained from the Owner's Representative. Tanks buried at depths exceeding 48-inches shall have a traffic rated, extra reinforced tank lid.

4. Groundwater:

a) If groundwater is present, dewater in accordance with TP 01.

b) All work in setting the tank shall be done under dry conditions.

c) In these conditions, the septic tank may need be filled with water to prevent flotation of the tank.

5. Effluent Filter: An approved effluent filter shall be installed in a sanitary tee/baffle on the septic tank outlet piping.

D. Effluent Filter:

1. Install effluent filter in conformance to the manufacturer's installation instructions.

2. Center and secure the filter assembly under the outlet manhole opening of the septic tank. Solvent weld tee/baffle to 4-inch PVC tank outlet pipe to house the filter, as needed. Extend piping a minimum of 12-inches beyond the outside of the septic tank before connecting to the pump tank PVC piping.

3. Install filter handle and extend handle to within 12-inches of the top of the access riser for ease of accessibility.

E. Pump Tank: The pump tank shall be installed at the location and elevation shown in the plans and detail drawings. Install tank in accordance with the manufacturer's recommendations. If required, install vent on pump tank in accordance with state and local codes.

1. Setting Tank:

a) Excavation shall be the minimum required to provide proper bedding and placement of the tank.

b) Prior to setting the tank, all rocks and other foreign material which might damage the tank upon placement shall be removed from the excavation.

c) The Contractor shall set the tank on a 6-inch thick (minimum) bed of sand or gravel to facilitate leveling the tank. The base bedding shall be compacted to 85% Standard Proctor Density (ASTM D698).

d) The base bedding shall present a smooth, uniform and level surface.

e) Seal the tank inlet and outlet with temporary plugs until connections are made to the inlet and outlet lines.

2. Sealed Joints:

a) Install matching 4-inch PVC pipe material (Schedule 40 or SDR 35) from the septic tank to the pump tank at a minimum slope of 1%.

b) Seal all joints between inlet piping, outlet piping, riser, etc. as approved by the Owner's Representative.

c) The sewer service line shall be sealed with a rubber gasket (boot-type fitting) or masonry grouted at connection points to the inlet and discharge openings of the pump tank to prevent ground water

infiltration. Grout shall conform to Section 02 of the Technical Provisions.

3. Backfilling:

   a) Prior to backfilling, the tank elevation shall be checked at all corners to assure that placement is level and at the appropriate depth.

   b) Backfill in 12-inch lifts and thoroughly compact in a manner that will not produce undue strain on the tank.

   c) Final backfill material shall be mounded 6-inches above the natural ground surface to allow for settlement.

   d) Do not exceed 48-inch cover unless tank is designed for a deeper bury depth and approval is obtained from the Owner's Representative. Tanks buried at depths exceeding 48-inches shall have a traffic rated, extra reinforced tank lid.

4. Groundwater:

   a) If groundwater is present, dewater in accordance with TP 01.

   b) All work in setting the tank shall be done under dry conditions.

   c) The pump tank may need be filled with water to prevent flotation of the tank.

F. Septic Tank and Pump Tank Risers: The Contractor shall install the approved covered risers for the inlet and outlet of the septic tank and the outlet of the pump tank.

1. The top of the riser covers shall be set at least 6 inches above finished grade.

2. All septic tank risers shall be connected to the top of the tank with a Ram-Nek flexible gasket as manufactured by the Henry Group (formerly K.T. Snyder Company) or equal water-tight material and shall be grouted to the top of the tank to eliminate water infiltration.

3. A ¼-inch minimum diameter nylon or poly-rope shall be attached to the septic tank concrete access covers/lids. Connect end of the rope to a hook inside of the tank riser within 24 inches of the top of the riser to facilitate the removal of the concrete access covers/lids inside the risers. The rope shall extend to 12-inches above grade.

4. The safety screen device (Kid-Catcher) shall be installed on each riser in accordance with the manufacturer's recommendation.

5. The stainless steel screws on the riser covers shall be secured tightly.

G. Effluent Pump: Install specified pump from the drawings in accordance with manufacturer's recommendations and at the location and configuration shown in the plans and detail drawings.

1. Set pump level on concrete block(s) or pump stand at the bottom of the pump chamber.

2. Connect effluent discharge line piping and fittings as shown in the detail drawing.

3. Connect end of pump chain to a hook inside of the pump tank riser within 24 inches of the top of the riser to allow for removal of the pump directly up through the riser and cover.

H. Electrical Controls and Cable: Electrical connections to the pump, floats, alarm and control panel shall be completed in accordance with the manufacturer's recommendations.

1. All buried electrical cable (pump power cable and 3 float-switch cables) shall be placed in one trench or installed in approved rigid watertight conduit as shown on the plans. All exposed wiring shall be enclosed in approved conduit.

2. Mount floats in the pump tank at the elevations shown on the drawings, as directed by manufacturer's

specifications and as approved by the Owner's Representative.

3. Wire the pump to a new breaker in main breaker box (15A/2P breaker) and provide a dedicated circuit to the pump control panel.
4. Wire splicing shall be water proof, in accordance with NEC and easily accessibly in the pump tank riser for future replacement of wiring as needed.
5. Install the alarm system on a circuit separate from the pump.
6. Seal all conduit openings entering the control panel and pump chamber with expanding foam.
7. Install the control enclosure box and alarm system within sight of the pump tank and near the residence in the location shown on the plans or as selected by the Owner or Owner's Representative and the homeowner. Mount the control panel on a 4"x4 pressure treated mounting-post rated for ground contact.
8. If requested by the Owner or Owner's Representative, install bollards to protect the pump tank riser and pump controls at the locations shown on the plans.

I. Effluent Discharge Line: The effluent discharge line shall be installed in accordance with the detail plans and these specifications.

1. Connect Schedule 80 piping to effluent pump discharge outlet.
2. Install the approved check valve(s) at the locations shown on the plans. A check valve shall be installed between the pump and union (near discharge outlet of the pump).
3. The discharge line must have a union installed inside the tank, within reach of the riser, to allow for removal of the pump through the riser by only disconnecting the union. Place union within 24-inches of the top of the tank riser.
4. For connections to sewer force mains, a second check valve shall be installed immediately after the disconnect assembly, to eliminate backpressure flows into the pump tank from any other pumping systems which may also be connected to the pressurized force main piping.
5. In cold climates, provide a weep hole in the effluent discharge line or provide insulation along the service force line. The weep hole shall be a ¼" hole drilled in the effluent discharge line just above the check valve such that the effluent discharge line and the service force line drains back into the tank after a pumping cycle to prevent freezing. The freeze prevention measure shall be approved by the Owner or Owner's Representative.
6. The effluent discharge line shall penetrate through the corrugated riser wall, just above the pump tank as shown on the plans and details. The piping through this penetration shall be secure and sealed to prevent water infiltration.
7. Once beyond the pump tank, the Contractor shall adapt the effluent discharge line to the service force line material (pressure rated HDPE Pipe).
8. All effluent discharge piping size, length, orientation and spacing shall be in accordance with the detail and drawing or as approved by the Owner or Owner's Representative.

J. Service Force Line: The service force line shall be installed in accordance with the detail, plans and these specifications

1. The pipe diameter of the effluent service force line shall be as specified on the design plans and as listed on the Bid Schedule.
2. The PE service force line shall be connected to the effluent discharge line piping (Schedule 80 PVC) from the tank with appropriate adapters and compression fittings.

3. The service force line shall be one continuous segment of PE pipe with no joints, to the maximum extent possible. If joints are needed, they shall be completed by butt fuse method or compression fittings, all in accordance with the manufacturer's recommendations. All service force line joints shall be visually inspected by the Owner or Owner's Representative under system pressure by running the effluent pump.
4. The service force line piping shall slope up continuously to the sewer main unless otherwise directed by the Owner or Owner's Representative. If the pipe does not slope up continuously and there are high points in the sewer service force line, a wastewater air release valve may be added to the contract per the Owner or Owner's Representative, as needed.
5. Install service force line piping at a bury depth of 3-feet or greater. In colder regions, as directed by the Owner or Owner's Representative, install insulation board over sewer force line in traveled/traffic areas if service force line bury depth is less than 3 feet and if there is no ¼" weep hole drilled in the effluent discharge piping for drain-back into the pump tank. If insulation board is required and shown in the plans, it shall meet the material specification of TP 01 and shall be installed in accordance with TP 01.

K. Installing Tracer Wire and Warning Tape: Install tracer wire and warning tape on all service force line.

1. Tracer wire and warning tape shall be installed from the pump tank to the sewer main (gravity or force).
2. A tracer wire access box shall be installed next to the pump tank, as shown on the plans and detail.
3. Tracer wire shall be attached to saddle at sewer main.
4. Tracer wire, tracer wire access box and warning tape shall be installed in accordance with TP 01 and at the locations shown on the plans.

L. Connection to Gravity Sewer Main: Connect to existing gravity sewer main using an approved sewer wye saddle for the gravity main material (PVC, Clay, Concrete, AC etc.). Install sewer wye saddle in accordance with the manufacturer's recommendations.

1. Install sewer wye saddle at approved connection point on the gravity main as shown on the plans or determined by the Owner or Owner's Representative.
2. The saddle shall be installed at a 45 degree from the top the gravity sewer main.
3. The installed saddle shall be secure and water tight.
4. Connect PE service force line to saddle using approved compression style fitting and necessary adapter fittings.
5. Proper compaction shall be provided beneath and around the service force line piping and saddle connection to minimize or eliminate settlement from the resulting loading and pressures at this connection.

M. Connection to Sewer Force Main: Connect to existing sewer force main using an approved service saddle for the force main material (HDPE, C900 etc.). Install service saddle in accordance with the manufacturer's recommendations.

1. Install service saddle at approved connection point on the force main as shown on the plans or determined by the Owner or Owner's Representative.
2. The saddle shall be installed at the approved angle on the sewer force main.
3. The installed saddle shall be secure and water tight.
4. Install corporation stop into service saddle on the sewer force main. All connections shall be live

tapped through the corporation stop with a tapping machine in accordance with manufacturer's recommendations.

5. Proper compaction shall be provided beneath and around the service force line piping and saddle connection to minimize or eliminate settlement from the resulting loading and pressures at this connection.

6. While backfilling, support the corp stop by carefully compacting around the corp stop and service force line to prevent ground shifts and any other type of ground movement which could damage the valve and connection.

N. Septic Tank Abandonment: Old, unused, or deteriorated septic tanks that have been determined by the Owner or Owner's Representative to be disconnected and abandoned, shall be abandoned according to the following method:

1. The tank(s) shall have the liquid and solids/sludge pumped by a septic pump truck so that the tank is left empty. The removed materials shall be disposed of properly according to state and federal requirements.

2. Remove and dispose of tank cover, risers, inspection pipes and any tank interior pumps as directed by the Owner's Representative. The interior pipes and plumbing may be left in the tank for abandonment.

3. The tank shall then be crushed in place and filled with its own crushed debris. Contractor shall ensure that the bottom of the tank is breached to prevent the holding of any liquid.

4. The crushed tank shall then be backfilled with suitable, compactable, soil material, to fill the voids left by the tank.

5. The backfilled soil shall be properly compacted to prevent subsidence and to bring the backfilled area to the same level as the surrounding grade.

TP - 16.05 TESTING AND INSPECTION

A. Pressurized System: Pressure test for leaks before backfilling and before connecting to the home sewer drain in the presence of the Owner or Owner's Representative. All connections and joints shall be visually inspected by the Owner or Owner's Representative to evaluate system pressure conditions. Contractor shall contact the operating utility prior to obtaining water from the public water system. If any leaks occur, the Contractor shall make all necessary repairs to the installed single residence effluent lift station system, at the Contractor's expense.

1. Connections to Gravity Sewer Mains:

a) Fill pump tank with clean water to a sufficient depth to allow for the effluent pump, service force line joints and all connections to be tested and visually inspected.

b) Turn effluent pump "ON" at control panel to pump water into and pressurize the service force line to the gravity sewer main.

c) Inspect saddle connection, force line joints, pump tank connection, check-valves and effluent discharge line piping system for any leaks.

d) Verify that water level is dropping in the tank with the pump running during the testing and inspection process.

2. Connections to Sewer Force Mains:

a) The effluent pump system shall begin the test in the OFF position.

b) Open the corporation stop to allow force main pressure to enter the service force line system.

c) Inspect saddle connection, force line joints, pump tank connection, check-valves and effluent discharge line piping system for any leaks.

d) Fill pump tank with clean water to a sufficient depth to allow for the effluent pump, service force line joints and all connections to be tested and visually inspected.

e) With the corporation stop open, turn effluent pump "ON" at control panel to pump water into and pressurize the service force line to the sewer force main.

f) Inspect saddle connection, force line joints, pump tank connection, check-valves and effluent discharge line piping system for any leaks.

g) Verify that water level is dropping in the tank with the pump running during the testing and inspection process.

B. Electrical System: Conduct an electrical system test in the presence of the Owner or Owner's Representative. Proper electrical operation of the system shall be visually verified by the Owner or Owner's Representative.

1. Test the floats by activating the ON, OFF and ALARM floats. Test the Alarm system.
2. Use the push-to-test alarm button. Verify that the red alarm light and horn/buzzer work.
3. Test the horn silence switch by switching from the "Normal" to the "Silence" position and thus silencing the audible alarm. Verify that the red alarm light remains energized. Verify alarm condition continues until switching back to the "Normal" position.

TP - 16.06 RECORD DRAWINGS:

Record drawings shall be furnished for individual sewage disposal systems and shall include two swing ties from permanent structures or facilities to each of the following:

A. Inspection/access ports on the septic tank and pump tank (Risers)

B. Control panel and alarm

C. Tracer wire access box

D. All cleanouts

E. All bends and elbows

F. Location of the sewer main tap (saddle and corp stop)

G. Intersections with other utilities or drainages

TP - 16.07 MEASUREMENT AND PAYMENT: All measurements and payments will be based on completed and accepted work performed in strict accordance with the plans and specifications and the respective prices and payment shall constitute full compensation for all work complete, including incidentals. No separate payment will be made for testing, excavation, trenching and backfilling or for other items of work covered under this section of the specifications and all such costs pertinent to these items shall be included in the applicable unit prices

A. Sewer Service Line: The solid gravity PVC pipe shall be measured in lineal feet along the centerline of the pipe including fittings. Payment shall be at the unit bid price as stated in the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials and incidentals required for complete installation, including excavation, bedding, backfill, compaction, pipe installation, fittings, all connections, record drawings and final cleanup.

B. Cleanout: Payment for the two-way cleanout shall be at the unit price bid as stated in the Bid Schedule.

Payment shall be full compensation for furnishing all labor, equipment, materials and incidentals required for complete installation, including excavation, backfill, compaction, pipe installation, fittings, connections, foam, reinforced concrete pad, record drawings and final cleanup.

C. Septic Tank: Payment for septic tank shall be at the unit price bid as stated on the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for complete installation; including excavation, setting, leveling, backfilling, effluent filter, record drawings, and final clean-up.

D. Pump Tank: Payment for pump tank shall be at the unit price bid as stated on the Bid Schedule. Payment shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for complete installation; including excavation, setting, leveling, backfilling, record drawings, and final clean-up.

E. Septic/Pump Tank Risers: Payment for septic/pump tank risers shall be at the unit price shown on the Bid Schedule, and based on actual feet (measure vertically) installed, including one septic/pump tank cover for each riser. Payment shall be full compensation for all materials, labor, and equipment required for a complete installation including the water tight connection to the septic tank, rope for the concrete tank lids/covers, backfilling and compaction around the risers. No separate payment for the covers shall be made.

F. Riser Safety Screen: Payment for septic/pump tank riser safety screens shall be at the unit price shown on the Bid Schedule. Payment shall be full compensation for all materials, labor, and equipment required for a complete installation.

G. Effluent Pump with Controls: Each effluent pump shall be counted and paid for at its respective unit bid price. Payment shall be full compensation for all materials, labor and incidentals required to furnish and install the pump and controls including the concrete blocks/pump stand, pull chain, float switches, HOA switch, alarm, control enclosure box, all electrical wiring and conduit, 4x4 treated post, anchoring control box, all electrical connections to circuits and controls, effluent discharge piping, check valve(s), union, ball valve and wye fitting inside the effluent pump tank/lift station.

H. Electrical Cable: Buried electrical cable shall be paid on the basis of feet installed at the unit price in the Bid Schedule. Payment shall be full compensation for all labor, equipment, excavation, and materials including electrical cable, conduit and adapters necessary to install the electrical cables.

I. Service Force Line: The continuous HDPE pipe shall be measured in lineal feet along the center line of the pipe including fittings. Payment shall be at the unit bid price. Payment shall be full compensation for furnishing all labor, equipment, materials and incidentals required for complete installation, including excavation, bedding, backfill, compaction, pipe installation, fittings, connections, pipe butt fusing, saddles, corp stop, connection to sewer main, tracer wire, tracer wire access box, warning tape, record drawings and final cleanup.

J. Septic Tank Abandonment: Payment for abandonment of the existing septic tank shall be at the contract unit price measured each and shall be full compensation for pumping and crushing the existing concrete tank, backfilling the void left by the tank, and compacting the soil to prevent subsidence and to bring it to the same level as the surrounding grade.

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SUBMITTAL REVIEW FORM, SECTION 16 – SINGLE RESIDENCE LIFT STATION

DATE INITIALS Submittal No.

Received by ENGINEER: _____ _____ Project No. _____

Received by OWNER: Contract No. _____

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
16.03B	PVC Sewer Pipe & Fittings		
16.03C	Cleanout, Fittings, Cap, Foam, Mesh, Concrete		
16.03D 16.03F	Septic/Pump Tank		
16.03M	Septic/Pump Tank Riser, Safety Screen & Cover		
16.03E	Effluent Filter		
16.03H 16.03I 16.03.J	Effluent Pump, Controls & Electrical Cable		
16.03K 16.03L	Effluent Discharge Line, Check & Ball Valve, Fittings		
16.03N 16.03O 16.03P	Service Force Line, Saddle, Fittings, Corp Stops		
16.03.S 16.03T 16.03U	Paint, Pipe Hangers & Expanding Foam		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

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TECHNICAL PROVISIONS

SECTION 28 - HIGH DENSITY POLYETHYLENE (HDPE) MAIN & FITTINGS

TP - 28.01 SCOPE:

The work covered by this section consists of furnishing all labor, equipment, materials and incidentals, in connection with the construction of high density polyethylene (HDPE) pipe and fittings for water and wastewater applications, in accordance with these drawings and specifications. HDPE pipe and fittings shall conform to all applicable standards and procedures as referenced in this specification and meet all applicable testing and material properties as described by the applicable standards referenced in this specification.

TP - 28.02 GENERAL:

HDPE pipes and fittings shall be acceptable for use with water and wastewater and shall be supplied by a single manufacturer. Any material used for potable water shall be listed and approved for potable water in accordance with NSF/ANSI 61. Approximately every 5 feet, the pipe shall be marked showing the NSF-61 seal of approval, the manufacturer's name, pipe diameter, DR rating, material type/classification, pressure class, and production date.

The pipe shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications. Pipe shall be manufactured by Performance Pipe, WL Plastics, JM Eagle, or equal as approved by the Owner or Owner's Representative.

Work covered by this section will not be accepted until the backfilling and testing connected with the work has been completed satisfactorily. Any section of HDPE that is found defective in material, alignment, or joints before acceptance shall be corrected to the satisfaction of the Owner or Owner's Representative.

TP - 28.03 MATERIALS:

A. Pipe and Fitting Material:

1. Materials used for the manufacture of polyethylene pipe, tube and fittings shall be PE 4710 high density polyethylene.
2. HDPE pipe sizes 4-inch diameter and larger shall be ductile iron pipe size (DIPS) complying with ANSI/AWWA C906.

B. HDPE Pipe Fittings:

1. Fittings shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined and shall be manufactured from PE 4710 material in accordance with this specification.
2. All fittings shall meet the requirements of AWWA C906. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used.
    a) Molded butt fusion fittings, including flange adapters and mechanical (MJ) adapters, shall comply with ASTM D3261.
        i. The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resistant bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly. After installation apply a bitumastic coating to bolts and nuts.

ii. MJ adapters shall be provided with stainless steel stiffeners.

b) Fittings shall be manufactured by Georg Fischer Central Plastics or equal as approved by the Owner or Owner's Representative

C. Warning Tape and Tracer Wire: Warning tape and tracer wire shall be installed in accordance with Section 01 of these Technical Provisions.

D. Markers and Bollards: Marker and bollards shall be installed in accordance with Section 01 of these Technical Provisions.

TP - 28.04 JOINING METHOD:

A. Heat Fusion: Joints shall be butt-fused per ASTM D2657 and the manufacturer's recommendations except as where indicated otherwise on the plans. Ensure that adjoining HDPE pipes are of the same grade and dimensions. Do not remove the butt-fused joint bead, unless approved by the Owner.

1. Fusible HDPE pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

2. Fusible HDPE pipe will be fused by qualified fusion technicians, as documented per PPI TN-42 and ASTM F3190. Certifications shall be provided for all qualified fusion technicians that will be fusing the HDPE pipe.

3. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

a) Heat Plate: Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

b) Carriage: Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

c) General Machine: Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

d) Data Logging Device: An approved data logging device with the current version of the pipe supplier's recommended and compatible software shall be used. Data logging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

e) Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible HDPE pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

f) Other equipment specifically required for the fusion process shall include the following:

i. Pipe rollers shall be used for support of pipe to either side of the machine.

ii. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations. The fusing working area under

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the canopy shall be kept clean and free from dust, water and high wind conditions.

iii. An infrared (IR) pyrometer for checking pipe and heat plate temperatures.

iv. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

v. Facing blades specifically designed for cutting fusible HDPE pipe shall be used.

B. Electrofusion: Heat fusion is the preferred method for welding HDPE pipe, but certain projects may benefit from the use of electrofusion. For this reason, it shall be considered an acceptable joining method on a site-by-site basis. The use of electrofusion must be approved by the Owner or Owner's Representative.

C. Mechanical Connections:

1. Mechanical Compression Fitting for Small Diameter Pipes:

a) All service brass shall comply with AWWA C-800. Any components in contact with potable water will also comply with the latest requirements of the Federal Safe Drinking Water Act. Brass or bonze body fitting shall be designed to prevent collapsing and pullout using a threaded compression nut, an elastomer compression ring or pack joint, a stiffener, and/or a grip ring.

b) Fittings shall not contain lead and shall be Mueller Insta-tite, Ford (Pack Joint, Quick Joint, or Grip Joint) or equal as approved by the Owner or Owner's Representative.

2. HDPE Connection to PVC and Ductile Iron Pipe:

a) Flange and Mechanical Joint (MJ) Adapter:

i. Acceptable mechanical fittings for use with HDPE pipe and fittings shall be mechanical fittings that are qualified by the mechanical fitting manufacturer for use with HDPE pipe and fittings.

ii. Adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly. After installation apply a bitumastic coating to bolts and nuts.

iii. Mechanical fittings for use with HDPE pipe shall provide restraint against longitudinal separation that is inherent to the design of the joint. Mechanical joints that do not provide restraint against pull-out or push-off are prohibited.

iv. Mechanical connections to non-HDPE devices and appurtenances shall be by bolted flange adapter or MJ adapter. Flange adapter and MJ adapter connections shall be assembled, installed and tightened in accordance with flange adapter or MJ adapter manufacturer's instructions. Flange bolt tightening shall be in accordance with PPI TN-38 and backed up by stainless steel flanges conforming to ANSI B16.1 shaped as necessary to suit the outside dimensions of the pipe.

v. HDPE to PVC and ductile iron pipe shall use MJ ductile iron sleeve equal to Tyler Union C153 sleeve or approved equal. Anchoring retaining glands shall be approved equal of EBAA Iron Megalug. Stiffeners shall be Cascade HDPE stainless steel stiffener or equal as approved by the Owner or Owner's Representative.

TP - 28.05 INSTALLATION:

A. Lengths of pipe shall be assembled by the butt-fusion process. All pipe so joined shall be made from the same class and type of raw material made by the same raw material supplier. Pipe shall be furnished in standard laying lengths not to exceed 50 feet and no shorter than 20 feet.

B. HDPE pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the drawings and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall perform all heat fusion joints.

C. HDPE shall be installed either by Open Trench Construction or Directional Bore Method as outlined in these Technical Provisions.

1. Open Trench Installation: Trenching and backfilling operations shall be performed as specified in Section 01 of these Technical Provisions.

2. Directional Bore Installation: Directional boring shall be performed as specified in Section 56 of these Technical Provisions.

D. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Owner or Owner's Representative. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.

E. Under no circumstances shall the pipe or accessories be dropped into the trench or forced through a directional bore upon "pull-back".

F. Care shall be taken during transportation of the pipe such that it will not be cut, kinked or otherwise damaged.

G. Ropes, fabric or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.

H. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

I. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 5 percent of the wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.

J. Pipe shall be laid to lines and grade shown on the drawings with bedding and backfill as shown on the details.

K. When laying pipe is not in progress, including lunchtime, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means.

L. Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.

M. The pipe shall be joined by the method of thermal butt fusion. All joints shall be made in strict compliance with the manufacturer's recommendations.

N. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks

shall be through flanged connections which shall consists of the following:

1. A polyethylene flange or MJ shall be thermally butt-fused to the stub end of the pipe.
2. A 316 stainless steel back up ring shall mate with a 316 stainless steel flange.
3. 316 stainless steel bolts and nuts shall be used.

O. Flange connections shall be provided with a full-face neoprene gasket.

P. All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

Q. If defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

TP - 28.06 PIPE CLEANING:

At the conclusion of the work, thoroughly clean all of the new pipe lines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period by forcing a cleaning swab through all mains 6-inch or greater. Flushing velocities shall be a minimum of 2.5 feet per second. All flushing shall be coordinated with the Owner or Owner's Representative. Debris cleaned from the lines shall be removed from the job site.

TP - 28.07 TESTING:

A. Hydrostatic pressure leak tests of PE pressure piping systems should be conducted in accordance with ASTM F 2164.

B. All HDPE water mains shall be disinfected after or during pressure testing in accordance with Section 04 of these Technical Provisions.

C. All HDPE mains shall be pressure tested. Contractor shall supply all labor, equipment, material, gages, pumps, meters and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.

D. All mains shall be tested at the lowest elevation in the test section at 150 percent of the system design pressure of the pipe unless otherwise approved by the Owner or Owner's Representative.

E. Maximum length of pipe allowed during each pressure test shall be approved by the Owner or Owner's Representative.

F. The pipeline test section must be restrained against movement in the event of catastrophic failure. Joints at the main connection points or other locations may be requested to be exposed by the Owner or Owner's Representative for leakage examination, provided that restraint is maintained.

G. The testing equipment capacity and the pipeline test section should be such that the test section can be pressurized and examined for leaks within test duration time limits. Lower capacity testing and pressurizing equipment may require a shorter test section.

H. Test equipment and the pipeline test section should be examined before pressure is applied to ensure that connections are tight, necessary restraints are in place and secure, and components that should be isolated or disconnected are isolated or disconnected. All low pressure filling lines and other items not subject to the test pressure should be disconnected or isolated.

I. For pressure piping systems where test pressure limiting components or devices have been isolated, or

removed, or are not present in the test section, the maximum allowable test pressure for a leak test duration of 8 hours or less is 1.5 times the system design pressure at the lowest elevation in the section under test. If lower pressure rated components cannot be removed or isolated from the test section, the maximum test pressure is the pressure rating of the lowest pressure rated component that cannot be isolated from the test section. Test pressure is temperature dependent. At ambient or water temperatures > 80 degrees F, use manufacturer's recommendation for test pressure.

J. Pressure testing procedure shall be per manufacturer's recommendations or as follows:

1. Fill line slowly with water. Maintain flow velocity less than 2 feet per second. The test section should be completely filled with the test liquid, taking care to bleed off any trapped air.
2. Expel air completely from the line during filling and again before applying test pressure. Air shall be expelled by means of taps at points of highest elevation.
3. The test procedure consists of initial expansion and test phases. For the initial expansion phase, the test section is pressurized to 10% above the test pressure and allowed to stand without makeup pressure for two to three hours, to allow for diametric expansion or pipe stretching to stabilize.
4. For the test phase, make-up test liquid is added as required to reach and maintain 10% below the test pressure for four (4) hours. This is the target test pressure. If the pressure remains steady (within 5% of the target test pressure) for an hour, leakage is not indicated.
    a) If leaks are discovered, depressurize the test section before repairing leaks. Correctly made fusion joints do not leak. Leakage at a butt fusion joint may indicate imminent catastrophic rupture. Depressurize the test section immediately if butt fusion leakage is discovered. Leaks at fusion joints require the fusion joint to be cut out and redone.
    b) If the pressure leak test is not completed due to leakage, equipment failure, etc., the test section should be de-pressurized and repairs made. Allow the test section to remain depressurized for at least eight (8) hours before retesting.
5. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the Owner or Owner's Representative at the point where the pressure is being monitored and shall show on the recorded pressure read-out submitted to the Owner.
6. All visible leaks are to be repaired regardless of the amount of leakage.

TP - 28.08 SITE CLEAN UP:

Upon completion of the work, the entire site shall be cleared of all debris, and the ground surface shall be finished to smooth and uniform slopes. Cleanup shall be considered an incidental item and no additional payment shall be made for it.

TP - 28.09 MEASUREMENT AND PAYMENT:

This section is intended to be a supplement for other technical provisions. Measurement and payment for HDPE pipe shall be included in the applicable section specifying the intended use, such as water pipe, water service line, sewer force main, or other pipe indicated as HDPE in the Bid Schedule or plans.

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SUBMITTAL REVIEW FORM,

SECTION 28 – HDPE PIPE

	DATE	INITIALS	
Received by ENGINEER:			Submittal No.
			Project No.
Received by OWNER:			Contract No.

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
28.03A 28.03B	HDPE Pipe and Fittings		
28.04	Joining Method		
28.04	Certifications		
28.04	Equipment		
28.07	Pressure Test Results		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

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TECHNICAL PROVISIONS

SECTION 43 - SEWER FORCE MAIN

TP - 43.01 SCOPE:

The work covered by this section consists of furnishing all equipment, labor, materials, and incidentals necessary for the complete installation of the sewer force mains and appurtenances, in strict accordance with applicable drawings and these specifications.

TP - 43.02 GENERAL:

The sewer force main shall be constructed in the locations to the grades and of the sizes shown on the drawings, or as directed by the Owner or Owner's Representative. Excavation, trenching and backfilling shall be in accordance with Section 01 of the Technical Provisions. Staking, utility locates and existing system abandonment shall be conducted in accordance with Section 01 of these Technical Provisions.

Pipe joints, fitting and appurtenance installation shall be in accordance with the manufacturer's recommendations. All pipes and joints shall be approved by the Owner or Owner's Representative prior to backfilling. The work will not be accepted until satisfactory backfilling, compaction, testing and cleanup is complete. Final grading should prevent surface water runoff from pooling around installed facilities. If the work does not meet the specified requirements of this Section, the Contractor shall remove and replace and re-test, as necessary, at the Contractor's expense. The Contractor shall leave each premise in a neat and orderly condition, restoring it as near as possible to its original condition and to the approval of the Owner or Owners' Representative

TP - 43.03 MATERIALS:

Materials shall be inspected to verify that they meet these specifications and match the approved submittals. Materials not meeting these requirements shall not be permitted to be installed. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes and regulations, and these specifications.

The unloading, handling, and storage of the pipe and materials shall be conducted in a safe manner. Handle pipe with padding between metal machinery and pipe. Keep dirt and foreign material away from pipe interiors and sealing surfaces. Lower pipe carefully into the trench without dropping, rolling or dumping the pipe

A. General: Inspect all materials prior to installation to ensure that they are in new condition. Ensure that pipe, fittings and materials are free from defects and damage at the time of delivery and prior to installation in the trench. Plastic pipe with scratches, gouges, or grooves deeper than 10% of the wall thickness or ultraviolet discoloration shall be rejected. Remove all materials from site that are defective, damaged, used, unsound, or that otherwise do not meet the specifications within 24-hours of discovery.

B. Pipe: Required pipe material is identified in the Bid Schedule, plans and details.

1. PVC Pipe:

a) PVC Pipe (2-inch): PVC pipe shall be SDR 21 (200 psi). Pipe shall conform to ASTM D-2241 and ASTM D-1784. Fittings shall be 2-inch SDR-21 gasketed fittings with the PVC material conforming to ASTM D-1784, joints conforming to ASTM D-3139, and gaskets conforming to ASTM F-477.

b) PVC Pipe (4 to 12-inches): PVC pipe and joints shall conform to the requirements of ANSI/AWWA C900 or C909, DR18 Class 235 (minimum), Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, DR18 Class 235 with gaskets meeting ASTM F477 and joints in compliance with ASTM D3139 or as otherwise defined on the Bid Schedule.

c) PVC Pipe (14-inch and larger): All 14-inch and larger PVC pipe shall conform to the

requirements of AWWA C905 with gaskets meeting ASTM F477 and joints in compliance with ASTM D3139.

2. Ductile Iron Pipe: All ductile iron pipe shall be manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51 for centrifugally cast ductile iron pipe. Pipe shall be manufactured in accordance with ANSI/AWWA C111/A21.11 for rubber gasket joints and ANSI/AWWA C115 for flanged joints for ductile iron pressure pipe and fittings.

   Pipe thickness shall meet the requirements of ANSI/AWWA C150/A21.50 for thickness design of ductile iron pipe. Pipe shall be cement mortar lined and seal coated meeting the requirements of ANSI/AWWA C104/A21.4 for cement mortar lining for ductile iron pipe and fittings for water. Pipe shall have push-on joints, unless otherwise indicated on the plans or in the bid schedule.

3. High Density Polyethylene Pipe (HDPE): All HDPE used in constructing the sewer force main shall conform to Section 28 of the Technical Provisions.

C. Ductile Iron Fittings: Ductile iron fittings shall meet ASTM A536, 350 psi pressure rating for 2" to 24" diameter fittings in accordance with ANSI/AWWA C153/A21.53. Fittings shall meet ANSI/AWWA C153/A21 with the maximum deflection of 8° for 2" to 4" fittings, 7° for 6" fittings, 5° for 8" to 12" pipe, 3° for 14" to 24" fittings, and 2° for 30" to 48" fittings.

Flanged ends on fittings shall meet ANSI/AWWA C115/A21.15 and ANSI B16.1 class 125 flanges. Fittings shall be cement lined in accordance with ANSI/AWWA C104/A21.4. Fittings shall be coated with an asphaltic seal coat inside and out in accordance with ANSI/AWWA C104/A21.4 and referenced in ANSI/AWWA C153/A21.53. Gaskets shall be styrene butadiene rubber (SBR) meeting ANSI/AWWA C111/A21.11. Fittings shall have t-bolts and nuts manufactured of low alloy steel meeting ANSI/AWWA C111/A21.11.

D. Mechanical Joint Restraint:

1. General: Mechanical joint restraints shall be manufactured of DI in accordance with ASTM A536 with the following additional requirements or exceptions. Mechanical joint restraints shall be incorporated into the design of a follower gland. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts in accordance with AWWA C111 and C153.

2. Design: The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges that are designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized the same as tee-head bolts, shall be used to ensure the proper actuating of restraining devices. When the nut is sheared off, a standard hex nut shall remain.

3. Pressure Rating: The mechanical joint restraint device shall be as listed below:

Type of Pipe	Sizes (Inches)	PSI	Safety Factor
DI	3 to 16	350	2
	20 to 36	250	2
PVC	Various	Equal to that of the pipe being used	2

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4. Acceptable Models and Manufacturers:

Mechanical Joint Restraint – PVC Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
EBAA Iron, Inc.	Megalug 2000 PV Series	4 to 20
Sigma Corporation	One-Lok SLCE Series	4 to 20
Star Pipe Products	StarGrip 4000 Series	4 to 20

Mechanical Joint Restraint – DI Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
EBAA Iron, Inc.	Megalug 1100 Series	3 to 24
Romac Industries	RomaGrip	3 to 24
Sigma Corporation	One-Lok SLDE Series	3 to 12
Star Pipe Products	StarGrip 3000 Series	3 to 24
Uni-Flange (Ford)	UFR 1400 Series	3 to 24

Bell-Spigot Restraint – PVC Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
EBAA Iron, Inc.	Series 1500 TD	4 to 12
	Series 1500	4 to 12
Ford Meter Box	Ford 1390	4 to 12
Star	Series 1100	4 to 12

Bell-Spigot Restraint – DI Pipe		
Manufacturers	**Models**	**Sizes (Inches)**
American	Fastgrip Gasket	4 to 16
EBAA Iron, Inc.	Megalug 1700 Series	3 to 20
	Series 1500 TD	4 to 12
Star Pipe Products	StarGrip 3100P Series	3 to 20
U.S. Pipe	Field Lok Gasket	4 to 16

Bolt-Through Mechanical Joint Restraint
Foster Adaptor

E. Gate Valves: Gates valves shall conform to the latest revision requirements of AWWA C-509 or C-515 for resilient-seated gate valves. Gate valves shall be of cast iron or ductile iron body construction, bronze mounted, solid wedge, resilient seal, with 2-inch square operating nut, 200 psi operating pressure or

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higher, counterclockwise opening, inside screw, non-rising stems with O-ring seals. Gate valves shall maintain full nominal pipe diameter through the valve and have mechanical joint or flange fitting ends.

All valves shall be furnished with valve stems made from 300 or 400 series stainless steel. When a valve is required near a fitting, such as a tee, the valve shall be secured to the fitting. The Contractor shall provide to the Owner, at no additional cost, one gate valve wrench 6 foot long with "T" handle.

The name, monogram or initials of the manufacturer shall be legibly cast on the valve body. The make of valves furnished shall be easily identifiable by catalog numbers. All valves shall be equal to the Mueller A-2360 or American Flow Control Series 2500.

1. Lining: All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 6 mils. Epoxy linings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550.
2. Coating: All exterior ferrous surfaces, except finished or bearing surfaces, shall be factory coated with two coats of asphaltic varnish conforming to Federal Specifications TT-V-51c, or shall be epoxy coated as required above for interior surfaces.

F. Gate Valve Boxes: All gate valves shall be provided with a $5^{1}/_{4}$-inch inner-diameter shaft, 2-piece sliding extension type cast iron valve box, Tyler Union 6855 Domestic Heavy Duty, or equal. All boxes shall extend from the body of the valve to the finished grade. The vertical column of the box shall be designed so that the top section may be adjusted while in position. The cast iron lid shall be 5-1/4" Domestic Heavy Duty Drop Lid with the word "SEWER" cast into it.

1. Extension stems: When the valve operating nut is more than four feet below the top of the valve box, stainless steel extension stems equal to TROY VALVE Stainless Steel Valve Extension Stems shall be provided. The top of the extension shall be 3 1/2 to 4 feet below the top of the valve box.
2. Debris Cap: Each valve box shall have a debris cap designed to prevent debris such as dirt and sand from passing around the cap and down into the valve housing and installed just below the valve cover. The cap shall be held in place by a mechanism which will not damage the valve housing. The cap must withstand, without slippage, a minimum vertical force of 50 pounds at a loading rate of 1 inch/minute. The debris cap and bottom of valve cover shall be separated by a minimum of 1 inch and not to exceed 2 inches. The cap shall be manufactured with corrosive-resistant material and fit the valve box's 5¼" diameter shaft. Caps shall be debris cap model number DC455 manufactured by SW Services, LLC or equal.

G. Sewer Force Main Cleanout: Sewer force main cleanouts shall be installed at the locations shown in the plans.

1. Piping and Fittings:
   a) Double main line (two-way) cleanout piping and fittings shall be 4-inch diameter as shown in the details. Cleanout construction material shall be as shown in the details. The cleanout piping and cap shall be threaded.
   b) Galvanized iron pipe, coupling and access cover shall conform to the requirements of ASTM A53 standard weight, schedule 40.
2. Concrete Pad and Concrete Collar:
   a) The double main line cleanout shall be supported by a concrete pad as shown in the detail drawing.
   b) The double main line cleanout shall be installed in a 60-inch x 24-inch x 4-inch reinforced concrete collar as shown in the detail drawing. The wire mesh used for the concrete collar shall be ASTM approved W 1.4 (1/8 inch) wire mesh.

c) A marker post and tracer wire access box shall be installed in the concrete collar as shown in the detail drawings.

d) All concrete for force main cleanouts shall have a 28 day compressive strength of 3,000 psi and be in accordance with Section 02 of these Technical Provisions.

e) Reinforcing steel shall conform to Section 03 of these Technical Provisions.

H. Wastewater Combination Air and Vacuum Valve and Vault: The combination air and vacuum valve shall be installed at the locations shown on the plans. The valve shall have a 2-inch N.P.T. inlet and outlet vent with a cast iron body and cover with stainless steel float. The valve shall be equal to CLA-VAL Series 36-WW22BW or Val-Matic 802ABW. Ball valves shall be brass, 1/2-inch, 1-inch, or 2-inch Watts or equal.

1. General:

a) The operating pressure of the valve shall be 0-150 psi with a venting capacity of 90 CFM.

b) The body and all operating parts shall be made of high strength corrosion-resistant materials.

c) The valve shall have the ability to automatically release small pockets of air during normal operation.

d) The valve shall have the ability to automatically discharge or admit large volumes of air during filling and draining.

e) Utility marker shall conform to Section 01 of the Technical Provisions.

f) Concrete shall conform to Section 02 of the Technical Provisions and reinforcing steel shall conform to Section 03 of the Technical Provisions.

2. ARV Vault:

a) Inside diameter of the vault shall be 48-inches.

b) Vault shall be composed of precast reinforced manhole barrel sections and shall have a 28-day compressive strength of at least 3,000 psi. Riser grade rings with tar sealer may be used.

c) Minimum height of sections shall be 24-inches. If two or more manhole sections are used to construct the vault, the joints between precast manhole sections shall be sealed with “Ram Nek” bituminous rope type sealer, or equal.

d) The sections shall be grouted to a smooth finish on the interior and exterior of the manhole.

e) All connections between pipe and manhole walls shall be sealed with non-shrinking grout.

f) Grout for jointing and connections shall be as specified in Section 02 of the Technical Provisions.

g) The depth of the vault from interior floor to the underside of the access hatch shall be a minimum of 42-inches but shall not exceed 48 inches.

3. Vault Concrete Collar and Vault Lid:

a) Concrete collar shall be reinforced with #4 steel hoops centered horizontally and vertically.

b) Vault lid (access hatch cover) shall be a Halliday Series R1R Model R1R48 or approved equal.

c) Opening of the lid shall be over the larger area of the vault as shown on the detail.

d) The frame edge for the vault shall be coated with bituminous coating where in contact with the concrete vault for proper sealing.

e) Four (4) stainless steel lag-bolts with a minimum bolt diameter of 3/8-inch shall be used to mount the frame to the inside wall of the vault. An appropriate concrete anchoring system such as expanding lead lag-shields shall be used. The bolts shall be installed in an equally spaced, four quadrant pattern as shown on the plans or directed by the Owner's Representative.

f) The underside of the lid shall be insulated in cold climates, as shown on the design plans or directed by the Owner or Owner's Representative. The insulation can be field installed or can be factory installed by the manufacturer. Field installed insulation shall be completed using 2-inch polystyrene insulation board with appropriate compatible adhesive or an approved securing mechanism, as directed by the Owner's Representative. Polystyrene insulation board shall be installed in accordance with TP 01.

I. Transition Manholes

1. Transition manhole type(s) and location(s) are shown on the drawings and shall transition the pressurized sewer flow from the sewer force main to gravity flow in a sewer gravity main.

2. Manhole materials including base, barrel, cone, frame, cover, steps, adjustment rings, coating, joints, and waterstops shall meet the requirements of Section 06 of these Technical Provisions.

3. Transition manholes shall be tested in accordance with TP 06.

J. Warning Tape and Tracer Wire: Warning Tape and Tracer Wire (including tracer wire access boxes and tracer wire splice kits) shall be in accordance with Section 01 of the Technical Provisions. Warning tape shall be GREEN in color with "CAUTION - BURIED SEWER LINE BELOW" continuously printed on it.

K. Markers and Bollards: Marker and bollards shall be installed in accordance with Section 01 of these Technical Provisions.

TP - 43.04 INSTALLATION OF PRESSURE SEWER LINES:

A. General: Trenching and backfilling operations shall be performed as specified in Section 01 of the Technical Provisions. Pipe and fittings shall be installed in accordance with the manufacturer's printed specifications and instructions, to the standards of AWWA for installing the type of pipe used, and in accordance with Sections TP-01 and TP-04. Each section of pipe shall rest upon undisturbed earth, or compacted bedding materials, with recesses excavated to accommodate joints.

B. PVC Pipe Laying: Unless otherwise indicated, there shall be a minimum of 3 feet of cover over the pipe. Pipe, fittings, and valves shall be carefully handled to avoid damage. As the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous materials of every description. Trenches shall be kept free from water and the pipe shall not be laid when conditions of the trench or the weather are unsuitable for such work. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed with a water tight plug so that no trench water, rodents, earth, or other substances will enter the pipe.

Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflecting the joints. The amount of deflection at each pipe joint shall not exceed the manufacturer's printed recommended deflections. When rubber gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wider on curves for this purpose. Any pipe that has its grade or joint disturbed after laying shall be taken up and re-installed. The interior of all pipe shall be thoroughly cleansed of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by use of plugs or other approved devices.

1. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe without additional expense to the Owner. The Contractor shall make every effort to backfill all excavation by the end of each workday.

2. When trench bottom is soft and, in the opinion of the Owner or Owner's Representative, cannot support the pipe, a further depth and/or width shall be excavated and refilled to grade with stabilization and bedding material as specified in Section 01 of these specifications.

3. All pipe shall be laid to the depth shown on the plans, or at such depths as may be established by the Owner or Owner's Representative in order to connect the new pipe to the existing sewer mains. Unless otherwise specified, the pipe shall be laid to a depth that will provide for a cover of at least 3 feet over the top of the pipe.

4. Joints with pipes of differing materials shall be made with appropriate adapters approved by the Owner or Owner's Representative, but in no case will threading of the PVC pipe wall be allowed.

5. Where required, PVC pipe shall be cut square using a powered cutoff saw, carpenter's fine tooth handsaw, or hacksaw. Once cut, the pipe shall be machine or hand beveled to give a one-half inch tapered end.

C. HDPE Pipe Installation: All HDPE used in constructing the sewer force main shall conform to Section 28 of these Technical Provisions.

D. Mechanical joint restraints shall be installed at all bends and tees. Pipe joints adjacent to restrained bends and fittings shall be restrained in accordance with manufacturer's recommendations based on soil conditions. Mechanical joint restraints shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.

1. When thrust blocking is approved by the Owner or Owner's Representative, concrete blocking shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to block weep holes or obstruct access to the joints of the pipe or fittings.

2. Polyethylene wrap shall be placed on fitting bolts to prevent hardening of concrete on connections. The concrete shall not cover nuts and bolts of joints or fittings. The concrete shall have minimum 28 day compression strength of 3,000 psi. Under no circumstances shall concrete thrust blocks be allowed on vertical bends in lieu of mechanical restrained joints.

E. Warning tape, tracer wire and tracer wire access boxes shall be installed according to Section 01 of the Technical Provisions.

TP - 43.05 WATER AND SEWER LINE SEPARATION REQUIREMENTS:

Water and sewer main separation shall be per Technical Provision 01.

TP - 43.06 CONNECTIONS TO TRANSITION MANHOLE:

A. General:

1. Connections to a new transition manhole shall be made as shown on the plans and in accordance with the detail drawing and TP 06, or as directed by the Owner or Owner's Representative.

2. Connection to an existing manhole, to be used as a transition manhole, shall be made in accordance with TP 06 along with any modifications shown in the detail drawing for the transition manhole.

B. Transition Manhole Base:

1. The base of the manhole shall slope up from the sewer force main connection to the gravity sewer main connection, as shown in the detail drawing.

2. Elevation of the gravity sewer invert shall be a minimum of 1-foot above the elevation of the force main crown.

3. Provide a smooth upward sloping channel on the manhole base from the force main to the gravity sewer.

C. Pipe to Manhole Connection:

1. Install sewer force main and sewer gravity main pipe to manhole using approved gasket per manufacturer's recommendations.
2. All connections between sewer pipe and manhole walls shall be made using approved water stops and be sealed with non-shrinking grout in such a manner to make the manholes water tight.
3. Manholes shall not be acceptable if any evidence of infiltration into them is found. The Contractor shall take whatever actions are necessary, at his expense, to ensure that the manholes are completely watertight.

TP - 43.07 CONNECTIONS TO EXISTING FORCE MAINS:

Connections to existing sewer force mains, including joints and mechanical joint restraints, shall be made in accordance with these specifications and with the manufacturer's recommendations, based on the type of existing pipe material being connected to. The joint shall be tested for water tightness in accordance with this specification. Connections to existing sewer gravity mains shall not be allowed.

TP - 43.08 SETTING GATE VALVES AND BOXES:

A. General:

1. Install valves at locations indicated on the plans.
2. All valves, including gate valves, air release valves, and blowoff assemblies, shall be set, jointed and restrained to the pipe in the manner as set forth in the AWWA Standards for the type of connecting ends furnished.
3. Valve installation shall be as shown on the standard detail.
4. Before installing the valve assembly, care shall be taken to see that all foreign material and objects are removed from the interior of the valve.

B. Setting Valves and Valve Boxes:

1. Valves and valve boxes shall be set plumb and valve boxes shall be placed over the valve or valve operator in such a manner that the valve box does not transmit shock or stress to the valve.
2. Support gate valves on a 4-inch concrete block set on compacted base during assembly and fully restrain the valve to the water main piping.
3. Center the valve box over the valve nut.
4. Backfill shall be placed and compacted around the valve box. The valve box shall be maintained plumb and centered over the valve nut during backfilling and compaction.
5. The valve shall be opened and closed to verify that all moving parts are in working order.
6. The cast iron valve box cover shall be set flush with elevated concrete collar or flush with the road surface.
7. Install a debris cap in the valve box meeting the requirements of TP 04.03.F.3 and as shown in the detail drawing.

C. Concrete Collar:

1. After installing the gate valve box, the Contractor shall properly compact the area around the gate valve box prior to installing the concrete collar to ensure that there is no settlement.
2. A 32-inch diameter OR a 24-inch square by 4-inch thick reinforced concrete pad shall be poured around each valve box as shown on the plan and detail drawings or instructed by the Owner or Owner's Representative.
3. A tracer wire access box shall be set in the concrete collar and next to the valve box with the tracer wire routed and connected as shown in the detail drawing.
4. Before the concrete has set, the Contractor shall neatly scribe in the concrete pad the size of the valve, material of pipe and orientation of the pipe with two arrows.

D. Valve Markers:

1. For valves outside of the right of way, the Contractor shall install two offset permanent Metal Marker Posts for all sewer force main valves installed under this contract.
2. The marker posts shall be equidistant (4 feet typical) at a 45 degree angle from the valve to the sewer force main.
3. Set marker post with 36-inches of post above grade with label facing roadway and valve between roadway and post.
4. Stencil the size of the valve and the distance to the valve legibly on the aluminum cap. Dimensions and thickness shall meet requirements shown in applicable detail. Metal marker post shall meet the requirements of and be installed in accordance with Section 01 of these Technical Provisions.
5. For valves within the right of way, the Contractor shall install a Utility Line Marker to locate the valve. Utility line markers shall meet the requirements of and be installed in accordance with Section 01 of these Technical Provisions.

TP - 43.09 SEWER FORCE MAIN CLEANOUT INSTALLATION

A. Cleanout:

1. The cleanout shall be constructed at the locations shown on the plans and shall be constructed according to the detail drawing.
2. Fittings shall not be greater than 45 degrees (1/8 bend).
3. Cleanout shall allow for rodding/snaking the force main line in both directions.
4. Non-setting pipe thread sealant shall be used on the plug threads, such as Teflon T Plus 2 or equal.

B. Concrete Support Pad:

1. A concrete pad shall be poured to support the base of the ductile iron wyes of the cleanout, as shown in the detail drawing.
2. The concrete pad shall meet the dimensions of the pipe diameter (wide) x 18-inches (long) x 6-inches (thick).
3. Concrete shall not be in contact with the ductile iron flanges.

C. Concrete Collar:

1. The cleanout shall be extended so that the top face of the threaded plug is at the finished grade of the concrete collar.
2. The concrete collar shall be constructed around the cleanout at the ground surface per the detail after site grading is complete to match finished grade.

3. The concrete collar shall be reinforced with welded wire mesh with a minimum of ½-inch of concrete over the mesh.

TP - 43.10 WASTEWATER COMBINATION AIR/VACUUM VALVE AND MANHOLE INSTALLATION:

The wastewater air release valve shall be installed in accordance with the manufacturer's printed specifications and instructions. The air valve vault shall be installed in accordance with the applicable sections of TP-01

A. General:

1. The air release valve and vault shall meet the requirements of TP 43.03.G.
2. The air release valve shall be installed inside a manhole as indicated in the detail drawing and at the location shown on the plans.
3. Before installing the valve assembly, care shall be taken to see that all foreign material and objects are removed from the interior of the valve.
4. Utility marker shall be installed as shown on the detail drawing and in accordance with TP-01.

B. Setting Vault:

1. Manhole shall be installed at the location and elevation shown on the site plans or as directed by the Owner or his/her representative in the field.
2. Vault shall be set plumb and level on solid concrete masonry blocks and gravel base as shown on the detail drawings. The diameter of the gravel base shall be 6-feet minimum. Gravel shall be placed below the vault and in the vault to the depth shown in the detail drawings.
3. Manhole sections, and adjustment rings if required, shall be grouted in place when the manhole is constructed. The grout shall be spread evenly over the entire mating surface. The maximum number of adjustments rings shall be indicated on the plans. The jointing and sealing materials shall be approved by the Owner or Owner's Representative prior to installation.
4. Backfill shall be placed and compacted around the vault. The vault shall be maintained plumb during backfilling and compaction.
5. Penetrations in the vault walls shall be made as shown in the detail drawings. All vault penetrations shall be sealed with approved grout material.

C. Concrete Collar:

1. After installing the concrete vault, the Contractor shall compact the area around the vault prior to installing the concrete collar to ensure that there is no settlement.
2. A 12-inch wide by 6–inch thick (minimum) reinforced circular concrete pad shall be poured around the vault as shown on the plan and detail drawings or as instructed by the Owner or Owner's Representative.
3. The concrete collar shall have a minimum slope of 1/12 away from the vault.
4. The vault lid shall be securely bolted to the inside wall of the vault per the manufacturer's recommendations. The lid shall be oriented, bolted and sealed in accordance with TP 43.03.G.3. The lid shall be set 4-inches above finished grade with the concrete collar sloping as shown on the detail drawing. A pad lock shall be provided with the lid and keyed as requested by the operating utility.

D. Setting Valve and Piping:

1. The sewer force main shall tapped at the location shown on the plans or as indicated by the Owner or Owner's Representative.

2. The inlet line shall be connected to the sewer force main using a water tight connection as shown on the plans. The Contractor shall use the approved connecting fittings including tees, reducers, service saddles, corp stops and piping. Mechanical restraints shall be used as necessary to secure the connection.
3. Where the air release valve and vault are offset horizontally from the water main, the horizontal sections of piping shall have a minimum of 1% slope upwards to allow for the upward movement of air from the water main.
4. The size of the air release valve and fittings, as well as the inlet and outlet piping for the valve shall be as sized by the Owner's Representative and as indicated on the plans.
5. The location and configuration of the air release valve and fittings, as well as the inlet and outlet piping for the valve shall be as indicated on the detail drawings. The valve and riser piping assembly shall be located 12-inches to 18-inches from the vault wall.
6. The air relief line shall be a screened return bend. Screen shall be #12 mesh copper, bronze or brass. This air relief line shall be affixed to the inside vault wall with a 2-inch stainless steel strap.
7. A 4-inch diameter GI air vent shall be installed with #4 mesh stainless steel screen.

   The valve shall be fitted with blow off valves, quick disconnect couplings and minimum 5 feet of hose, to permit backflushing after installation without dismantling valve.

TP - 43.11 POLYETHYLENE WRAPPING:

Where called for in the plans and specifications or as directed by the Owner or Owner's Representative, pipe (ductile iron), valves, and fittings shall be encased in a polyethylene protective wrapping referred to hereafter as polywrap.

A. Materials: The polywrap shall be of virgin polyethylene, not less than 8 mils in thickness, formed into tubes or sheets as may be required. Naturally pigmented material may be used where exposure to ultra violet light will be less than 48 hours. Otherwise the material shall be pigmented with 2 to 2 1/2 percent of well dispersed carbon black with stabilizers. The polywrap shall be secured as specified below with 2 inches wide pressure sensitive plastic tape not less than 10 mils thick. Tape shall be Scotchrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex, or approved equal. The minimum tube sizes for each pipe diameters are indicated in the table below:

Polywrap Flat Tube Widths		
Nominal Pipe Diameter (inches)	Tube Widths with push-on joints (inches)	Tube Widths with mechanical joints (inches)
4	14	16
6	17	20
8	21	24
10	25	27
12	29	30

B. Installation: The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. With the pipe suspended from the center, the tube shall be slipped over the spigot end and bunched up between the point of support and the spigot end. After the pipe is installed into the bell of the adjacent pipe, the pipe shall be lowered to the trench bottom and the supporting sling removed from the center of the pipe. The pipe shall then be raised at the bell end enough to allow the tube to be slipped

along the full length of the barrel with enough left at each end to overlap the adjoining pipe about 1 foot. A shallow bell hole must be made at each joint to facilitate installation of the polywrap.

Pull the bunched-up polywrap from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. Then slip the end of the polywrap from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe, and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe. Repair any rips, punctures or other damage to the tube with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

TP - 43.12 PIPE CLEANING:

At the conclusion of the work, thoroughly clean all of the new pipe lines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period by forcing a cleaning swab through all mains 6-inch or greater. Flushing velocities shall be a minimum of 2.5 feet per second. All flushing shall be coordinated with the Owner or Owner's Representative. Debris cleaned from the lines shall be removed from the job site.

TP - 43.13 PVC PIPE PRESSURE TESTING:

This section only refers to PVC pipe pressure testing. HDPE pipe shall be pressure tested according to Technical Provision Section 28.

A. All pipe shall be tested for leaks. Use Pressure Test Form at the end of this section. Where any section of a force main is provided with concrete thrust blocking for fittings, the pressure tests shall not be made until at least 48 hours after installation of the concrete thrust blocking unless otherwise approved by the Owner or Owner's Representative.

B. Contractor shall provide all necessary equipment, including but not limited to, an appropriate pump, water container, water meter, pressure gauge, valve, and corporation stop connection, and shall perform all work required in connection with the tests. Contractor shall coordinate with Owner or Owner's Representative so they may witness the entire duration of each pressure test. Prior to requesting the Owner or Owner's Representative to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have previously successfully performed the test to verify that the test section will pass. The Contractor shall notify the Owner or Owner's Representative a minimum of two working days in advance of the date that the Contractor plans to perform the pressure tests.

C. The test equipment shall be provided by the Contractor and is subject to inspection by the Owner or Owner's Representative. Arrangements for water used in pipeline testing and payment for the water shall be coordinated with the operating utility. Pressure gauges used in testing shall be graduated at a maximum in 5 psi increments. Two gauges will be used simultaneously for verification of the gauges' functionality. Prior to the test, the pipeline will be pressured to 10 psi above the test pressure, and then the pressure will be decreased to the test pressure so that gauge responsiveness can be observed. Each section tested shall be slowly filled with water, with care being taken to expel all air from the mains and service lines, if installed. If necessary, the pipes shall be tapped at high points to vent the air. All pipelines shall be tested for water tightness up to the individual building service meter.

D. The test pressure shall be 150 psi (measured at the lowest point of elevation in the test section). No section shall be tested that is greater than 2,500 feet in length or that has greater than 25 psi pressure change due to elevation. In no case shall the test pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints. The test shall be conducted in such a manner that existing lines and service user's plumbing is not damaged. Damage caused by testing shall be corrected at the expense of

the Contractor. All connections shall be tested with the main as far as is practicable. Air testing shall not be allowed.

1. The test section shall be slowly filled with water and all air shall be vented from the line. The test shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption. The test shall have a minimum duration of two hours with the two hour period beginning when the test pressure is attained and the pump ceases operation.
2. Any time the test pressure drops 5 psi, the pressure shall be restored to full test pressure and the quantity of water used shall be recorded. The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter with a sweep unit hand registering 1 gallon per revolution. At the conclusion of the test period, the Contractor shall pump the test section to full test pressure and record the total water used during the test.
3. The Contractor shall keep a record of all pressure tests. Minimum information recorded at the time of the test shall include the contract number, Contractor name, date, time, stationing or other description of the test section, length and diameter of the test section, total allowable leakage, leakage detected, pass or fail indication and printed name of recorder. Copies of field pressure tests records shall be submitted to the Owner to show compliance with these requirements before payment is requested.
4. Allowable maximum leakage is 0.04 gallons per inch diameter per 24 hours per coupling. Visible leakage will not be allowed. All leaks shall be repaired and additional tests conducted until leakages are less than the allowable maximum. All repairs shall be made in a manner approved by the Owner and shall be at the expense of the Contractor.

TP - 43.14 MEASUREMENT AND PAYMENT:

A. Force Main: Sewer pipe shall be measured in linear feet along the centerline of the pipe, including fittings, for each of the various sizes of sewer pipe installed. Payment for sewer pipe shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, bedding, stabilization material, pipe installation, fittings, thrust block/mechanical joint restraints, warning tape, tracer wire and box, hydrostatic testing, trench backfilling, compaction, final grading, as-built drawings, and final cleanup.

B. Gate Valves: Gate valves shall be measured each for the various sizes of gate valves installed. Payment for gate valves shall be at the contract unit price shown on the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, related valves boxes, materials, and incidentals required for a complete installation, including excavation, gate valves, gate valve boxes, mechanical joint restraints, concrete blocks, reinforced concrete collar, tracer wire and box, marker posts, backfilling, compaction, record drawings, and final cleanup.

C. Sewer Force Main Cleanout: Sewer force main cleanout shall be measured each. Payment shall be at the contract unit price shown in the Bid Schedule, which shall be full compensation for furnishing all labor, equipment, material and incidentals required for a complete installation, including but not limited to excavation, concrete pad, fittings, concrete collar, tracer wire access box, marker post, backfilling, record drawings and final cleanup.

D. Wastewater Combination Air Release and Vacuum Valve and Vault: Each air release valve and vault shall be measured as one unit price item. Payment for the combination air release and vacuum valve, cover and vault shall be at the contract unit price shown on the Bid Schedule. This shall be full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including excavation, connection to sewer force main, connection fittings, piping, combination air and vacuum valve, ball valve, pipe support, screened gooseneck, seepage gravel, concrete

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vault, reinforced concrete collar, frame and cover, utility marker, compaction, backfilling, record drawings, and final cleanup.

E. Connection to Transition Manhole: Connection of sewer force main to transition manhole shall be paid at the lump sum unit price indicated on the Bid Schedule for each type of connection described. Payment shall be at the contract unit price shown in the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, material, and incidentals required for a complete installation, including but not limited to excavation, cutting into the existing manhole, water stop gasket, grouting, fittings, removing the existing invert, pouring and forming a new invert, backfilling, record drawings, and final cleanup.

F. Connection to Existing Force Mains: Connection of new sewer force main to existing force mains shall be paid at the lump sum unit price indicated on the Bid Schedule for each type of connection described. Such payment shall be full compensation for all labor, equipment and materials necessary to complete the connection including service interruption, cutting of existing force main, provision and installation of fittings, mechanical joint restraints, and resumption of service.

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PVC PRESSURE TEST FORM: METHOD AND RECORD

(PVC Pressure Pipes)

Project: _____ Owner: _____

Location: _____ Date: _____

Project #: _____

Contractor: _____

Inspector: _____

Tester: _____

Test Section Area: _____

Test Section Location: From Station: _____ To Station: _____

(I) CALCULATE ALLOWABLE LEAKAGE (for 2 hour test at 150 psi for PVC):

$$L = \frac{N \times D}{300}$$

L = Allowable leakage: _____ gallons

D = Diameter of pipe: _____ inches

N = Number of joints in test section: _____

(II) CONDUCT AIR VOLUME TEST:

1. Pressurize line to 150 psi
2. Remove volume of water equal to amount of allowable leakage
3. Recheck pressure to assure a significant change (10 psi min.) from 150 psi.

(III) CONDUCT PRESSURE TEST:

1. Re-pressurize line to 150 psi
2. Add water as necessary to maintain pressure between 140 and 150 psi for test period (2 hours)
3. Upon completion of test period add water to increase the pressure back to 150 psi
4. Measure total volume of water added in steps 2 & 3. ***If the volume of water added exceeds allowable leakage, the test failed.***

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Time	Air Volume Test			Pressure Test			Pass Y/N	Owner Witness Signature
	Initial Pressure (psi)	H_2O removed (gal)	Final Pressure (psi)	Initial Pressure (psi)	Final Pressure (psi)	Total H_2O Added (gal)		
	step 2.1	step 2.2	step 2.3	step 3.3	step 3.3	steps 3.2–3.4		

REMARKS:

"I CERTIFY THE ABOVE REFERENCED SECTION OF SEWER MAIN HAS BEEN PRESSURE TESTED AND PASSED IN ACCORDANCE WITH THE PROVISIONS OF THIS SPECIFICATION."

_____

Contractor's Representative Date

_____

Owner's Representative or Inspector Date

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SUBMITTAL REVIEW FORM, SECTION 43 – SEWER FORCEMAIN

	Date	Initials		
Received by ENGINEER:			Submittal No.	
Received by OWNER:			Project No.	
			Contract No.	

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
43.03B1	PVC Pipe		
43.03B2	DI Pipe		
43.03C	DI Fittings (Bends, Tees)		
43.03D	Pipe Restraint		
43.03E	Gate Valve		
43.03F	Gate Valve Box, Lid		
43.03.F1 & 43.03.F2	Extension Stem & Debris Cap		
43.03.G	Cleanout Piping, Fittings, & Wire Mesh,		
43.03H	Combination Air Release Valve Assembly		
43.03H2 & 43.03.H3	ARV Vault, Cover, Fittings, Valves & Piping		
43.11	Polywrap		
43.13	Pressure Testing Method & Equipment		
43.13	Pressure Test Results		

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43.06	Connection Method to Transition Manhole		
43.07	Connection Method to Existing Force Main		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

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TECHNICAL PROVISIONS

SECTION 56 - HORIZONTAL DIRECTIONAL DRILLING

TP - 56.01 GENERAL:

The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. This work shall include all labor, materials, equipment, and incidentals as required for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration. Contractor shall secure all necessary permits to complete the requirements of this Technical Provision. Contractor shall repair buildings, utilities and other improvements damaged by directional drilling at Contractor's own expense.

The work to be completed under these Technical Provisions includes the furnishing of all labor, materials, transportation, tools, supplies and appurtenances necessary to complete the crossings in accordance with the indicated requirements.

Qualifications: Contractor must have successfully completed work comparable in nature and scope to the required work of this project. The Contractor must furnish a minimum of three (3) project documents supporting the directional drilling Contractor's qualifications and experience of projects of a similar nominal diameter and length to the proposed project. Contractor shall submit the following information for each referenced project:

A. Name and general description of project.

B. List of key personnel.

C. Location of project.

D. Contract start and completion date.

E. Length and diameter of completed bore(s).

F. Description of pipe material.

G. Ground conditions.

H. Type of drilling equipment and installation equipment used.

TP - 56.02 SCOPE:

The Contractor shall install all pipe in accordance with the applicable drawings and these technical provisions. The Contractor shall install the pipe utilizing the HDD method described in this section.

TP - 56.03 MATERIALS & JOINTING METHOD:

A. Product Pipe: Select the casing and/or product pipe material according to the type of product indicated on the plans. The casing and/or carrier pipe must comply with all applicable technical provisions and ASTM standards depending on the purpose and material of the casing and product pipe. The Contractor shall inspect all pipe and appurtenances for defects and reject defective, damaged or unsound materials. Join the pipe sections so that the jointed pipe sections are installable using HDD. Ensure that the jointed casing and product pipes have adequate strength and flexibility to withstand the installation stresses, overburden pressures, and operating pressures without compromising the structural stability of the pipe wall. Ensure that the casing and product pipe meets the bend radius required for the proposed installation. Join the pipe sections so that the inner surfaces are flush and even.

   The following material standards are the minimum in place standards:

MATERIAL STANDARDS FOR HDD INSTALLATION		
Material Type:	**Non-Pressure:**	**Pressure:**
Polyethylene (PE) (NIC)	ASTM D 2447	ASTM 2513 ASTM D 2447
High Density Polyethylene (HDPE) (NIC)	ASTM D 2447 ASTM D 3350 ASTM F714	ASTM D 2447 ASTM F714
Polyvinyl-Chloride (PVC) (NIC)	ASTM F 789	ASTM D1785 ASTM D2241 AWWA C900/C905
Fusible HDPE		ASTM D3350, NSF-61 AWWA C906
Steel	ASTM A139 Grade B (1)	AWWA C200 API 2B(2)

(1) No hydrostatic test required

(2) Dimensional tolerances only

(3) (NIC) Not in contract

B. Fusion Technician Requirements: Fusion Technician shall be fully qualified as per the requirements in TP-28 by the pipe supplier to install fusible HDPE pipe type(s) and size(s) being specified.

C. Pipe Rollers: Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during handling and pullback operations. A sufficient quantity of rollers and spacing shall be used to assure adequate support and resist excessive sagging of the product pipe per approved manufacturer's recommendations.

D. Jointing Method: HDPE pipe joining process shall be per TP-28 requirements.

E. Joint Recording: Each joint shall be recorded as per TP-28 requirements.

F. Tracer Wire: Tracer wire shall be 10 AWG copper clad steel wire with a minimum 1400-lb break load and 45 mil high molecular weight polyethylene jacket equal to Copperhead SoloShot Extra High Strength Tracer Wire or Agave Wire BoreTough Extra High Strength CCS 1400 UL. The tracer wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all trace wire access points. Jacket color for shall be BLUE for water pipe and GREEN for sewer pipe. Wire can only be spliced with an approved connector equal to Copperhead ACE Connector.

Tracer wire access points shall be Copperhead Roadway SnakePit as manufactured by Copperhead Industries, LLC or approved equal. Materials used to construct lid and tube shall be non-corrosive or corrosion resistant. Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements. Lid material shall be of cast iron or ductile iron and color-coded according to American Public Works Association (APWA) standards. Access point lid color shall be BLUE for water pipe and GREEN for sewer pipe.

TP - 56.04 STEEL AND FUSIBLE POLYETHYLENE PIPE INSERTION AND INSTALLATION:

A. Excavation and Access Pits:

1. Access pit length shall be such that the minimum bending radius for the steel and fusible HDPE pipe, per the pipe supplier, is maintained. Access pit excavation in regards to slope stability as well as sheeting, shoring and bracing requirements shall be in accordance with TP-01.

2. Access pit excavations shall be performed at all points where the fusible HDPE pipe will be inserted into the existing pipeline. When possible, access pit excavations shall coincide with host pipe lateral connection points or other appurtenance installations.

B. Pulling Equipment:

1. The pulling mechanism shall be properly connected to the end of the steel and fusible HDPE pipe via a pulling head or arrangement approved by the pipe supplier.
2. The maximum pulling tension on the steel and fusible HDPE pipe shall not exceed the pipe supplier's safe pulling force as submitted for this project.
3. Immediately following the completion of an installation by slip-lining, if possible, the pipe should be pushed back into the location of the insertion, at the pulling head, until a small amount of movement is realized at the insertion pit on the other side of the installation from the pulling equipment.

C. Fusible Polyethylene Pipe Care:

1. The fusible polyethylene pipe shall be handled with care to minimize the possibility of it being cut, kinked, gouged, or otherwise damaged. The use of cables or hooks will not be permitted. Weld seems shall be free of burs.
2. Sections of the fusible polyethylene pipe damaged, cut, or gouged shall be repaired by cutting out the section of damaged pipe and rejoining.

D. Pipe System Connections: Pipe connection materials, jointing and restraining shall be in accordance with TP-04 and TP 28 of these Technical Provisions, as well as per the connection manufacturer's guidelines and as indicated in the construction documents and as shown in the plans. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines. PVC pipe and HDPE pipe shall be connected with MJ adapter and have restrained joint connection for the PVC pipe, as recommended by pipe manufacturer.

E. Hydrostatic Testing and Leakage Testing for Pressure Piping: Hydrostatic and leakage testing for piping systems that contain mechanical jointing as well as fused HDPE jointing shall comply with TP-28.

F. Disinfection of the Pipeline for Potable Water Piping: After passing all other testing, the pipeline shall be disinfected prior to being put into service. Unless otherwise directed by the Owner or Owner's Representative, the pipeline will be disinfected per AWWA C651.

TP - 56.05 QUALITY ASSURANCE:

The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Owner or Owner's Representative approval of any aspect of any directional bore operation covered by this technical provision, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the contract.

TP - 56.06 EQUIPMENT REQUIREMENTS:

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe, operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

Ensure proper calibration of all equipment before commencing directional drilling operation. Take necessary measures to ensure accurate record drawings. Install all facilities such that their location can be readily determined by electronic designation after installation.

A. Drilling System: Match the HDD drill rig and its auxiliary pieces of equipment to the diameter and length of casing and product pipe being installed and ensure that the drill rod can meet the bend radius required for the proposed installation.

1. Drilling Rig: The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.
2. Drill Head: The drill head shall be steerable by changing rotation and shall avoid the necessary cutting surfaces and drilling fluid jets.
3. Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.
4. Drill Pipe: Drill pipe shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.
5. Guidance System: The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system. Select the locating and tracking system to provide information on:
   a) Clock and pitch information
   b) Depth
   c) Transmitter temperature
   d) Battery status
   e) Position (x,y)
   f) Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility)

B. Drilling Fluid (Mud) System:

1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be sized for adequate storage of the mud. Mixing system shall continually agitate the drilling fluid during drilling operations.
2. Drilling Fluids: Use a drilling fluid mixture composed of potable water and stabilizing agent (usually bentonite and/or polymer and/or appropriate additives) continuously pumped to the drill bit. Design/select the drilling fluid: to transport the spoils; maintain temperatures of bits and transmitter; clean cuttings from drill bit and reamers; reduce friction, pullback, and torque on drill rods, casing and product pipe; stabilize the borehole; control ground water pressure; and reduce migration of drilling fluids in soil. Use water with pH between 7.5 and 10 and free of chlorine with calcium < 100 ppm, sodium chloride < 500 ppm, and chlorine < 50 ppm. Hard water may be treated with soda ash to reach the required pH.

   Design the quantity and the mixture of drilling fluids to perform the preceding functions in the expected soil. Vary the fluid viscosity to best fit the encountered soil conditions. Do not use any other chemicals or polymer surfactants in the drilling fluid without written consent from the Owner or Owner's Representative. Certify to the Owner or Owner's Representative in writing that any added chemicals are environmentally safe and not harmful or corrosive to the casing and product pipe and the environment. Approvals and permits are required from utility departments or other permit

granting jurisdictions, for obtaining water from such sources as streams, rivers, ponds or fire hydrants. Any water source used other than potable water requires a pH test.

3. Delivery System: The mud pumping system shall have a minimum capacity to supply mud in accordance with the drilling equipment pull-back rating at a constant required pressure. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, minimum of 12-inches high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage facilities.

C. Other Equipment:

1. Pipe Rollers: Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

2. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of Owner or Owner's Representative.

TP - 56.07 DRILLING OPERATIONS:

A. General: The Owner or Owner's Representative must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Owner or Owner's Representative is present at the job site and agrees that proper preparations for the operation have been made. The Owner's or Owner's Representative's approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. It shall be the responsibility of the Owner or Owner's Representative to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

B. Personnel Requirements: All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety.

C. Drilling Procedure:

1. Site Preparation: Prior to any alteration to work-site, Contractor shall photograph or video tape entire work area, including entry and exit points. One copy of which shall be given to the Owner or Owner' Representative and one copy to remain with Contractor for a period of one year following completion of the project.

2. Work Site: Work site as indicated on the plans, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

3. Drill Path Survey: Depth of the bore along its entire alignment shall be based on the design plans. Prior to the start of the boring operation, survey the work site with x, y, z coordinates at control point at 100/LF intervals at minimum along the planned bore path. Provide stakes at offset distances (left or right) from the centerline at these control points and at all known existing utility crossings. Submit this information to the Owner or Owner's Representative at least 24 hours before the start of pilot bore operations.

4. Pilot Hole: Drill the pilot hole along the path shown on the plans and profile drawings within the allowable tolerance of the type of utility. Provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontal and vertical placements). Measure the vertical deviation of the boring, and immediately notify the Owner or Owner's Representative if the boring

deviates from the alignment or grade required by the plans. Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring the drilling fluids parameters such as the pumping rate, pressures, viscosity and density during the pilot bore, back reaming, and casing and product pipe installation. Relief holes can be used as necessary to relieve excess pressure down hole. Obtain Owner or Owner's Representative approval of the location and all conditions necessary to construct relief holes. Maintain proper disposition of drilling fluids and minimize inconvenience to other facility users.

5. Pull Back Operations: To minimize heaving during pull back, use a pullback rate that maximizes the removal of soil cuttings without building excess down-hole pressure. Owner or Owner Representative approval is required for pullback velocities over 2 feet per minute. Contractor shall monitor tensile load on pipe during pull-back operation and not exceed the manufacturer's recommendation for allowable tensile load.

6. Excess Drilling Fluids: Contain excess drilling fluids at entry and exit points until the recycle, vacuum, or removal from the site during drilling operations. Ensure that entry and exit containments are of sufficient size to contain the expected return of drilling fluids and soil cuttings. Carry out excavation and backfill for entry, exit, recovery pits, connection pits, slurry sump pits, or any other excavation as specified in Technical Provision 01.

7. Disposal and Contamination: Ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate federal regulatory agencies. When drilling in contaminated ground, test the drilling fluid for contamination and appropriately dispose of it. The Owner or Owner's Representative will adjust the contract value and/or time if the Contractor was not notified about the contamination during the bidding phase. Remove any excess material upon completion of the bore. Contact the Owner or Owner's Representative immediately if it becomes evident that the soil is contaminated in the drilling process. Do not continue drilling without the Owner or Owner's Representative's consent.

8. Locating Facilities: Install all facilities such that their location can be readily determined by electronic designation after installation. For non-conductive installations, attach a continuous conductive tracking (tracer wire) materials, either externally, internally or integral with the product. Tracking conductors must extend two feet beyond bore termini. Test conductors for continuity.

9. Clean Up: Within 48 hours of completing the installation, clean the work site of all excess slurry or spoils, de-mobilize equipment, and ensure that the site is safe and secured.

D. Environmental Protection: Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berming, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200 feet of any water-body or wetland.

E. Safety: Contractor shall adhere to all applicable federal and local safety regulations and all operations shall be conducted in a safe manner.

F. Pilot Hole: In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a Mach funnel and then wait another 30 minutes. If mud fracture or returns loss continues, Contractor shall cease operations and notify the Owner or Owner's Representative. Owner or Owner's Representative and Contractor will discuss additional options and work will then proceed accordingly.

G. Reaming: Upon successful completion of pilot hole, Contractor shall ream bore hole to a minimum identified in the table using the appropriate tools. Contractor shall not attempt to ream at one time more than drilling equipment and mud system are designed to safely handle.

The following table includes the diameter of the back-reamer related to the diameter of the casing and product pipe.

Product Diameter	Reamed Diameter
< 8”	Diameter of product + 4”
8” – 24”	Diameter of product x 1.5
> 24”	Diameter of product + 12”

H. Pull-Back: After successfully reaming bore hole to the required diameter, Contractor shall pull the pipe and tracer wire through the bore hole. To protect the tracer wire during pull-back, secure tracer wire to the trailing end of a short section chain welded to the drilling head or attach the wire under the expander. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations, Contractor shall not apply more than the maximum safe pipe pull pressure at any time as per the manufacturer’s recommendations.

In the event that the pipe becomes stuck, Contractor shall cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, Contractor shall notify Owner or Owner’s Representative. Owner or Owner’s Representative and Contractor shall discuss options and then work will proceed accordingly.

Pull an extra 3 to 5 percent of the total pipe length to allow for pipe relaxation. After HDPE pipe has been installed, allow pipe to relax for a minimum of 12 hours prior to connecting to adjacent pipe.

TP - 56.08 CLEAN UP:

Following drilling operations, Contractor shall de-mobilize equipment and restore the work-site to original conditions. All excavations shall be backfilled and compacted per TP-01. Landscaping shall be restored to original conditions. Buildings, utilities, and other improvements damaged by directional drilling shall be repaired at no additional expense. All mud shall be disposed of by the Contractor.

TP - 56.09 SUBMITTALS:

A. Work Plan: Prior to beginning work, submit to the Owner or Owner’s Representative a Work Plan detailing the procedure and schedule to execute the project. The work plan will be comprehensive, realistic, and based on actual working conditions for the particular project. The work plan documents the planning required to successfully complete the project. The work plan includes complete descriptions of proposed plans, procedures, equipment, personnel, and if applicable, supporting material, for the following:

1. Drilling operations: Describe the pilot hole drilling procedure, the reaming operation, the pullback procedure, and illustrate the plan.
2. Profile of the bore plotted at a scale appropriate for the crossing and acceptable to the Owner or Owner’s Representative.
3. HDD site layout including entry and exit points with angle of entry.
4. Fusion technician qualification conformance certification from manufacturer.
5. Recommended minimum bending radius, for all materials, casing and carrier pipe.
6. Recommended maximum safe pull force, for all materials, casing and carrier pipe.

7. Directional drilling equipment list includes: drilling rig, drill bit, back-reamer, mud mixing and pumping systems, down-hole tools, guidance system, and rig safety system. Provide calibration records for guidance equipment.
8. Drilling fluid management plan: Identify drilling fluid types and specifications, cleaning and recycling equipment, estimated flow rates, procedures for minimizing drilling fluid escape, and the method/location for final disposal of waste drilling fluids. Provide the SDS for all drilling fluid additives that will be used.
9. Pipe storage and handling details.
10. Pipeline assembly and installation procedures for both casing pipe and product pipe.
11. SDS of any potentially hazardous substances to be used.
12. Contingency plans for possible problems.

1. Submit supporting calculations, certifications, or material demonstrating the strength of the casing and product pipes for acceptance before the beginning of the installation. Submit for the Owner or Owner's Representative's acceptance prior to construction, other casing and product pipe material than those listed on the plans. Demonstrate that the proposed material satisfies the purpose of the utility and withstands the design and construction stresses and pressures.
2. If site conditions change and require modification to the work plan, resubmit revised drilling plans to achieve successful installation. Explain, in the revised submittal, the anticipated and encountered conditions that mandated the change in plans.

B. Daily Reports and Operator Logs: Submit daily reports to the Owner or Owner's Representative within 24 hours. Include in the daily reports a log of boring operations and guidance system for each drill rod added or withdrawn during drilling, reaming, and pullback. The log covers downhole tools and equipment in use, drilling fluid, fluid pumping rate, drilling head location. The report shall provide details of and perceived reasons for events and delays greater than one hour excluding normal breaks.

C. Record Drawings: At the completion of the HDD casing and product pipe installation, the General Contractor will provide the Owner or Owner's Representative marked up plans noting all deviations from the plans that result in change of location, material, type or size of work guided by the boring operations and guidance system log. Post on the drawing the x, y, and z coordinates of the starting and ending points of the line at minimum. Include in the marked up plans, the station number or reference to a permanent structure within the project right-of-way, name of person collecting data, including title, position and company name, detection method used, and elevations and offset dimensions. Certify the accuracy of the drawing to the capability of the tracking system.

D. As-Recorded Data: The following as-recorded data are required from the Contractor:

1. Approved data logger device reports.
2. Fusion joint documentation containing the following information:

a) Pipe Size and Thickness

b) Machine Size

c) Fusion Technician Identification

d) Job Identification

e) Fusion Joint Number

f) Fusion, Heating, and Drag Pressure Settings

g) Heat Plate Temperature

h) Time Stamp

i) Heating and Cool Down Time of Fusion

j) Ambient Temperature

TP - 56.10 MEASUREMENT AND PAYMENT:

Horizontal Directional Drilling: The horizontal direction drilling shall be measured in linear feet along the centerline of the pipe. Payment for horizontal direction drilling shall be at the contract unit price shown on the Bid Schedule. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals required to drilling the hole for the installation of the proposed pipe, including excavation of pilot hole and pull-back pit, trench backfilling, pipe pull-back, record drawings, and final cleanup. The payment for pipe is paid separately as shown on the Bid Schedule.

INCORPORATED INTO THE CONTRACT

SUBMITTAL REVIEW FORM, SECTION 56 – HORIZONTAL DIRECTIONAL DRILLING

	Date	Initials		
Received by ENGINEER:			Submittal No.	
Received by OWNER:			Project No.	
			Contract No.	

TP	Specification	Description (Indicate Type, Model No., Manufacturer, etc.)	Action By Owner
56.01	Qualifications		
56.03A	Pipe & Casing		
56.02F	Tracer wire, access points and splice kit		
56.04D	PVC to HDPE Transition		
56.06.A.5	Guidance System		
56.09A & 56.09B	Work Plan, Daily Reports, Operator Logs		
56.09C & 56.09D	Record Drawings As-Recorded Data		

	Signature	Date
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

TECHNICAL PROVISIONS

SECTION 60 - CHAIN LINK FENCING

TP - 60.01 SCOPE:

The work covered under this section consists of furnishing all equipment, labor, materials, and incidentals necessary for the complete installation of a chain link fence and accessories, in strict accordance with the applicable drawings, the provisions of ASTM F567 (active standard), and these Technical Provisions.

TP - 60.02 GENERAL:

The fence shall be constructed in the locations as shown on the drawings, or as directed by the Owner or Owner's representative.

TP - 60.03 MATERIALS:

A. Fence Fabric: Fence Fabric shall be zinc coated steel fabric meeting the requirements of Federal Specifications RR-F-191/1C and ASTM A392. Fabric shall be woven in a 2-inch diamond mesh and of height specified on the drawings. The weight of zinc coating shall not be less than 1.2 oz/ft^2.

1. Wire used in four-foot (4') fence fabric shall be 11-gauge (0.120 inch diameter) and shall be knuckled on the top and bottom selvage.
2. Wire used in six-foot and eight-foot (6', 8') fence fabric shall be 9-gauge (0.148 inch diameter) and shall be twisted on the top selvage and knuckled on the bottom selvage. Wire ends shall be cut at an angle.

B. Tension Wire: Tension wire shall have a marcelled pattern. The wire shall be zinc-coated, galvanized steel wire, 7 gage (0.177 inches in diameter), conforming to ASTM A824.

C. Barbed Wire: Barbed wire shall be zinc-coated steel barbed wire conforming to ASTM A121. The barbed wire shall be design number 12-4-5-14R: two twisted strands of 12-gauge wire, and 4-point, 14-gauge barbs spaced 5 inches on center.

D. Chain Link Fence Accessories: The following components shall be zinc-coated steel with a minimum zinc coating of 1.2 oz/ft^2, and galvanized after fabrication, conforming to ASTM F626. Any additional fence accessory not specifically stated shall also meet these requirements unless otherwise approved by the Owner or the Owner's representative.

1. Post and line caps: Caps shall be designed to fit securely over the outside of the posts and be watertight.
2. Rail and brace ends: No additional requirements.
3. Tie wires, clips, and fasteners: No additional requirements. Hog rings shall be included in this category.
4. Tension and brace bands: No additional requirements.
5. Tension bars: Tension bars shall have a cross section no less than 3/16-inch by 3/4-inch. The tension bar shall be of a continuous length and not shorter than 2 inches less than the nominal height of the fabric.
6. Truss rod assembly: The truss rod assembly shall consist of a steel rod not less than 3/8" in diameter and be equipped with a turnbuckle or other equivalent provision for adjustment. The assembly shall be capable of withstanding a tension of 2,000 lbs.
7. Barbed wire arms: Barbed wire arms shall be designed to fit securely over the outside of the post while supporting horizontal braces and be watertight. Arms shall be at an angle of 45-degrees and

shall be fitted with clips for attaching three strands of barbed wire. Barbed wire arms shall be of sufficient strength to withstand a weight of 250-lbs applied at the outer strand of the barbed wire.

E. Posts, Post Rails and Braces: All pipe required for construction of the fence and gates shall be round Schedule 40 steel pipe, hot-dip galvanized (interior and exterior), zinc-coated, regular grade (30,000 psi) meeting or exceeding the requirements of ASTM F1083 and ASTM F1043 Group 1A. Pipe sizes for fence components are presented in the following table.

Use	Nominal Pipe Size	Outside Diameter (in.)	Weight (lbs/ft)	Fence Industry Trade Reference
Line Post				
1. 4' Fence	1 ½"	1.900	2.72	1 7/8"
2. 6' and 8' Fence	2"	2.375	3.65	2 3/8"
Brace rail, Intermediate Rail	1 ¼"	1.660	2.27	1 5/8"
Gate Frames				
1. 4' Fence	1 ¼"	1.660	2.27	1 5/8"
2. 6' and 8' Fence	1 ½"	1.900	2.72	1 7/8"
Terminal, End, Corner & Slope/Pull Posts				
1. 4' Fence	2"	2.375	3.65	2 3/8"
2. 6' and 8' Fence	2 ½"	2.875	5.80	2 7/8"
Gate Posts				
1. 4' Fence				
Gate leaf up to 4-feet	2"	2.375	3.65	2 3/8"
Gate leaf over 4' to 10'	2 ½"	2.875	5.80	2 7/8"
Gate leaf over 10' to 18'	3 ½"	4.000	9.11	4"
2. 6' and 8' Fence				
Gate leaf up to 6-feet	2 ½"	2.875	5.80	2 7/8"
Gate leaf over 6' to 12'	3 ½"	4.000	9.11	4"
Gate post sizes for gate leaf widths greater than listed shall be as directed by the Owner.				

F. Gates and Accessories: Swing gates, complete with latches, stops, keepers, hinges, drop bar, and barbed wire, shall be provided where shown on the plans. Swing gates shall conform to ASTM F900.

1. Gate Frames: Gate Frames shall be Schedule 40 steel pipe as described in 60.03 B of this specification.
2. Gate Fabric: The fabric shall be as specified for the fence as described in 60.03A of this specification.
3. All gate accessories shall be zinc-coated with a minimum zinc coating of 1.2 oz/ft^2, galvanized after fabrication, conforming to ASTM F626 and in accordance with tests set forth in ASTM A90.
4. Hinges: Gate Hinges shall be pressed steel or malleable iron. The hinges shall be designed to permit the gate to swing a full 180 degrees. The hinges shall be of adequate strength, with large bearing surfaces for clamping in position and shall not twist or turn under the action of the gate.
5. Latches: Double gate latches shall be a plunger bar arranged to engage the gate stop. Locking devices shall be constructed so that the plunger bar cannot be raised when the gate is locked. The latching device shall have provision for a padlock and shall be designed such that both gate leaves can be locked with a single padlock. Single gate latches may be of the same style, or a forked latch may be provided. Each latch shall be provided with a padlock, Master or equal, and four keys.

6. Gate Stops: Gate stops shall be provided for all double gates and shall consist of a galvanized, hot-dipped zinc-coated Schedule 40 drop-bar and a receiving gate stop as illustrated on standard details of the construction drawings.

7. Keepers: Keepers shall be provided for each gate leaf 5 feet in width or more. Gate keepers shall consist of a mechanical device for securing the free end of the gate when in the full open position.

G. Concrete: Concrete shall be in conformance with Section 02 of the Technical Provisions.

H. Warning Signs: Warning signs shall be prepared and erected to display the information/text/message as shown in the drawings. The size of the warning signs, number of warning signs, and the location of the warning signs shall be manufactured as shown on the construction drawings.

The signs shall be constructed of sixteen (16)-gauge zinc coated steel or 0.105 inch aluminum sheeting. The letters shall be black on white background of a size approved by the Owner or Owner's Representative. The white background shall be hot sprayed with a weather resistant, flexible enamel for enduring appearance. The letters shall be silk screened with sharp clear lines painted with a weather resistant flexible enamel.

The signs shall be the product of a company regularly engaged in the manufacture of metal signs.

TP - 60.04 INSTALLATION:

The fence shall be installed in accordance with ASTM F567 except as modified in these specifications.

A. Preparation: Prior to commencing all work, the Contractor shall locate all underground utilities and structures. The Contractor shall indicate the location and slope of fence lines, gates and terminal posts for actual construction by staking and shall secure the Owner's approval that such layout is in accordance with the plans. The Contractor shall clear and grade along the fence line only as necessary to provide a uniform clearance between the fence fabric and ground and permit proper installation. The Contractor shall remove existing fence at the work site as directed by the Owner or as indicated on the plans. All ground disturbances shall be filled to match existing grades.

B. Post Location: Line posts shall be spaced equidistantly at intervals not exceeding 10 feet. Terminal posts (end, corner, gate and slope/pull posts) shall be set where an abrupt change in alignment or grade of 30-degrees or more occurs or to divide straight runs of fencing which exceed 500-feet in length.

C. Post Setting: Set posts in concrete in holes of diameter and depth as shown in the tables below. Posts shall be set in a vertical position, plumb, in line and centered in the footing. Concrete shall be placed 6" below the post and shall extend 2 inches above grade and be crowned to shed water. Forms are not required. Fence fabric shall not be stretched until the concrete has cured for at least 7-days. If solid rock or concrete is encountered, the posts shall be set as recommended by the fencing manufacturer and approved by the Owner or Owner's Representative prior to installation.

1. Four-Foot (4') Fence Post Holes:

4' FENCE POST HOLES			
Type of Post	**Diameter of Post Hole**	**Depth of Post Hole**	**Depth of post in Concrete**
Line Posts *(1.900" OD)*	8"	24"	18"
Terminal Posts *(2.375" OD)*	10"	24"	18"
Gate Posts			
1. Gate leaf less than 4' *(2.375" OD)*	10"	36"	30"
2. Gate leaf between 4' to 10' *(2.875" OD)*	12"	36"	30"
3. Gate leaf over 10' to 18' *(4.000" OD)*	16"	36"	30"
Post holes for gate leafs greater than listed shall be as directed by the Owner.			

2. Six-Foot (6') and Eight-Foot (8') Fence Post Holes:

6' and 8' FENCE POST HOLES			
Type of Post	**Diameter of Post Hole**	**Depth of Post Hole**	**Depth of post in Concrete**
Line Posts *(2.375" OD)*	10"	30"	24"
Terminal Posts *(2.875" OD)*	12"	30"	24"
Gate Posts			
1. Gate leaf less than 6' *(2.875" OD)*	12"	36"	30"
2. Gate leaf over 6' to 12' *(4.000" OD)*	16"	36"	30"
Post holes for gate leafs greater than listed shall be as directed by the Owner.			

D. Post Caps: All posts shall be fitted with watertight caps. Barbed wire arms shall be installed on line posts to perform this function.

E. Top Rail and Bottom Tension Wire: The top rail shall be supported at each post so that a continuous brace from end-to-end of each stretch of fencing is formed. The top rail shall be securely fastened to the terminal posts and joined with sleeves or couplings. Bottom Tension wires are required and shall be fastened within the bottom three-inches (3") of the fence fabric. The tension wire shall be securely fastened to all terminal, gate and corner posts. Securely fasten the tension wire to the terminal, corner and gate posts with a brace or stretcher bar band. The tension wire shall be taut and free of sag. After the fabric is stretched, fabric shall be attached to the bottom tension wire with C-rings (Hog-rings) at intervals not exceeding 12-inches. Fence fabric shall be secured to the top rails with tie wire at intervals not exceeding 18-inches.

F. Bracing: Bracing shall be provided for each terminal, corner and gate post consisting of a brace rail and truss rod assembly. Corner posts shall have bracing assemblies installed in both directions to the next line post. The brace rail shall be installed between the terminal, corner or gate post and the adjacent line post at 2/3 height of the fabric. The truss rod assembly shall be installed from the bottom of the terminal, corner or gate post to the brace rail. The truss rod assembly shall be as shown on the plans and shall be finished neatly without undue protrusion of the ends.

G. Tension Bars: Tension bars shall be threaded through the fabric and attached to the terminal, corner or gate post by brace bands or tension bands at intervals not exceeding 12-inches. Terminal and gate posts shall have one (1) tension bar installed. Corner posts shall have two (2) tension bars installed.

H. Fence Fabric:

1. Install fence fabric on the outside of the fence and gate assembly framework.

2. Position the fence fabric two-inches (2") above ground level. Fasten the fabric to terminal, corner and gate posts with tension bars as specified. Cut the fabric and fasten each span independently at all terminal, corner and gate posts. Secure and apply sufficient tension to remove all slack and provide a smooth uniform appearance before making other attachments. Attach the fence fabric to the bottom tension wires with C-rings (hog rings) at intervals not exceeding 18" and to line posts with tie wires at intervals not exceeding 12".

3. The fence fabric shall be cut by untwisting a picket and attaching each span independently to the terminal post as described. Where the fabric must be spliced, weave a single picket through the end links to form a continuous mesh and form the appropriate selvage at each end.

I. Barbed Wire: Where barbed wire is required, barbed wire shall be stretched taut to remove all sag and installed in the slots of the extension arms. Attach each strand of barbed wire to the terminal post using a brace band.

J. Summary of Fence Fabric Attachment points:

Fence Fabric Attachment to:	Attach with:	Attachment Spacing:
Terminal Post Line Post Corner Post Gate Frame Horizontal member Gate Frame Vertical member	Brace Bands & Tension Bar Tie wire Brace Bands & Tension Bar Tie wire Brace Bands & Tension Bar	12”
Tension Wire	Hog ring	18”

K. Gates: Swing gates complete with latches, stops, keepers, hinges and barbed wire shall be provided where shown on the plans. Swing gates shall conform to ASTM F900 except as otherwise specified.

1. Frames shall be made of pipe as specified in 60.03B.
2. Frames shall be made with corner fittings or welding. Protect welds by applying a zinc-rich paint in accordance with ASTM A780 and the American Galvanizer Association such as Galvax Cold Galvanizing Paint (95% Zinc) or an approved equal. Where corner fittings are used, gates shall have truss rod assemblies even if not otherwise stated. Gate leaf design shall be as stated below. Interior bracing shall be evenly spaced within the frame. Gate leaf sizes that are not encompassed by the following requirements shall be as noted on the plans or as directed by the Owner.
   a. 4’ fabric gate leaf of 3’ – 4’ width shall have one diagonal truss rod assembly.
   b. 6’ – 8’ fabric gate leaf of 3’ - 4’ width shall have one horizontal brace.
   c. 6’ – 8’ fabric gate leaf between 5’ to 8’ width shall have one horizontal brace, one vertical brace and one diagonal truss rod assembly.
3. Where barbed wire is required, the end members of the gate frames shall extend one foot above the top horizontal member to which three strands of barbed wire, uniformly spaced, shall be attached by use of bands or clips.
4. Fabric shall be attached securely to the gate frame by tension bars, brace bands, and tie wires as specified for fence construction. All fence fabric attachments to gate framing is spaced a maximum of 12”.
5. Hinge and latch offset opening space from the gate frame to the gate post shall be no greater than 3” in the closed position.
6. Gate stops for double gates shall be set in a concrete footing of minimum 12” diameter and 24” deep.
7. The gate shall be capable of being opened and closed easily by one person and installed in a manner as to prevent removal of the gate by lifting off.
8. Gates shall swing or slide in the direction indicated in the drawings. Grade clearance and all possible gate obstructions shall be considered to provide adequate operational clearance. Gates shall be true to opening and plumb in a closed position.

L. Repairs to Coatings: Where galvanized coatings are cut, broken, burned, abraded, or otherwise damaged, affected areas shall be repaired by applying zinc-rich paint in accordance with ASTM Practice A780.

TP - 60.05 GRAVEL COVER:

Gravel cover shall be installed at the locations indicated on the plans. The designated areas within the fence shall be graded, sterilized, and covered with plastic sheeting and gravel. The Contractor shall excavate the designated areas within the fence to a depth of 3 inches below the final grade and shall shape and smooth the excavated area to correct any surface irregularities. If directed by the Owner or Owner’s representative, the area shall then be

sprayed with an approved soil sterilant, equal to Primatol, to prohibit vegetation growth. The designated soil sterilant shall be applied at a rate that is in accordance with the manufacturer's recommendations. Soil sterilant shall not be applied around well-heads/water source sites. If specified by the construction drawings, the treated ground surface shall be completely covered with one layer of woven, needle punched, 5.0 ounce polypropylene landscape fabric/weed-barrier designed for professional and commercial use equal to Dewitt Pro-5 Weed Barrier. All weed-barrier fabric joints shall overlap a minimum of 12 inches.

After placement of the landscape fabric/weed-barrier sheet-stock, the entire area shall be covered with a 3 inch uniform layer of washed gravel. Care will be taken in placing the gravel to assure the landscape fabric/weed-barrier is not displaced, punctured or torn. The gravel shall be 3/4-inch to 1-1/2 inch in size and shall be subject to the Owner's approval.

TP - 60.06 CLEANUP:

The area of the fence installation shall be left neat and free of any debris caused by the erection of the fence.

TP - 60.07 MEASUREMENT AND PAYMENT:

A. Mobilization/Demobilization: When applicable, and if separate from the inclusions of TP-01, payment for mobilization/demobilization shall be at the lump sum listed in the bid schedule. Mobilization shall consist of moving all necessary materials and equipment to the site to perform the work. Demobilization includes repacking and removal of all tools, equipment and construction debris from the work area to the satisfaction of the Owner. 60% of this line item may be requested upon complete mobilization to the job site and the remainder may be requested upon demobilization from the job site.

B. Removal of Existing Fence: Payment for the removal of existing fence shall be measured in linear feet of fence removed; this price being full compensation for all labor, equipment,and incidentals required to remove and dispose of the existing fence per federal, state and local regulations.

C. Fencing: The fencing shall be measured in linear feet along the fence line, including the gates. Payment for fencing shall be at the contract unit price shown in the Bid Schedule; this price being full compensation for furnishing all labor, equipment, materials, and incidentals required for a complete installation, including posts, rails, fabric, barbed wire, gates, signage, associated fence accessories and clean up.

D. Gravel Cover: Payment for gravel cover shall be made per cubic yard basis for furnishing all labor, equipment, materials and incidentals for placing the gravel. Such payment shall include, but not be limited to, furnishing materials, soil preparation, placement of landscape fabric/weed-barrier, labor, equipment, miscellaneous material, and clean-up.

INCORPORATED INTO THE CONTRACT

SUBMITTAL REVIEW FORM

SECTION 60 - CHAIN LINK FENCING

	DATE	INITIALS		
Received by ENGINEER:			Submittal No.	
			Project No.	
Received by OWNER:			Contract No.	

TP	Specification	Description (Indicate Type, Model No. Manufacturer, etc.)	Action by Owner
60.03	4’ Fence Fabric		
60.03	6’ – 8’ Fence Fabric		
60.03	Posts and Rails		
60.03	Tension Wire		
60.03	Barbed Wire		
60.03	Post & Line Caps		
60.03	Rail & Brace Ends		
60.03	Tie Wire and Hog Rings		
60.03	Brace Bands and Tension Bands		
60.03	Truss Rod Assembly		
60.03	Barbed Wire Arms		
60.03	Gate Hinges		
60.03	Gate Latch		
60.03	Gate Stop		
60.03	Gate Keeper		
60.03	Warning Signs		
60.04	Zinc-rich paint		
60.05	Gravel		
60.05	Landscape fabric/weed-barrier		
60.05	Soil sterilant		
02	Concrete Mix		

	Signature	Date:
CONTRACTOR:		
OWNER APPROVAL:		

INCORPORATED INTO THE CONTRACT

WMAT Modified Technical Details

1G WMAT EADO	Roadway or Pavement Patch
1H WMAT EADO	Tracer Wire Access Box
1I WMAT EADO	Concrete Pipe Encasement
-	
4C-1 WMAT EADO	Fire Hydrant with Gate Valve
4D-1 WMAT EADO	Blow-Off Hydrant & Gate Valve
4E-1 WMAT EADO	Blow-Off Hydrant with Portable Discharge Riser
-	
5A-1 WMAT EADO	Water Service Line Connection
5B WMAT EADO	Water Service Line Connection with Curb Stop
5C WMAT EADO	Concrete Meter Box & Lids
-	
6A-1 WMAT EADO	Shallow Manhole
6B-1 WMAT EADO	Manhole & Manhole Frame & Cover
6G-1 WMAT EADO	Sewer Main Cleanout
6H WMAT EADO	Force Main to Gravity Sewer Transition Manhole
6I WMAT EADO	Beaver Slide Manhole
6J WMAT EADO	Steel Casing Piers
-	
7A-1 WMAT EADO	Sewer Service Cleanout
7B-1 WMAT EADO	Sewer Service without Connection
-	
11A-1 WMAT EADO	Casing Detail
-	
12A-1 WMAT EADO	Typical Two Compartment Concrete Septic Tank
12B-1 WMAT EADO	Septic Tank & Leaching Chamber Drainfield (Flat Site)
12C-1 WMAT EADO	Septic Tank & Leaching Chamber Drainfield (Sloping Site)
12E WMAT EADO	Concrete Distribution Box & Riser
-	
16A-1 WMAT EADO	Single Residence Lift Station & Septic Tank

DATE	REVISIONS	INITIALS
11-18	REVISED	

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(928) 537-0578

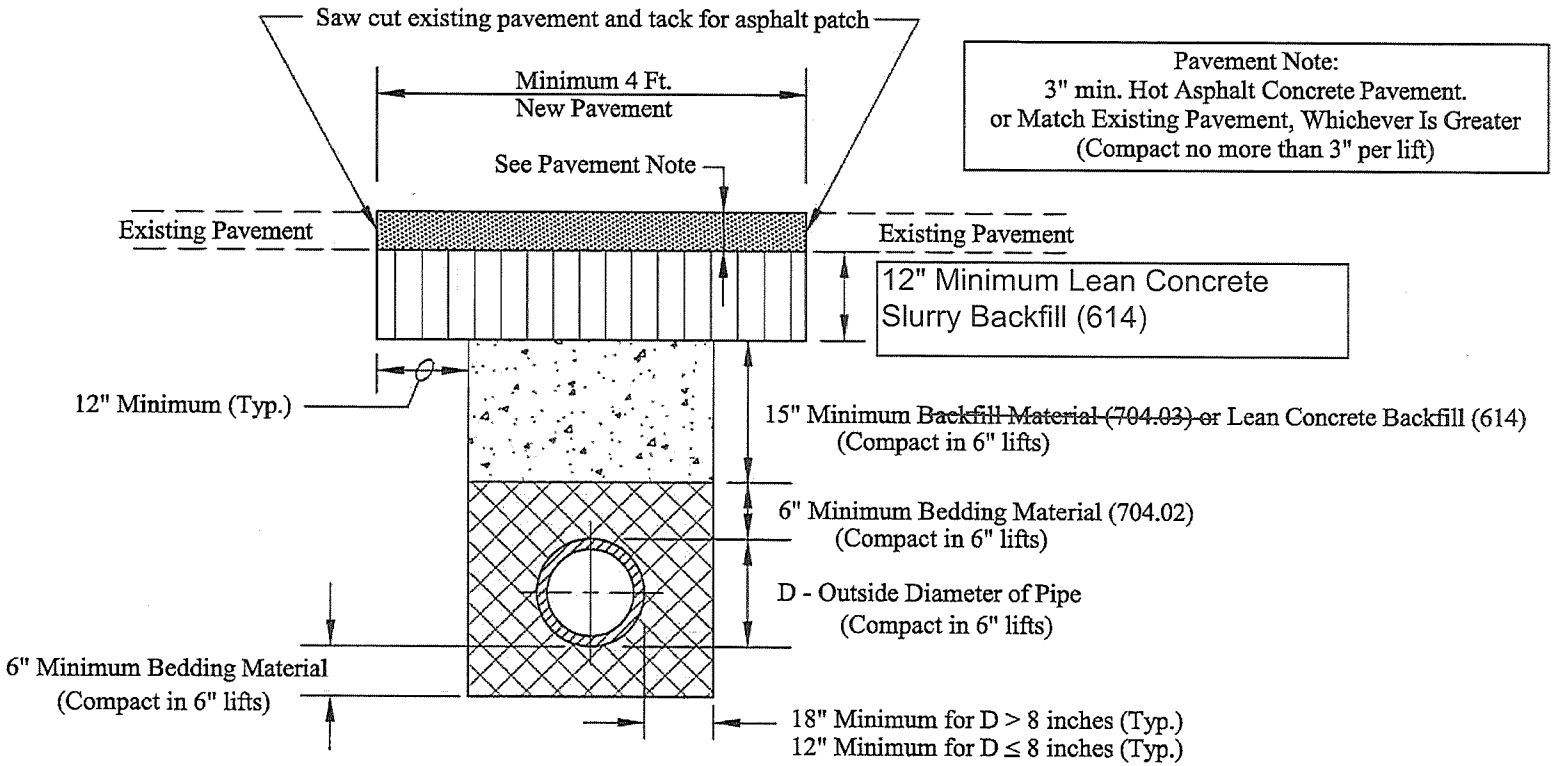
THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
SHEET SET TABLE

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS LIST
LAYOUT NAME: WMAT 00
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT

ROADWAY TRENCH
PAVEMENT CUT AND REPLACEMENT DETAIL
FOR UTILITY LINES AND CULVERTS



Pavement Note:
3" min. Hot Asphalt Concrete Pavement.
or Match Existing Pavement, Whichever Is Greater
(Compact no more than 3" per lift)

KEY NOTES

1. Bedding and Backfill Material shall be compacted to a min. of 95% of maximum density as determined by AASHTO T 99, Method "C". Determine in-place density and moisture content according to AASHTO T 310 for each 6" lift.

2. Aggregate Base Course (ABC) shall be compacted to a min. of 95% of maximum density as determined by AASHTO T 180, Method "D". Determine in-place density and moisture content according AASHTO T 310 for each 6" lift.

3. New Pavement shall be Hot Asphalt Concrete Pavement, Type II in accordance with FP-14 Section 403, compacted to a min. of 90% of maximum density as determined by AASHTO T 209. Determine the density by nuclear gauge.

3. All Materials shall be in accordance with the Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-14.

Section 614 - LEAN CONCRETE BACKFILL MIX	
Cement	50 Lb/CY
Slump	6-8 in.
Aggregate	703.15 of FP-14
Compressive Strength (7-day)	75 to 250 psi

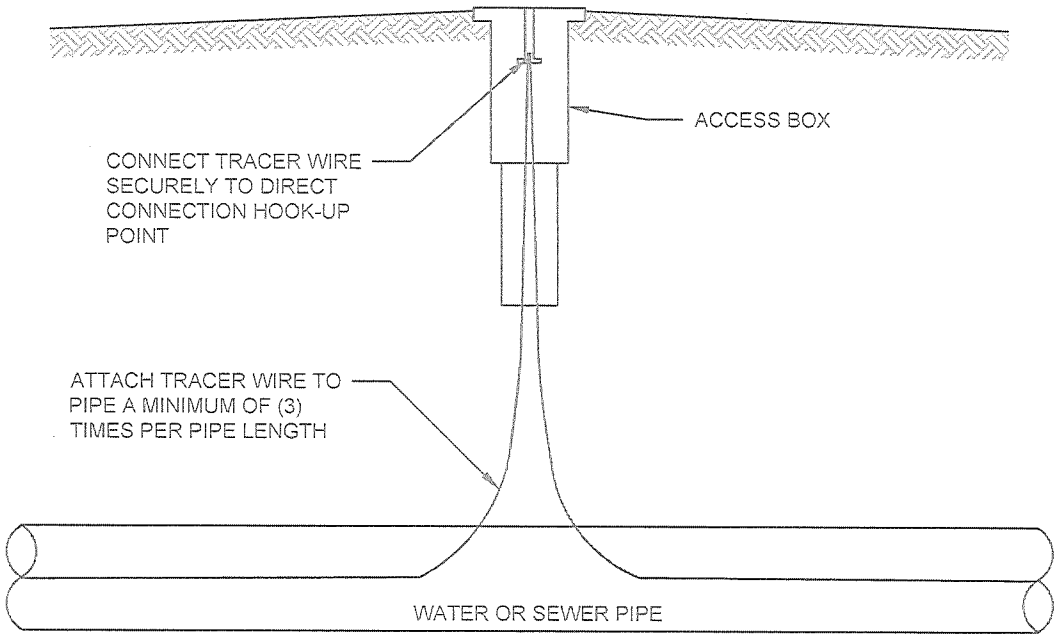
1G (WMAT) ROADWAY OR PAVEMENT PATCH

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
WESTERN REGIONAL OFFICE
DIVISION OF TRANSPORTATION

DWG. NAME: UTILITY TRENCH DETAIL

DRAWN BY: SLS 2018

INCORPORATED INTO THE CONTRACT



NOTE:

1. ACCESS BOXES SHALL BE LOCATED AS INDICATED ON THE PLANS.
2. ACCESS BOXES SHALL BE RATED FOR ROADWAY APPLICATIONS.
3. LID AND TUBE OF ACCESS BOX SHALL BE NON-CORROSIVE OR CORROSION RESISTANT MATERIAL AND SHALL BE SET PLUMB.
4. LID SHALL BE COLOR CODED FOR THE FACILITY INSTALLED (BLUE - WATER, GREEN - SEWER).
5. TEST TRACER WIRE FOR CONTINUITY AND PROPER FUNCTIONALITY.
6. TRACER WIRE SHALL BE ATTACHED ON THE BOTTOM HALF OF THE PIPE.
7. TRACER WIRE AND ACCESS BOX SHALL BE INSTALLED IN ACCORDANCE WITH THE SPECIFICATIONS AND THE MANUFACTURER'S RECOMMENDATIONS.

1H
(WMAT)

TRACER WIRE ACCESS BOX

Scale: NTS

DATE	REVISIONS	INITIALS

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PHOENIX AREA OFFICE
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PHOENIX, AZ 85004
(602) 364-5088

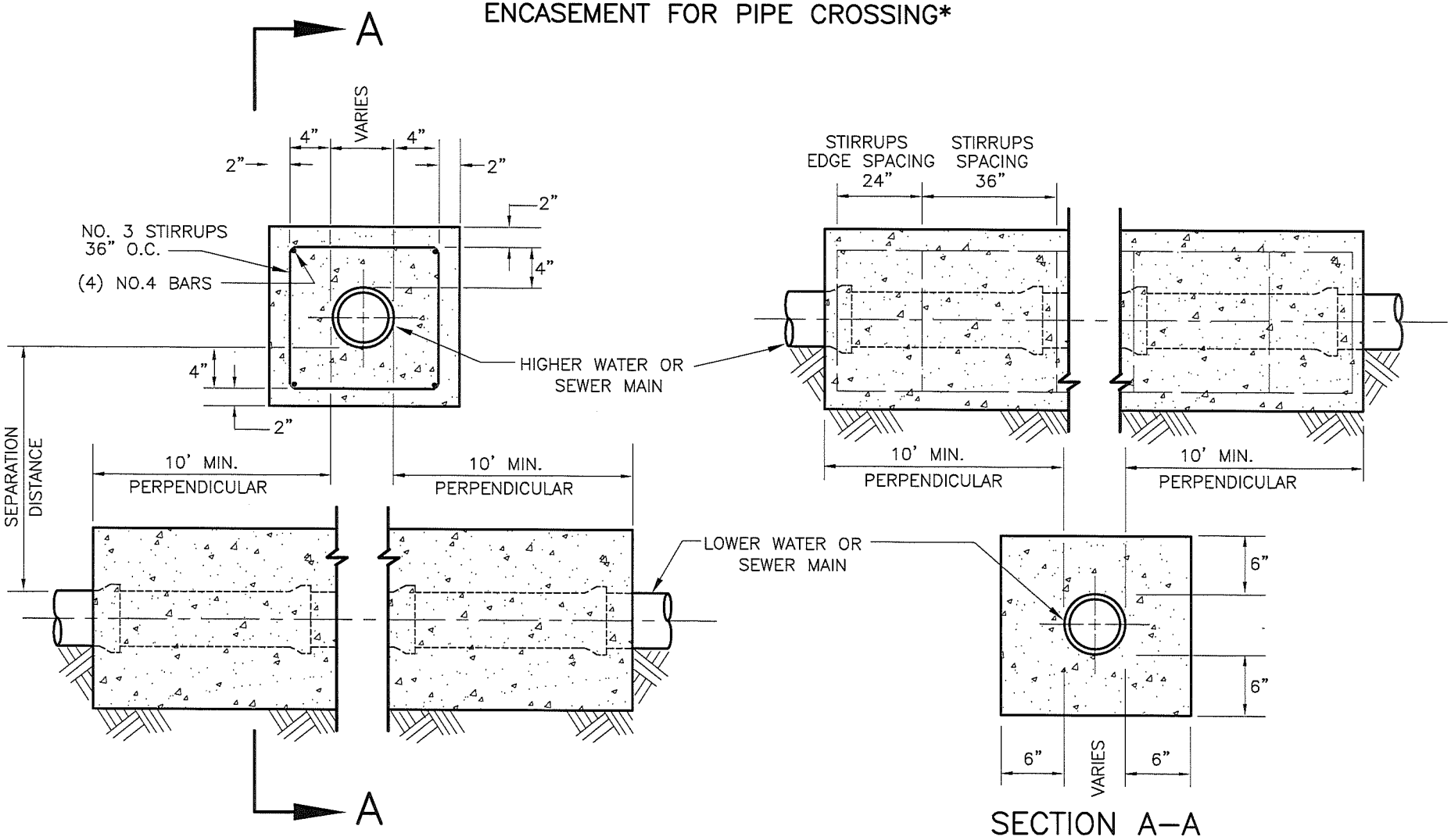
(WMAT) – TRACER WIRE ACCESS BOX DETAIL

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: LTS-2019
LAYOUT NAME: SHEET 01
PROJ ENG: LORENZO SANTANA

INCORPORATED INTO THE CONTRACT

ENCASEMENT FOR PIPE CROSSING*



SECTION A–A

NOTES:

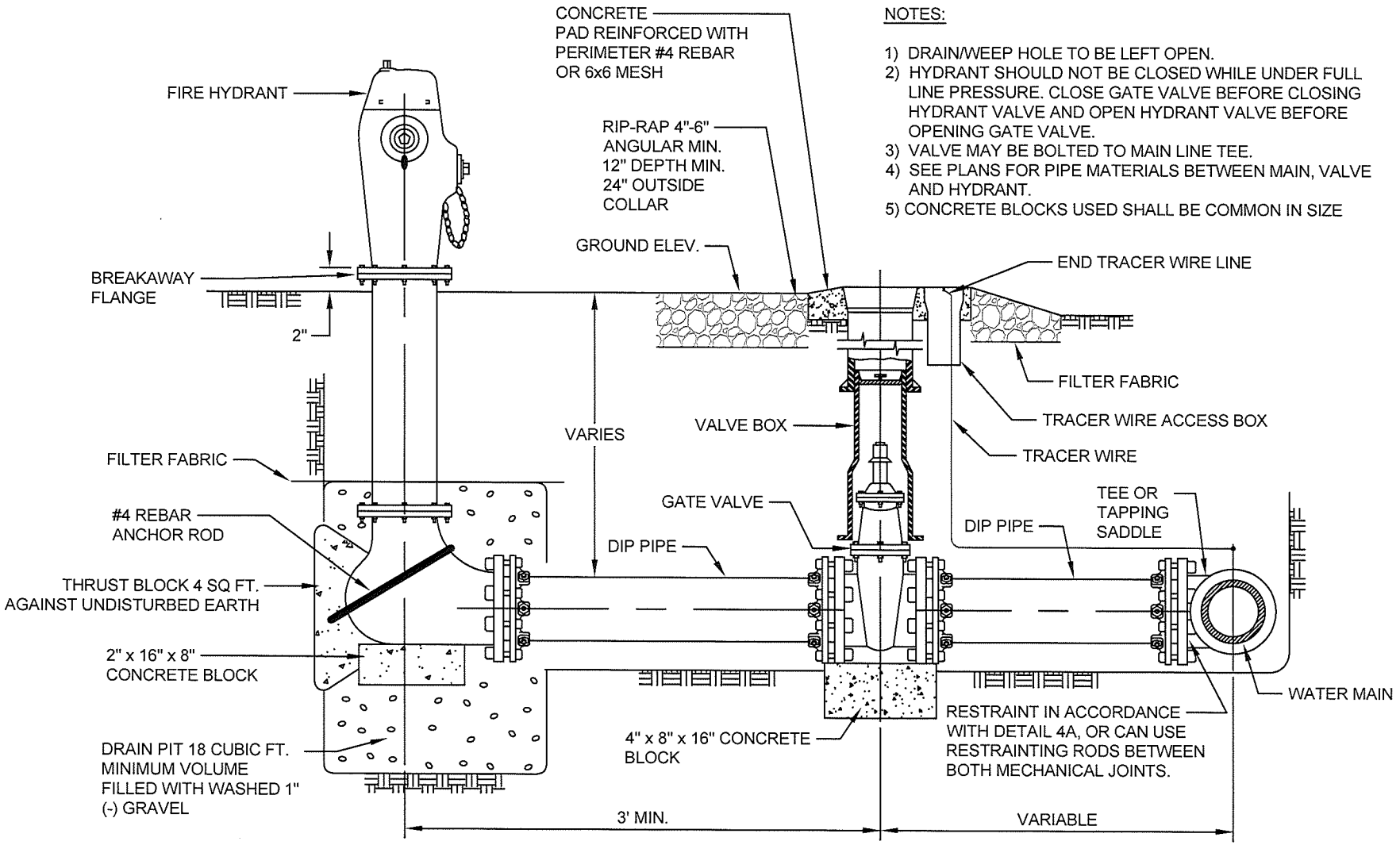
1. CLASS 'C' CONCRETE AS PER SECTION 725.

*REFER TO MAG STANDARD SPECIFICATION SECTION 610.

11 (WMAT) Concrete Pipe Encasement

DETAIL NO.		STANDARD DETAIL		REVISED	DETAIL NO.
404–3	MARICOPA ASSOCIATION of GOVERNMENTS	ENGLISH	WATER AND SANITARY SEWER SEPARATION/PROTECTION	01–01–2006	404–3

INCORPORATED INTO THE CONTRACT



NOTES:

1) DRAIN/WEEP HOLE TO BE LEFT OPEN.
2) HYDRANT SHOULD NOT BE CLOSED WHILE UNDER FULL LINE PRESSURE. CLOSE GATE VALVE BEFORE CLOSING HYDRANT VALVE AND OPEN HYDRANT VALVE BEFORE OPENING GATE VALVE.
3) VALVE MAY BE BOLTED TO MAIN LINE TEE.
4) SEE PLANS FOR PIPE MATERIALS BETWEEN MAIN, VALVE AND HYDRANT.
5) CONCRETE BLOCKS USED SHALL BE COMMON IN SIZE

FIRE HYDRANT WITH GATE VALVE

4C-1 (WMAT)

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
07-18	REVISED	LTS
01-19	REVISED	LTS
03-19	REVISED	C.G.
03-19	REVISED	LTS

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(602) 364-5088

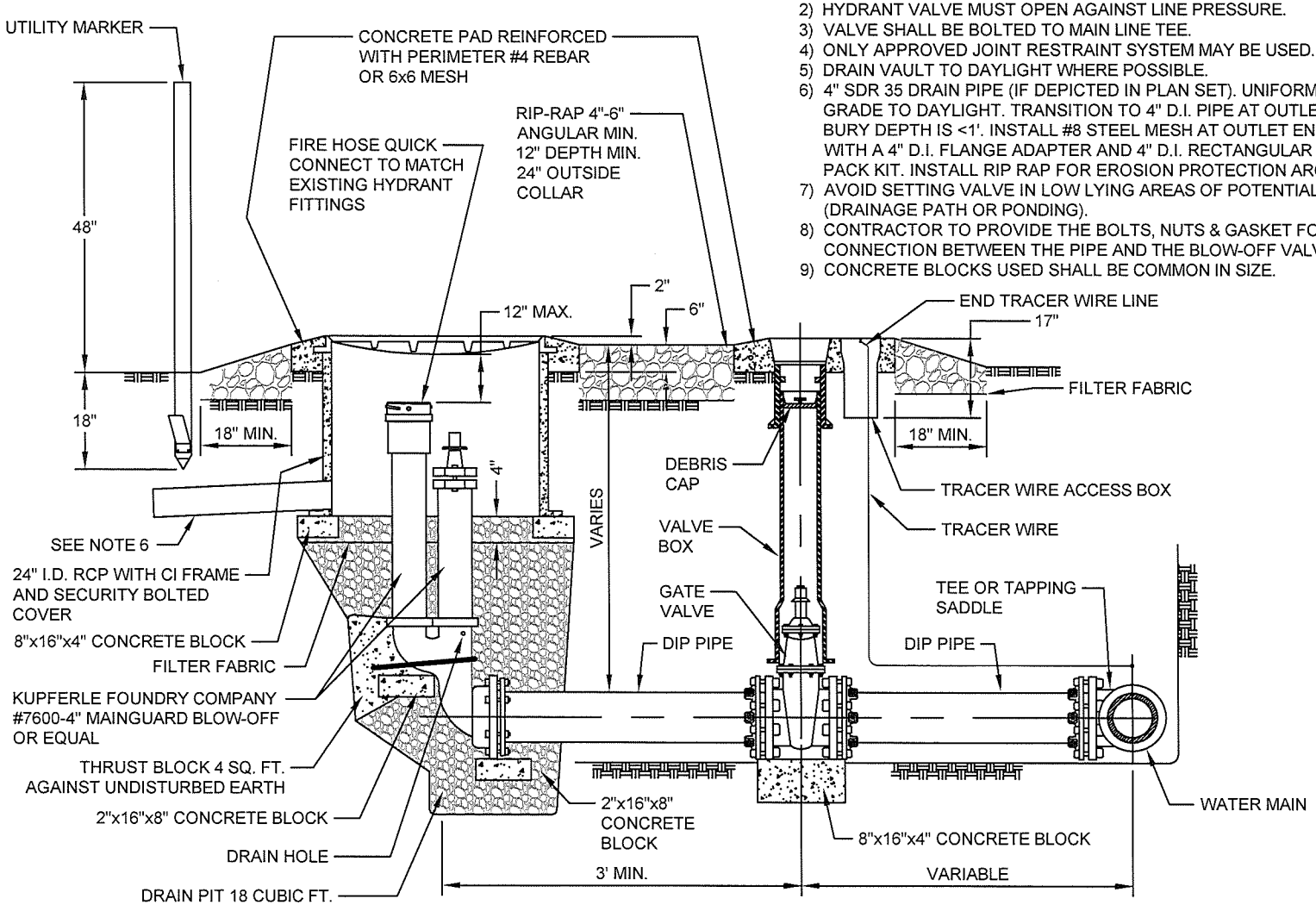
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
WMAT - 4C-1 WMAT EADO

DRAWN BY: ----- DATE: -----
CHECKED BY: ----- DATE: -----

FILE NAME: REVISED WATER DRAWINGS WMAT
LAYOUT NAME: 4C-1 WMAT EADO
PROJ ENG: -----

INCORPORATED INTO THE CONTRACT

NOTES:
1) DRAIN HOLE TO BE LEFT OPEN.
2) HYDRANT VALVE MUST OPEN AGAINST LINE PRESSURE.
3) VALVE SHALL BE BOLTED TO MAIN LINE TEE.
4) ONLY APPROVED JOINT RESTRAINT SYSTEM MAY BE USED.
5) DRAIN VAULT TO DAYLIGHT WHERE POSSIBLE.
6) 4" SDR 35 DRAIN PIPE (IF DEPICTED IN PLAN SET). UNIFORM (2% MINIMUM) GRADE TO DAYLIGHT. TRANSITION TO 4" D.I. PIPE AT OUTLET END WHERE BURY DEPTH IS <1'. INSTALL #8 STEEL MESH AT OUTLET END ANCHORED WITH A 4" D.I. FLANGE ADAPTER AND 4" D.I. RECTANGULAR ACCESSORY BOLT PACK KIT. INSTALL RIP RAP FOR EROSION PROTECTION AROUND OUTLET.
7) AVOID SETTING VALVE IN LOW LYING AREAS OF POTENTIAL FLOODING (DRAINAGE PATH OR PONDING).
8) CONTRACTOR TO PROVIDE THE BOLTS, NUTS & GASKET FOR THE MJ CONNECTION BETWEEN THE PIPE AND THE BLOW-OFF VALVE.
9) CONCRETE BLOCKS USED SHALL BE COMMON IN SIZE.



4D-1 (WMAT)

BLOW-OFF HYDRANT & GATE VALVE

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
07-18	REVISED	LTS
01-19	REVISED	LTS
03-19	REVISED	C.G.
03-19	REVISED	LTS

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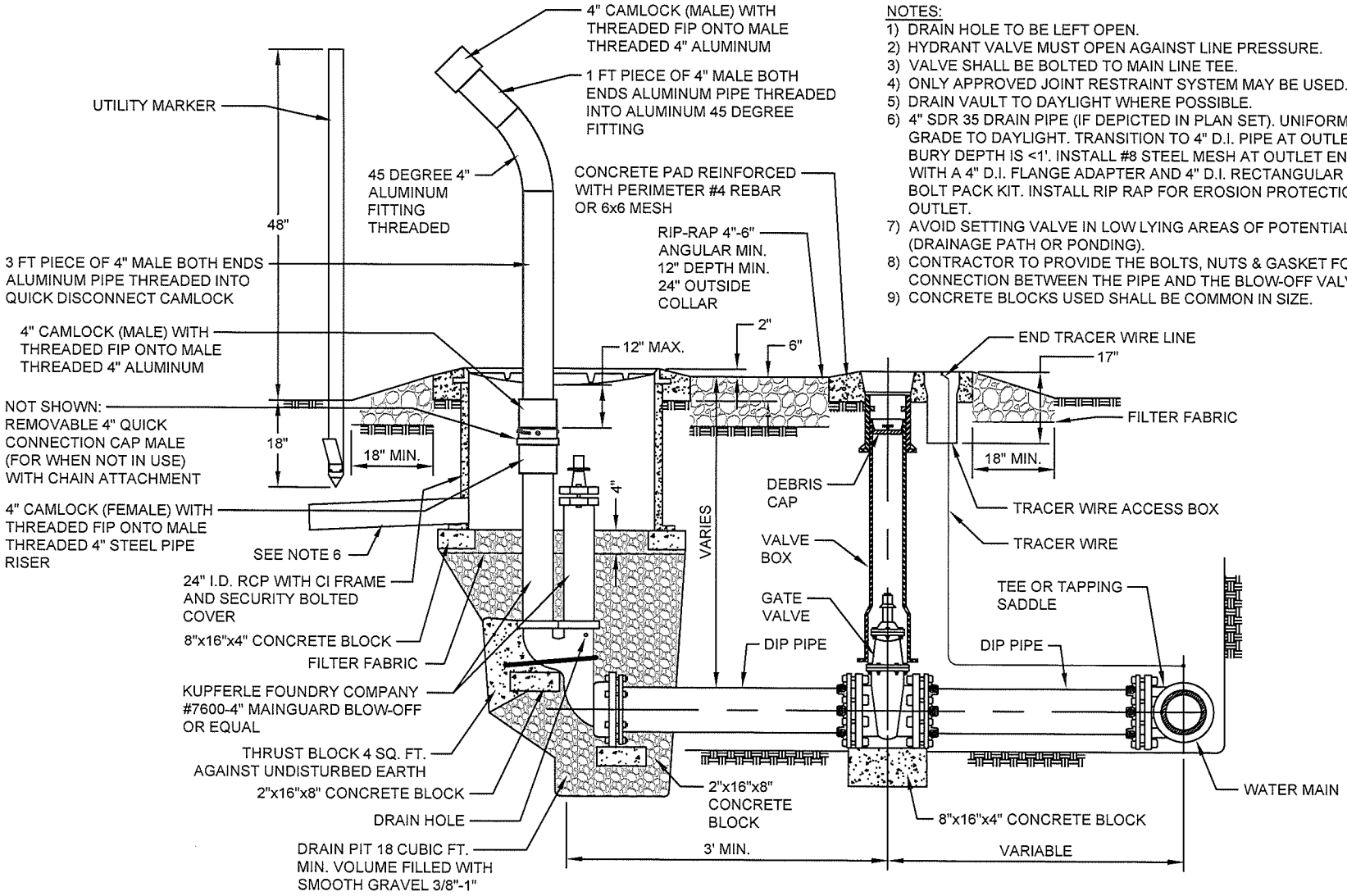
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
WMAT - 4D-1 WMAT EADO

DRAWN BY: ----- DATE: -----
CHECKED BY: ----- DATE: -----

FILE NAME: REVISED WATER DRAWINGS WMAT
LAYOUT NAME: 4D-1 WMAT EADO
PROJ ENG: -----

INCORPORATED INTO THE CONTRACT



NOTES:
1) DRAIN HOLE TO BE LEFT OPEN.
2) HYDRANT VALVE MUST OPEN AGAINST LINE PRESSURE.
3) VALVE SHALL BE BOLTED TO MAIN LINE TEE.
4) ONLY APPROVED JOINT RESTRAINT SYSTEM MAY BE USED.
5) DRAIN VAULT TO DAYLIGHT WHERE POSSIBLE.
6) 4" SDR 35 DRAIN PIPE (IF DEPICTED IN PLAN SET). UNIFORM (2% MINIMUM) GRADE TO DAYLIGHT. TRANSITION TO 4" D.I. PIPE AT OUTLET END WHERE BURY DEPTH IS <1'. INSTALL #8 STEEL MESH AT OUTLET END ANCHORED WITH A 4" D.I. FLANGE ADAPTER AND 4" D.I. RECTANGULAR ACCESSORY BOLT PACK KIT. INSTALL RIP RAP FOR EROSION PROTECTION AROUND OUTLET.
7) AVOID SETTING VALVE IN LOW LYING AREAS OF POTENTIAL FLOODING (DRAINAGE PATH OR PONDING).
8) CONTRACTOR TO PROVIDE THE BOLTS, NUTS & GASKET FOR THE MJ CONNECTION BETWEEN THE PIPE AND THE BLOW-OFF VALVE.
9) CONCRETE BLOCKS USED SHALL BE COMMON IN SIZE.

4E-1 (WMAT)

BLOW-OFF HYDRANT WITH PORTABLE DISCHARGE RISER

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
07-18	REVISED	LTS
01-19	REVISED	LTS
03-19	REVISED	C.G.
03-19	REVISED	LTS

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PAO REVISED DETAILS
WATER – SEWER – MISC DETAILS
BLOW-OFF VALVE WITH PORTABLE DISCHARGE RISER

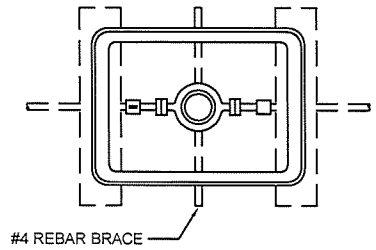
DRAWN BY: ----- DATE: -----
CHECKED BY: ----- DATE: -----

FILE NAME: REVISED WATER DRAWINGS WMAT
LAYOUT NAME: 4E-1 WMAT EADO
PROJ ENG: -----

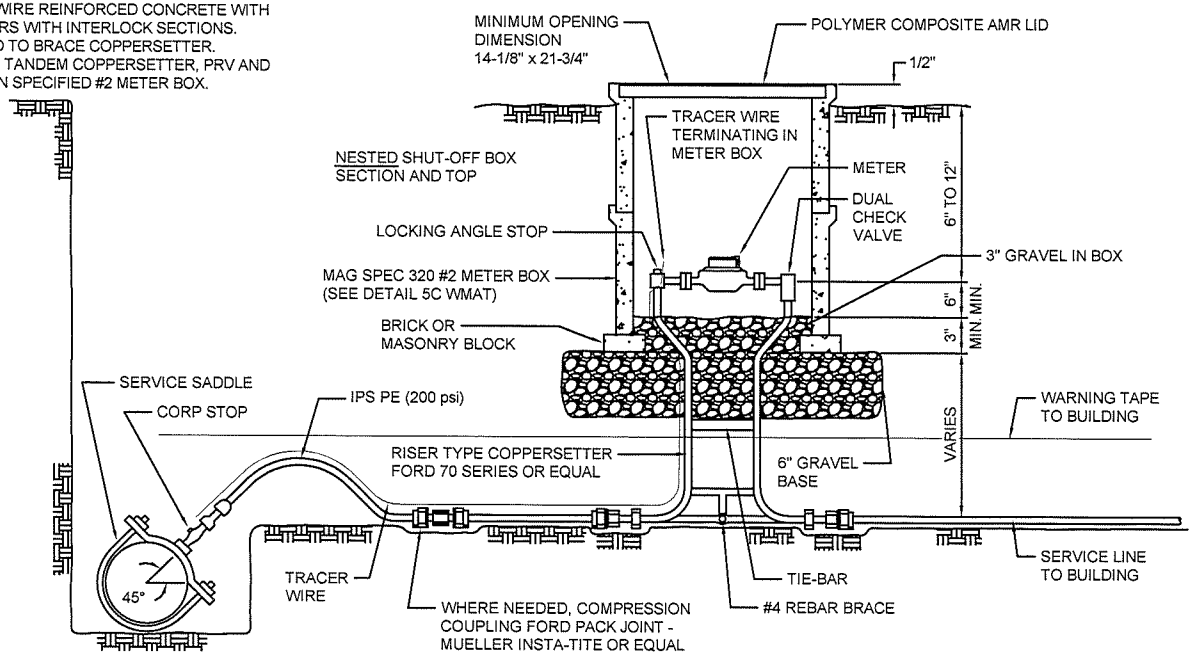
INCORPORATED INTO THE CONTRACT

NOTES:

1) MINIMUM HORIZONTAL DISTANCE BETWEEN WATER SERVICE LINE & SEWER SERVICE LINES SHALL BE 10 FEET.
2) WATER SERVICE LINE BURY SHALL BE A MINIMUM OF 36 INCHES.
3) POLYETHYLENE (PE) PIPE SHALL BE 1 INCH FOR SERVICE LINES LESS THAN 200 FEET & 1-1/2 INCHES FOR SERVICE LINES OVER 200 FEET AND LESS THAN 300 FEET.
4) WATER SERVICE LINES SHALL NOT EXTEND BEYOND 300 FEET. IF NEEDED, 2 INCH PE. LATERALS SHALL BE INSTALLED TO EXTEND WATER SERVICE TO INDIVIDUAL HOMES.
5) WATER METER BOX SHALL BE LOCATED AS SHOWN ON THE PLANS OR DIRECTED BY OWNER.
6) WHERE APPLICABLE, EXISTING WATER SERVICE LINES SHALL BE CONNECTED TO NEW WATER MAIN LINES USING A NEW SERVICE SADDLE AND CORPORATION STOP.
7) WARNING TAPE SHALL BE INSTALLED ON ALL WATER SERVICE LINES FROM THE MAIN TO THE BUILDING.
8) TRACER WIRE SHALL ONLY BE INSTALLED ON WATER SERVICE LINES FROM THE MAIN TO THE METER, WHEN SHOWN ON THE DRAWINGS OR INSTRUCTED BY THE OWNER AND IN ACCORDANCE WITH THE SPECIFICATIONS.
9) TRACER WIRE ACCESS BOX SHALL BE LOCATED AS INDICATED ON THE PLANS.
10) ALL THREADED FITTINGS (CORPORATION STOP, PE CONNECTORS) FOR PE PIPE ARE TO BE IPS THREADS. OTHER THREADS NOT ALLOWED.
11) OUTLET TO COPPER SETTER SHALL HAVE A DUAL CHECK VALVE.
12) METER BOXES IN TRAFFIC AREAS SHALL BE WIRE REINFORCED CONCRETE WITH STEEL DIAMOND PLATE OR CAST IRON COVERS WITH INTERLOCK SECTIONS.
13) 18" LONG, #4 REBAR OR 1/2" PIPE TO BE USED TO BRACE COPPERSETTER.
14) FOR INDIVIDUAL PRV INSTALLATION USE THE TANDEM COPPERSETTER, PRV AND METER AS SPECIFIED IN TP 05 AND INSTALL IN SPECIFIED #2 METER BOX.



TOP VIEW



SECTION VIEW

5A-1 (WMAT) WATER SERVICE LINE CONNECTION

Scale: NTS

DATE	REVISIONS	INITIALS
10-18	REVISED	LTS
12-18	REVISED	LTS
03-19	REVISED	LTS

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(928) 537-0578

THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
WATER SERVICE LINE CONNECTION

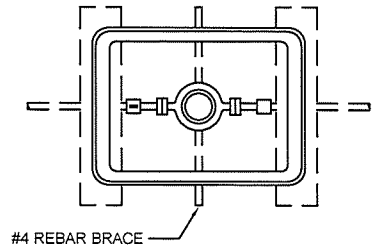
DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 5A-1 WMAT EADO
PROJ ENG: _____

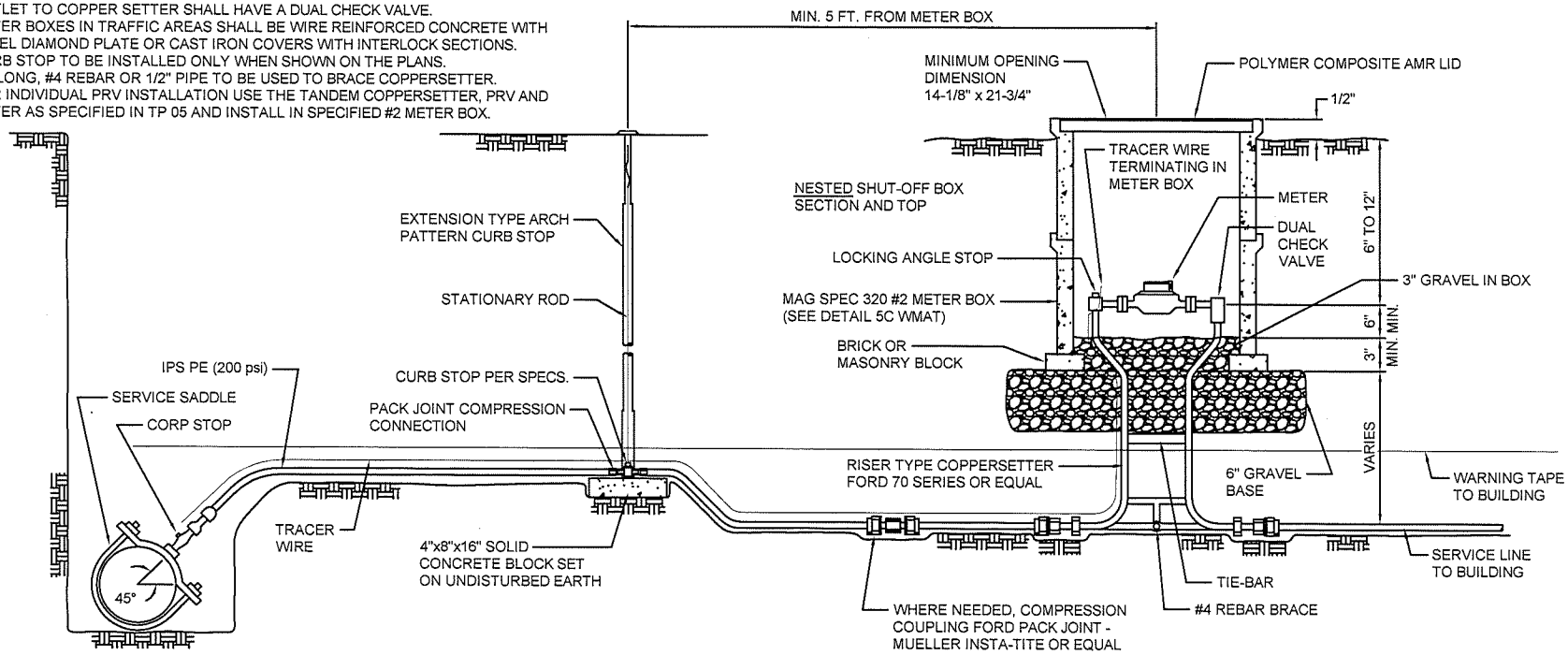
INCORPORATED INTO THE CONTRACT

NOTES:

1) MINIMUM HORIZONTAL DISTANCE BETWEEN WATER SERVICE LINE & SEWER SERVICE LINES SHALL BE 10 FEET.
2) WATER SERVICE LINE BURY SHALL BE A MINIMUM OF 36 INCHES.
3) POLYETHYLENE (PE) PIPE SHALL BE 1 INCH FOR SERVICE LINES LESS THAN 200 FEET & 1-1/2 INCHES FOR SERVICE LINES OVER 200 FEET AND LESS THAN 300 FEET.
4) WATER SERVICE LINES SHALL NOT EXTEND BEYOND 300 FEET. IF NEEDED, 2 INCH PE. LATERALS SHALL BE INSTALLED TO EXTEND WATER SERVICE TO INDIVIDUAL HOMES.
5) WATER METER BOX SHALL BE LOCATED AS DIRECTED BY OWNER.
6) WHERE APPLICABLE, EXISTING WATER SERVICE LINES SHALL BE CONNECTED TO NEW WATER MAIN LINES USING A NEW SERVICE SADDLE AND CORPORATION STOP.
7) WARNING TAPE SHALL BE INSTALLED ON ALL WATER SERVICE LINES FROM THE MAIN TO THE BUILDING.
8) TRACER WIRE SHALL ONLY BE INSTALLED ON WATER SERVICE LINES FROM THE MAIN TO THE METER, WHEN SHOWN ON THE DRAWINGS OR INSTRUCTED BY THE OWNER AND IN ACCORDANCE WITH THE SPECIFICATIONS.
9) TRACER WIRE ACCESS BOX SHALL BE LOCATED AS INDICATED ON THE PLANS.
10) ALL THREADED FITTINGS (CORPORATION STOP, PE CONNECTORS) FOR PE PIPE ARE TO BE IPS THREADS. OTHER THREADS NOT ALLOWED.
11) OUTLET TO COPPER SETTER SHALL HAVE A DUAL CHECK VALVE.
12) METER BOXES IN TRAFFIC AREAS SHALL BE WIRE REINFORCED CONCRETE WITH STEEL DIAMOND PLATE OR CAST IRON COVERS WITH INTERLOCK SECTIONS.
13) CURB STOP TO BE INSTALLED ONLY WHEN SHOWN ON THE PLANS.
14) 18" LONG, #4 REBAR OR 1/2" PIPE TO BE USED TO BRACE COPPERSETTER.
15) FOR INDIVIDUAL PRV INSTALLATION USE THE TANDEM COPPERSETTER, PRV AND METER AS SPECIFIED IN TP 05 AND INSTALL IN SPECIFIED #2 METER BOX.



TOP VIEW



SECTION VIEW

5B (WMAT) WATER SERVICE LINE CONNECTION WITH CURB STOP

Scale: NTS

DATE	REVISIONS	INITIALS
10-18	REVISED	LTS
12-18	REVISED	LTS
03-19	REVISED	LTS

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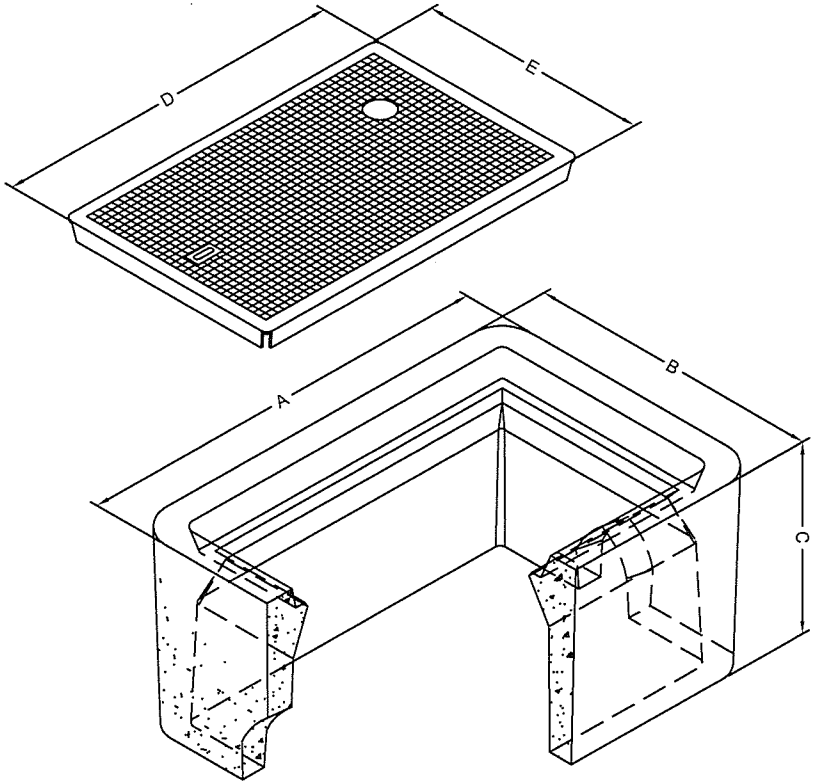
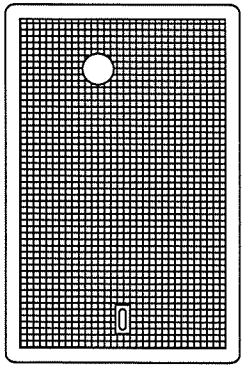
THE WHITE MOUNTAIN APACHE TRIBE
WATER – SEWER – MISC DETAILS
WATER SERVICE LINE CONNECTION WITH CURB STOP

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

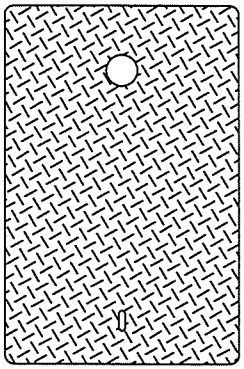
FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 5B WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT





POLYMER WITH TOUCH READ OR I-TRON SLOT FOR RESIDENTIAL METERS (OR NON-TRAFFIC RATED AREAS)



DIAMOND PLATE STEEL WITH TOUCH READ FOR COMMERCIAL METERS (OR TRAFFIC RATED AREAS)

MAG SPEC 320 BOX DIMENSIONS					MAG SPEC 320 LIDS		COVER DIMENSIONS	
BOX NO.	A	B	C	BOX WEIGHT	POLYMER	DIAMOND WITH TOUCH READ & I-TRON SLOT	D	E
1	19"	12"	12"	85 lbs.	NO. 1	NO. 1	15-7/8"	9"
2	25-3/4"	18"	12"	139 lbs.	NO. 2	NO. 2	21-3/4"	14-1/8"
3	29-1/2"	18-1/2"	12"	123 lbs.	N/A	NO. 3	26-1/4"	15-1/4"
4	33-1/2"	22-3/4"	12"	196 lbs.	N/A	NO. 4	30"	19-1/2"

NOTES:
1) HIGH DENSITY CONCRETE BOXES CONFORMING TO MAG SPEC. 320.
2) MAG #2 SHOWN.
   - CONCRETE BOX
   - STEEL COVERS
   - POYLMER LID
3) APPROXIMATE DIMENSIONS SHOWN.

5C (WMAT) **CONCRETE METER BOX & LIDS**
Scale: N.T.S.

DATE	REVISIONS	INITIALS
12-18		LTS
03-19	REVISED	LTS

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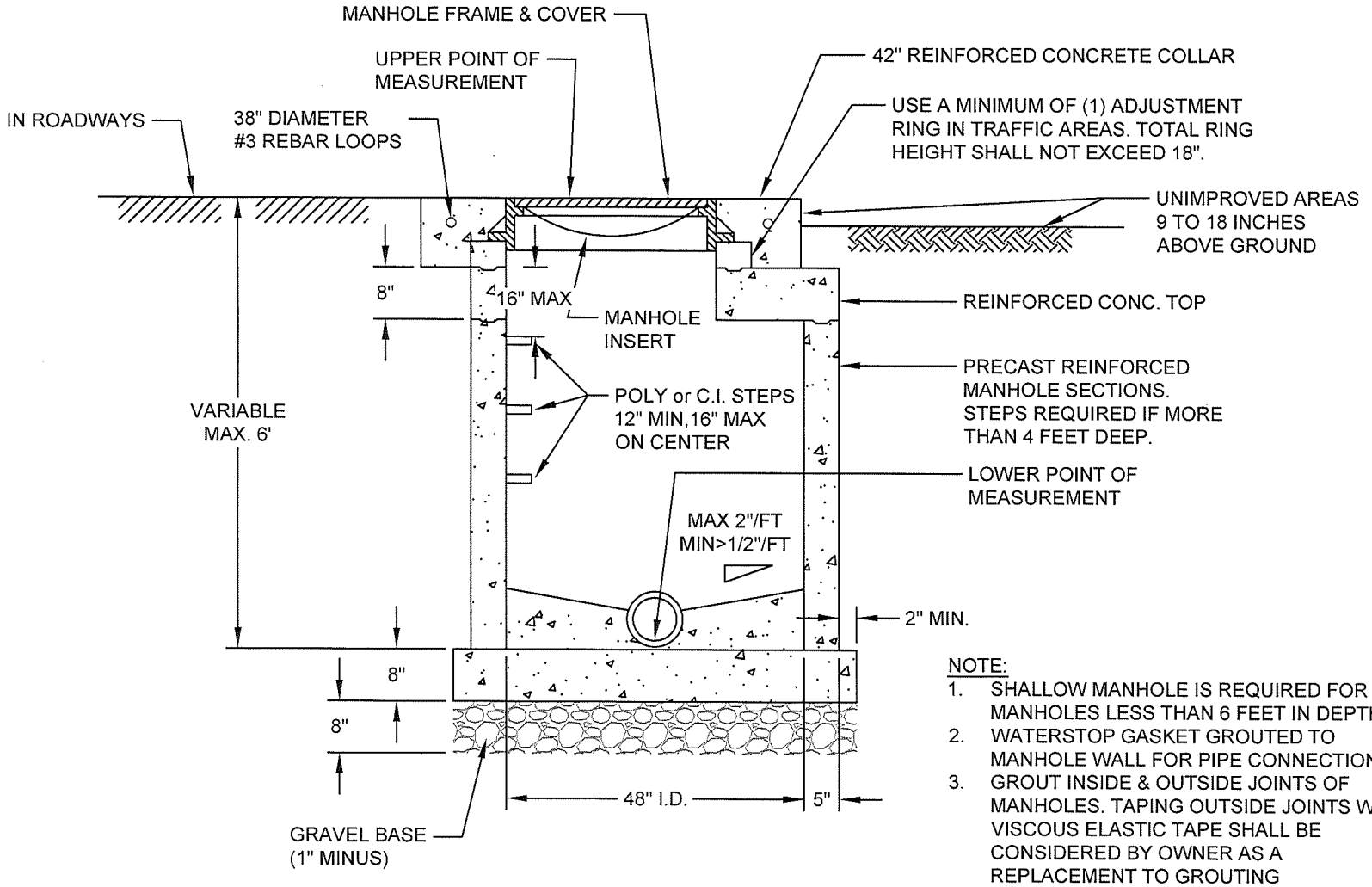
THE WHITE MOUNTAIN APACHE TRIBE
WATER – SEWER – MISC DETAILS
CONCRETE METER BOX & LIDS

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 5C WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT



6A-1 (WMAT)

SHALLOW MANHOLE

Scale: N.T.S.

NOTE:

1. SHALLOW MANHOLE IS REQUIRED FOR ALL MANHOLES LESS THAN 6 FEET IN DEPTH.
2. WATERSTOP GASKET GROUTED TO MANHOLE WALL FOR PIPE CONNECTIONS.
3. GROUT INSIDE & OUTSIDE JOINTS OF MANHOLES. TAPING OUTSIDE JOINTS WITH VISCOUS ELASTIC TAPE SHALL BE CONSIDERED BY OWNER AS A REPLACEMENT TO GROUTING
4. STEPS SHALL BE CENTERED OVER MANHOLE OUTLET.
5. REINFORCEMENT IN CONCRETE COLLARS ONLY NEEDED IN ROADWAYS.
6. TEST MANHOLE PRIOR TO BACKFILLING.

DATE	REVISIONS	INITIALS
12-14	UPDATED	
05-18	REVISED	DA
01-19	REVISION	LTS
03-19	REVISED	C.G.
03-19	REVISED	LTS

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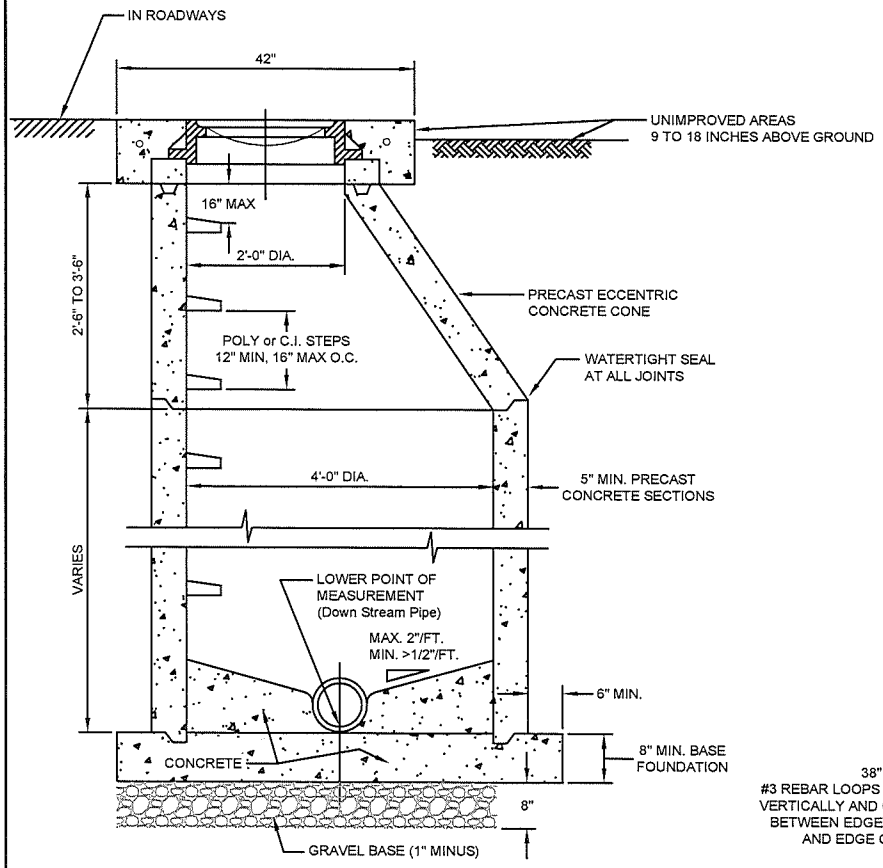
PAO REVISED DETAILS
WATER – SEWER – MISC DETAILS
SHALLOW MANHOLE

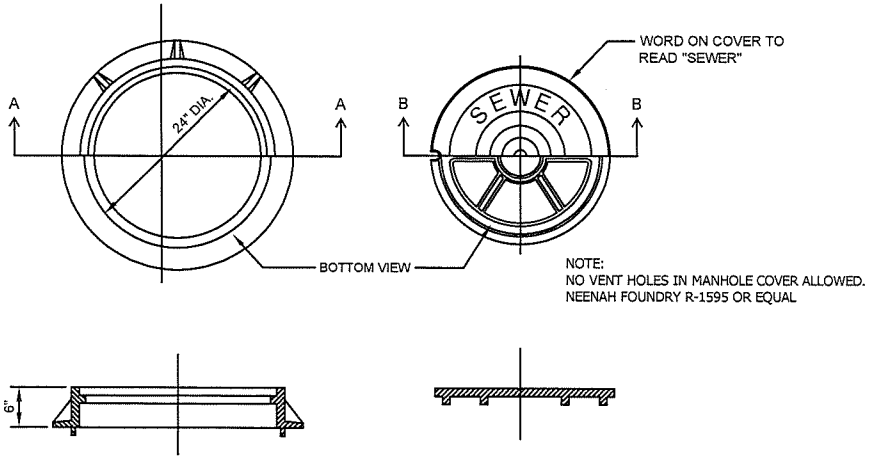
DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

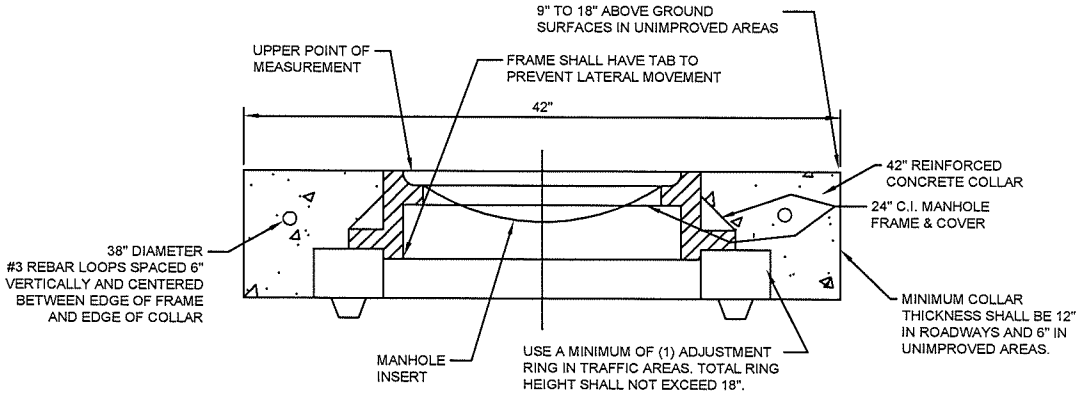
FILE NAME: REVISED SEWER DRAWINGS WMAT
LAYOUT NAME: 6A-1 WMAT EADO
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



NOTES:
1) WATERSTOP GASKET GROUTED TO MANHOLE WALL FOR PIPE CONNECTIONS.
2) GROUT INSIDE & OUTSIDE JOINTS OF MANHOLES, TAPING OUTSIDE JOINTS WITH VISCOUS ELASTIC TAPE, SUCH AS VISCOTAQ OR APPROVED EQUAL, SHALL BE CONSIDERED BY OWNER AS A REPLACEMENT TO GROUTING.
3) REINFORCEMENT IN CONCRETE COLLARS ONLY NEEDED IN ROADWAYS.
4) MH DEPTH >13 FT REQUIRES A 12 IN MIN BASE FOUNDATION, MH DEPTH >20 FT REQUIRES STRUCTURAL CALCULATIONS FOR BASE FOUNDATION THICKNESS.
5) STEPS SHALL BE CENTERED OVER MANHOLE OUTLET.
6) TEST MANHOLE PRIOR TO BACKFILLING.





MANHOLE FRAME & COVER DETAIL

6B-1 **MANHOLE & MANHOLE FRAME & COVER**
Scale: N.T.S.
(WMAT)

DATE	REVISIONS	INITIALS
12–14	UPDATED	
05–18	REVISED	DA
01–19	REVISION	LTS
03–19	REVISED	C.G.
03–19	REVISED	LTS

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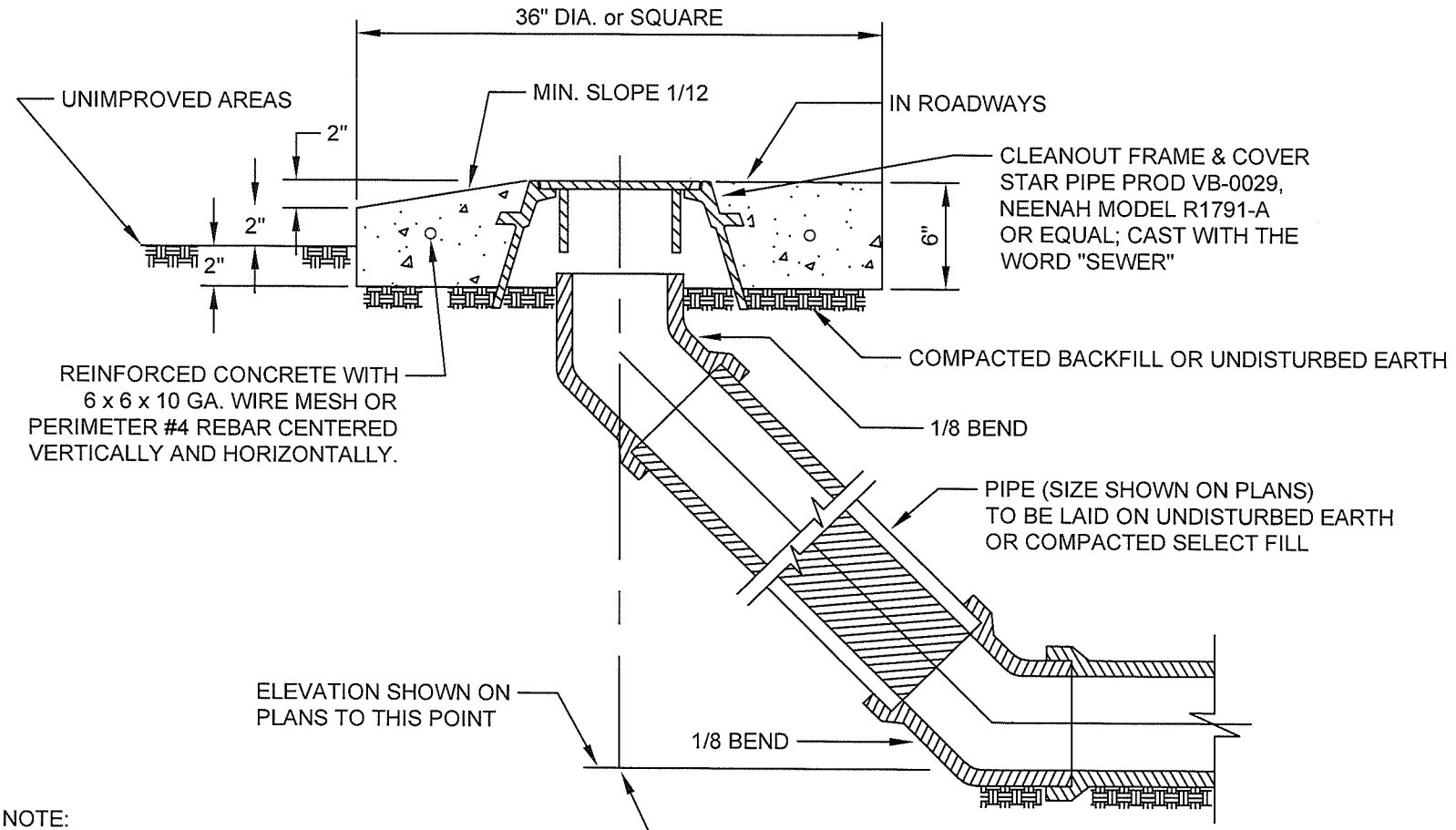
PAO REVISED DETAILS
WATER – SEWER – MISC DETAILS
MANHOLE & MANHOLE FRAME & COVER

DRAWN BY: ----- DATE: -----
CHECKED BY: ----- DATE: -----

FILE NAME: REVISED SEWER DRAWINGS WMAT
LAYOUT NAME: 6B–1 WMAT EADO
PROJ ENG: -----

INCORPORATED INTO THE CONTRACT



NOTE:

1) IF WIRE MESH IS USED INSTEAD OF REBAR, THE WIRE MESH SHALL EXTEND TO WITHIN 2" OF THE EDGE OF THE COLLAR

SEWER MAIN CLEANOUT

6G-1 (WMAT)

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA
01-19	REVISION	LTS
03-19	REVISED	C.G.
03-19	REVISED	LTS

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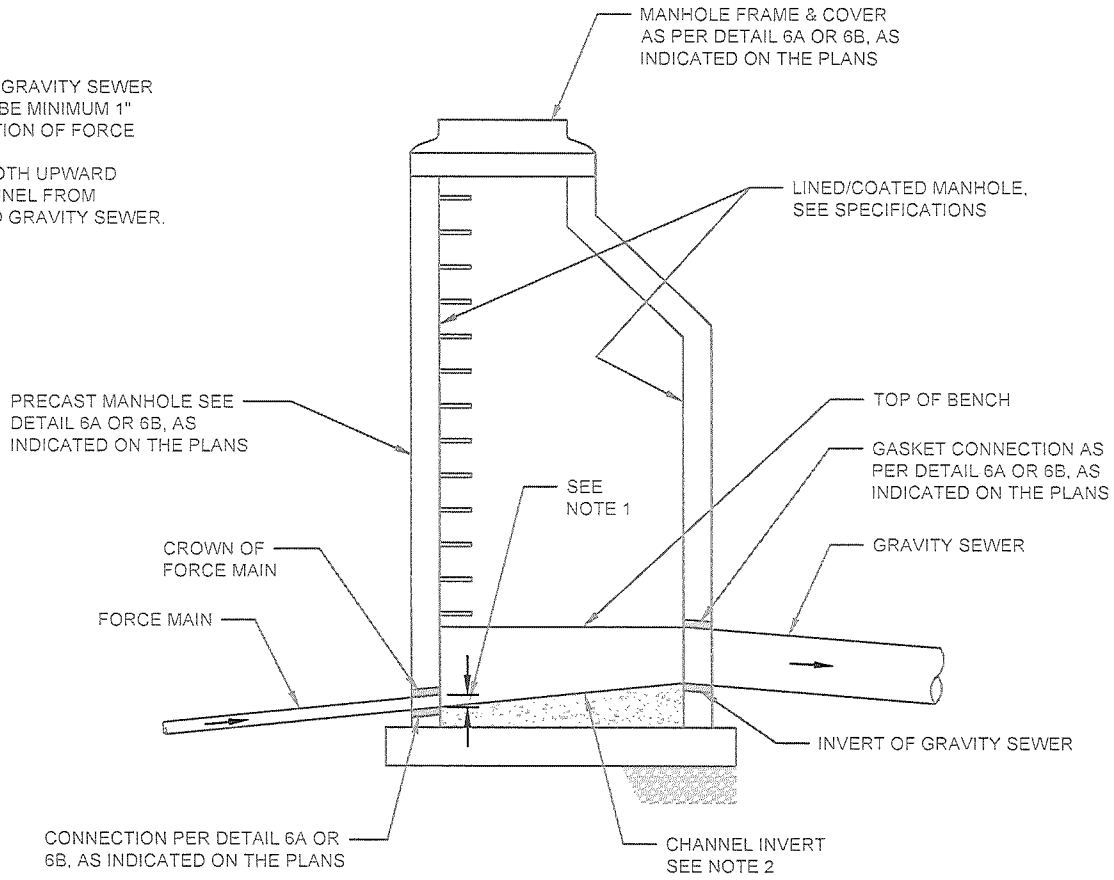
PAO REVISED DETAILS
WATER – SEWER – MISC DETAILS
SEWER MAIN CLEANOUT

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED SEWER DRAWINGS WMAT
LAYOUT NAME: 6G-1 WMAT EADO
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT

NOTES:
1. ELEVATION OF GRAVITY SEWER INVERT SHALL BE MINIMUM 1" ABOVE ELEVATION OF FORCE MAIN CROWN.
2. PROVIDE SMOOTH UPWARD SLOPING CHANNEL FROM FORCEMAIN TO GRAVITY SEWER.



6H
(WMAT)

FORCEMAIN TO GRAVITY SEWER TRANSITION MANHOLE

Scale: NTS

DATE	REVISIONS	INITIALS

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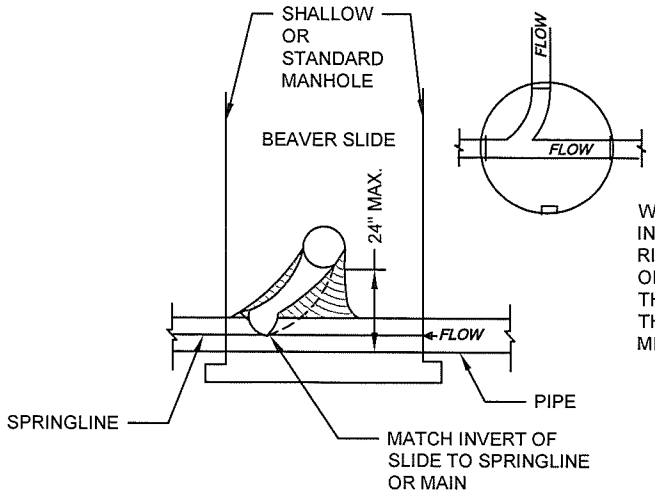
(WMAT) FM TO GRAVITY SEWER TRANSITION MH DETAIL

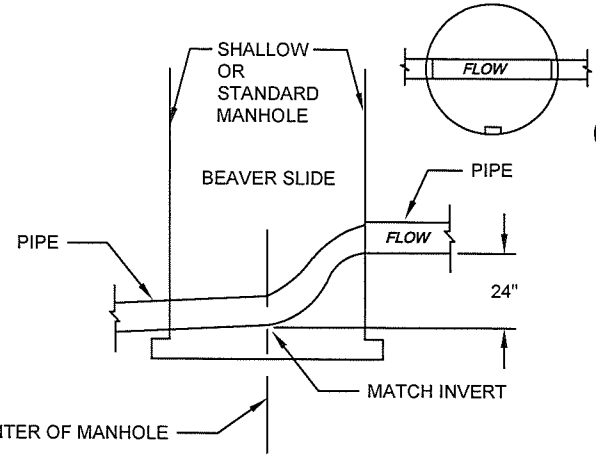
DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

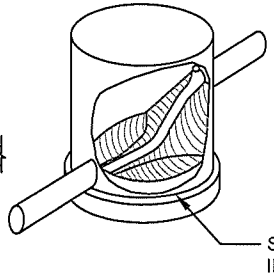
FILE NAME: LTS-2019
LAYOUT NAME: SHEET 02
PROJ ENG: LORENZO SANTANA

INCORPORATED INTO THE CONTRACT



WHEN INSTALLING A BEAVER SLIDE THAT INTERCEPTS AN EXISTING SEWER AT A RIGHT ANGLE. THE CONNECTING INVERT OF THE BEAVER SLIDE IS TO INTERCEPT THE EXISTING SEWER SLIGHTLY ABOVE THE SPRINGLINE AS SHOWN. DISTANCE MEASURED FROM INVERT ITO INVERT.





WHEN INSTALLING A BEAVER SLIDE WHERE THE FLOW IS STRAIGHT THROUGH THE MANHOLE. THE BEAVER SLIDE IS TO MATCH THE INVERT OF THE EXISTING LINE AND NOT TO EXTEND MORE THAN HALF-WAY THROUGH THE MANHOLE. DISTANCE MEASURED FROM INVERT TO INVERT. PREMIX MORTAR PROHIBTED.

6 I BEAVER SLIDE MANHOLE

Scale: N.T.S.

(WMAT)

DATE	REVISIONS	INITIALS
11-18	REVISED	LTS
12-18	REVISED	LTS
03-19	REVISED	LTS

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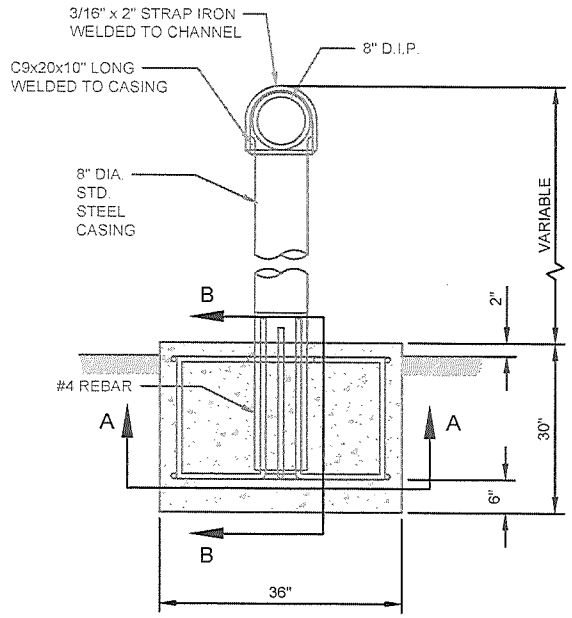
THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
BEAVER SLIDE MANHOLE

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

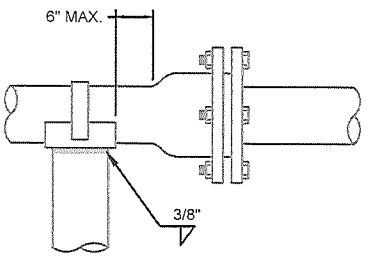
FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 6 I WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT

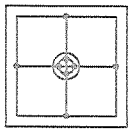
NOTE:
1. PAINT ALL EXPOSED CASING, CHANNEL AND STRAP.
2. PAINT SHALL BE TAN IN COLOR AND RUST RESISTANT.
3. INSTALL STEEL CASING PIER ASSEMBLY IN ACCORDANCE WITH SPECIFICATIONS.



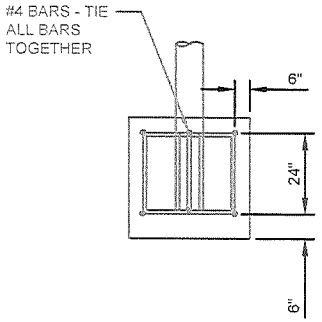
NOTE:
PIER SPACING WILL BE 18 FEET OR 20 FEET DEPENDING UPON LENGTHS OF PIPE ROVIDED.



PIPE SUPPORT PLACEMENT



SECTION A-A



SECTION B-B

6J (WMAT) **STEEL CASING PIERS**
Scale: NTS

DATE	REVISIONS	INITIALS

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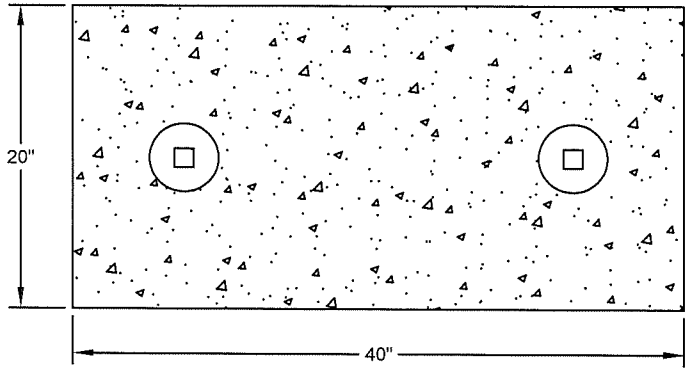
(WMAT) STEEL CASING PIERS

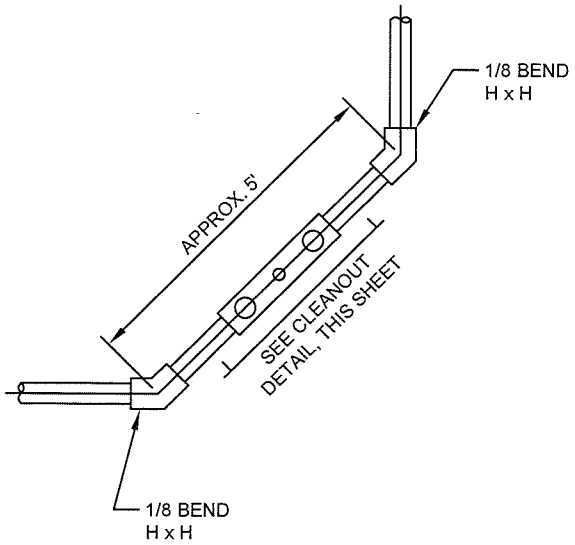
DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

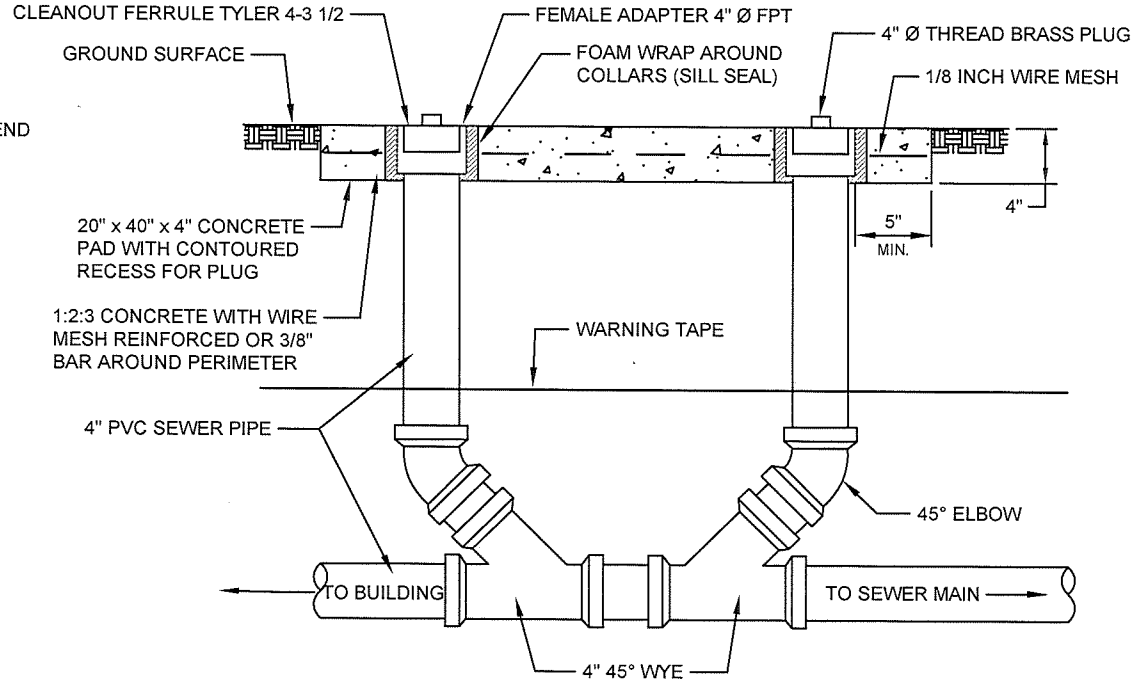
FILE NAME: LTS-2019
LAYOUT NAME: SHEET 03
PROJ ENG: LORENZO SANTANA

INCORPORATED INTO THE CONTRACT

NOTES:
1) ALL 90° TURNS IN 4" SEWER SERVICE LINES WILL BE MADE WITH 2 1/8 BENDS (45°), AS SHOWN BELOW. FOR OTHER TURNS FITTINGS AS REQUIRED.
2) THE REQUIRED DISTANCE BETWEEN THE TWO-WAY CLEANOUT AND THE HOUSE SHALL BE WITHIN 10 FT. OF BUILDING OR AS SHOWN ON PLANS.







7A-1 (WMAT)

SEWER SERVICE CLEANOUT

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11–14	UPDATED	
06–18	REVISED	LTS
03–19	REVISED	LTS

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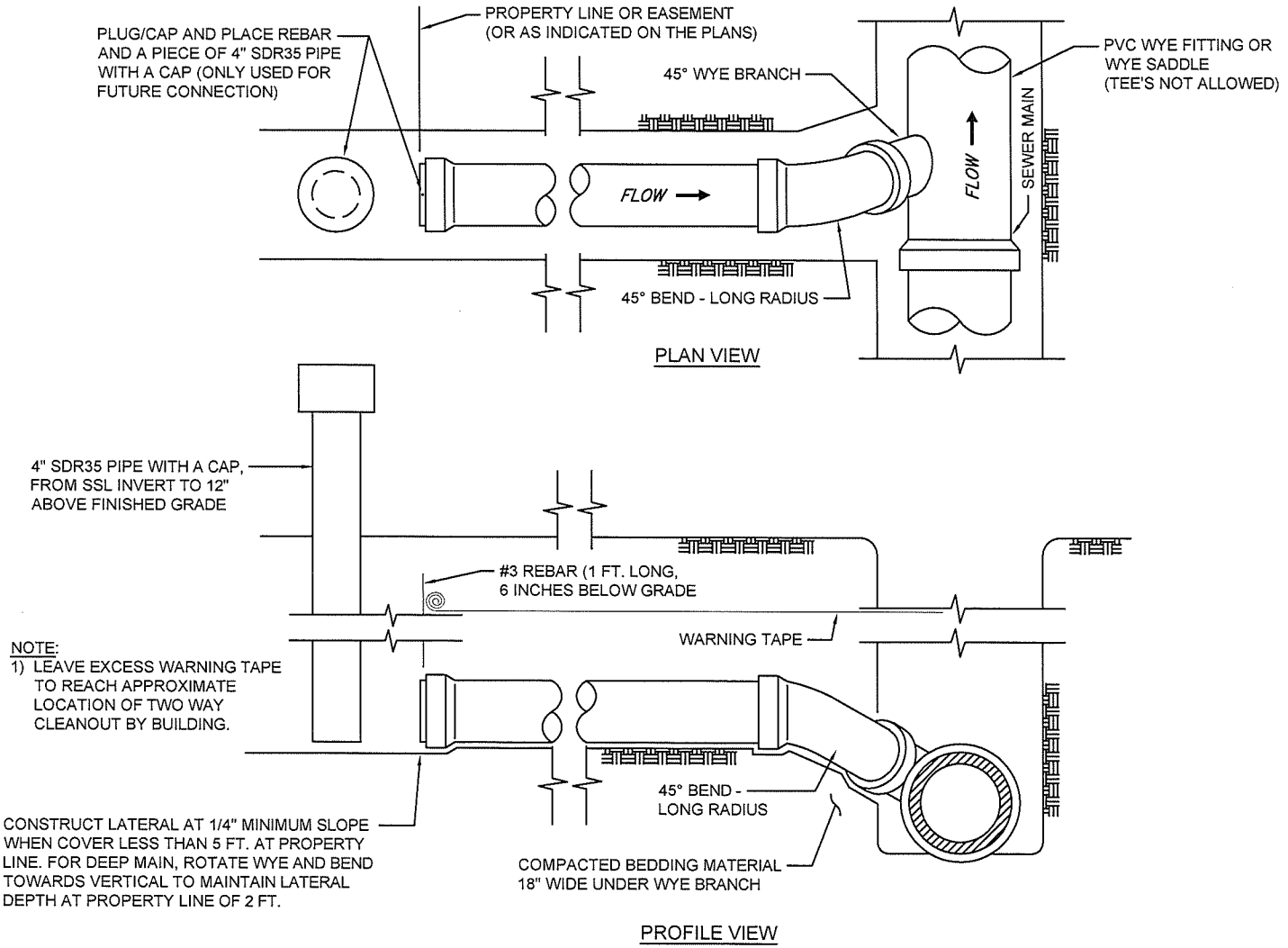
PAO REVISED DETAILS
WATER – SEWER – MISC DETAILS
SEWER SERVICE CLEANOUT

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED SEWER DRAWINGS WMAT
LAYOUT NAME: 7A–1 WMAT EADO
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



7B-1 (WMAT)

SEWER SERVICE WITHOUT CONNECTION

Scale: N.T.S.

DATE	REVISIONS	INITIALS
10-18	REVISED	LTS
12-18	REVISED	LTS
03-19	REVISED	LTS

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THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
SEWER SERVICE WITHOUT CONNECTION

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 7B-1 WMAT EADO
PROJ ENG: _____

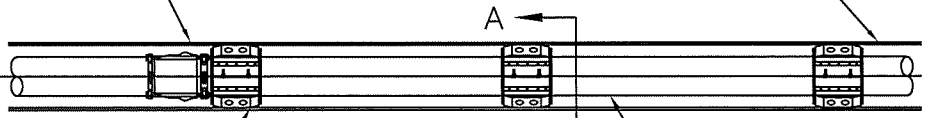
INCORPORATED INTO THE CONTRACT

ALL ASPECTS OF CASING INSTALLATIONS SHALL ADHERE TO UTILITY PERMIT REQUIREMENTS SPECIFIED BY THE ROW OWNER FOR ALL INSTALLATIONS WITHIN APPLICABLE RIGHT-OF-WAYS.

MINIMUM CASING PIPE DIAMETER REQUIREMENTS (UNLESS OTHERWISE INDICATED ON PLANS)	
CARRIER PIPE NOMINAL DIAMETER	MINIMUM NOMINAL CASING PIPE DIAMETER
4"	12"
6"	14"
8"	18"
10"	20"
12"	24"

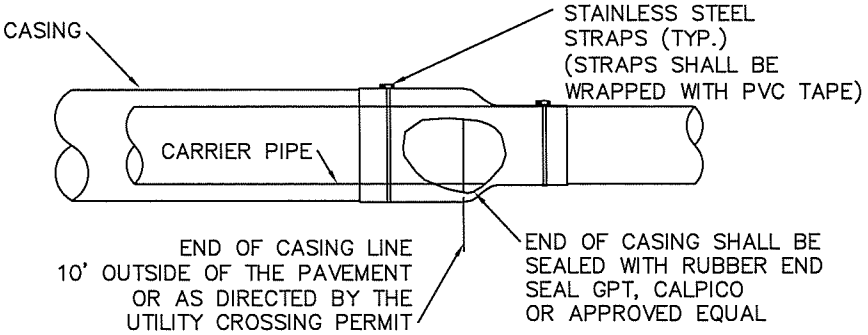
CASING PER UTILITY CROSSING PERMIT & PLAN SET. PRIOR TO INSTALLATION, THE CONTRACTOR SHALL VERIFY THAT THE DIAMETER OF CASING IS ADEQUATE TO ACCOMMODATE CARRIER PIPE, SPACERS AND PIPE RESTRAINTS.

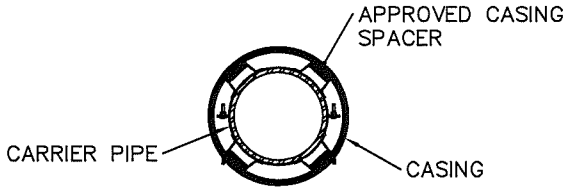
MAXIMUM SEPARATION OF SPACERS VARIES BY MANUFACTURER. PROVIDE A MIN.. OF 3 SPACERS PER 20' PIPE LENGTH



FOR PVC PIPE, ONE SPACER SHALL BE PLACED ON THE SPIGOT END OF EACH SEGMENT AT THE LINE MARKING THE LIMIT OF INSERTION INTO THE BELL. NOTE: JOINT RESTRAINTS ARE REQUIRED, ONE SPACER SHALL BE INSTALLED ADJACENT TO THE RESTRAINTS.

CARRIER PIPE & MATERIAL AS SPECIFIED IN CONTRACT DOCUMENTS





SECTION A - A

CASING DETAIL

11A-1

Scale: NTS

(WMAT)

DATE	REVISIONS	INITIALS
12-14	UPDATED	
04-18	REVISED	DA
03-19	REVISED	C.G.
03-19	REVISED	LTS

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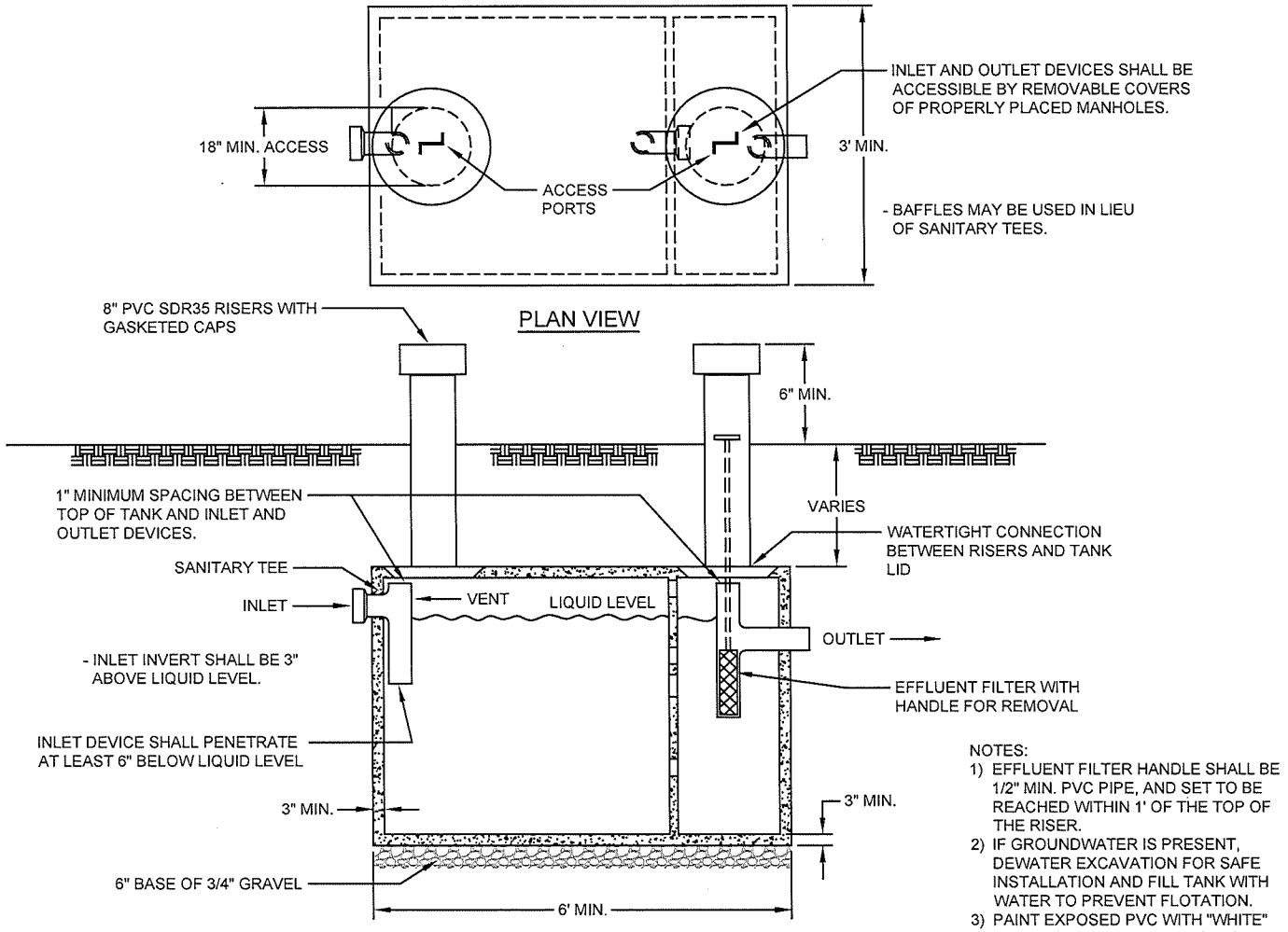
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
CASING DETAIL

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED MISC DRAWINGS WMAT
LAYOUT NAME: 11A-1 WMAT EADO
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



NOTES:
1) EFFLUENT FILTER HANDLE SHALL BE 1/2" MIN. PVC PIPE, AND SET TO BE REACHED WITHIN 1' OF THE TOP OF THE RISER.
2) IF GROUNDWATER IS PRESENT, DEWATER EXCAVATION FOR SAFE INSTALLATION AND FILL TANK WITH WATER TO PREVENT FLOTATION.
3) PAINT EXPOSED PVC WITH "WHITE" EPOXY OR ENAMEL UV PROTECTANT PAINT.

12A-1
(WMAT)

TYPICAL TWO COMPARTMENT CONCRETE SEPTIC TANK

Scale: NTS

DATE	REVISIONS	INITIALS
11-18	REVISED	LTS
12-18	REVISED	LTS
03-19	REVISED	LTS

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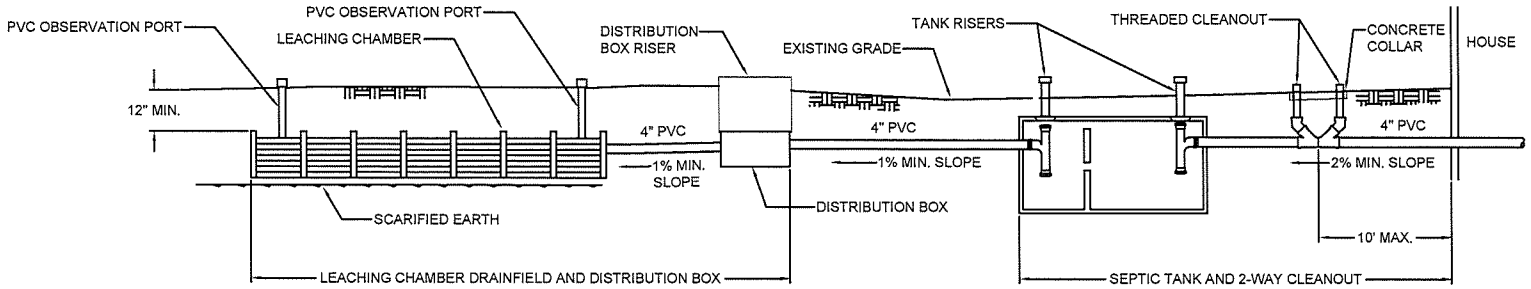
THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
TYPICAL TWO COMPARTMENT CONCRETE SEPTIC TANK

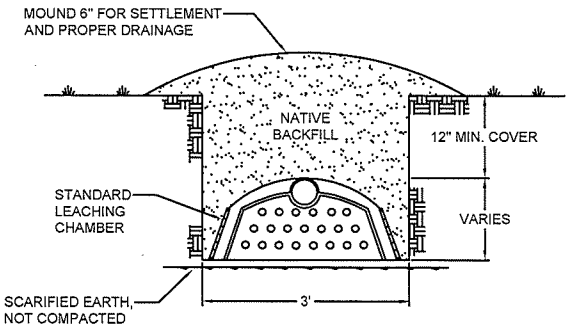
DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 12A-1 WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT

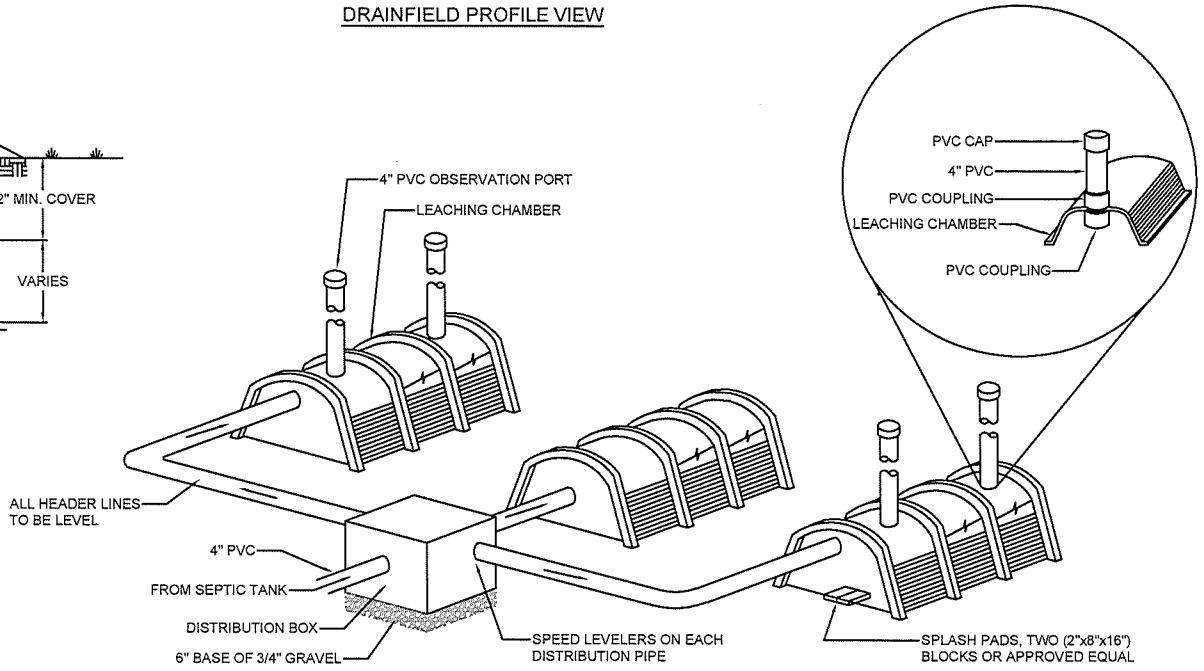


DRAINFIELD PROFILE VIEW



TRENCH DETAIL - END VIEW

NOTES:
1) ACTUAL NUMBER OF LEACHING CHAMBER ROWS, AND THE LENGTH OF EACH ROW FOR SPECIFIC SITES WILL BE BASED ON CALCULATIONS EVALUATING HOME SIZE AND SOIL LOADING RATES AND SHALL BE IDENTIFIED ON THE PLANS.
2) LOCATION OF OBSERVATION PORTS WILL BE ON ALL (4) CORNERS OF THE DRAINFIELD, UNLESS INDICATED OTHERWISE ON THE SITE PLANS OR BY THE OWNER'S REPRESENTATIVE.
3) PAINT EXPOSED PVC WITH "WHITE" EPOXY OR ENAMEL UV PROTECTANT PAINT.



LEACHING CHAMBER DRAINFIELD ISOMETRIC

12B-1 (WMAT) SEPTIC TANK & LEACHING CHAMBER DRAINFIELD (FLAT SITE)

Scale: NTS

DATE	REVISIONS	INITIALS
11-18	REVISED	LTS
12-18	REVISED	LTS
03-19	REVISED	LTS

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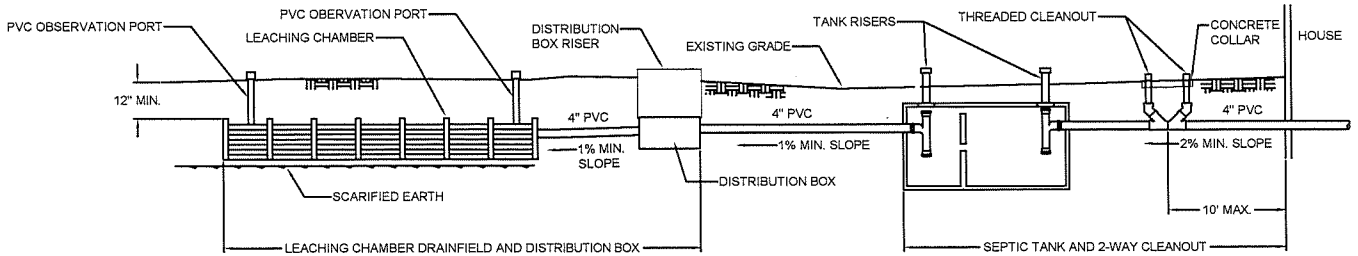
THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
SEPTIC TANK & LEACHING CHAMBER DRAINFIELD (FLAT SITE)

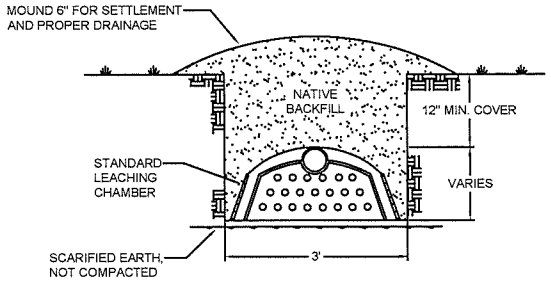
DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 12B-1 WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT

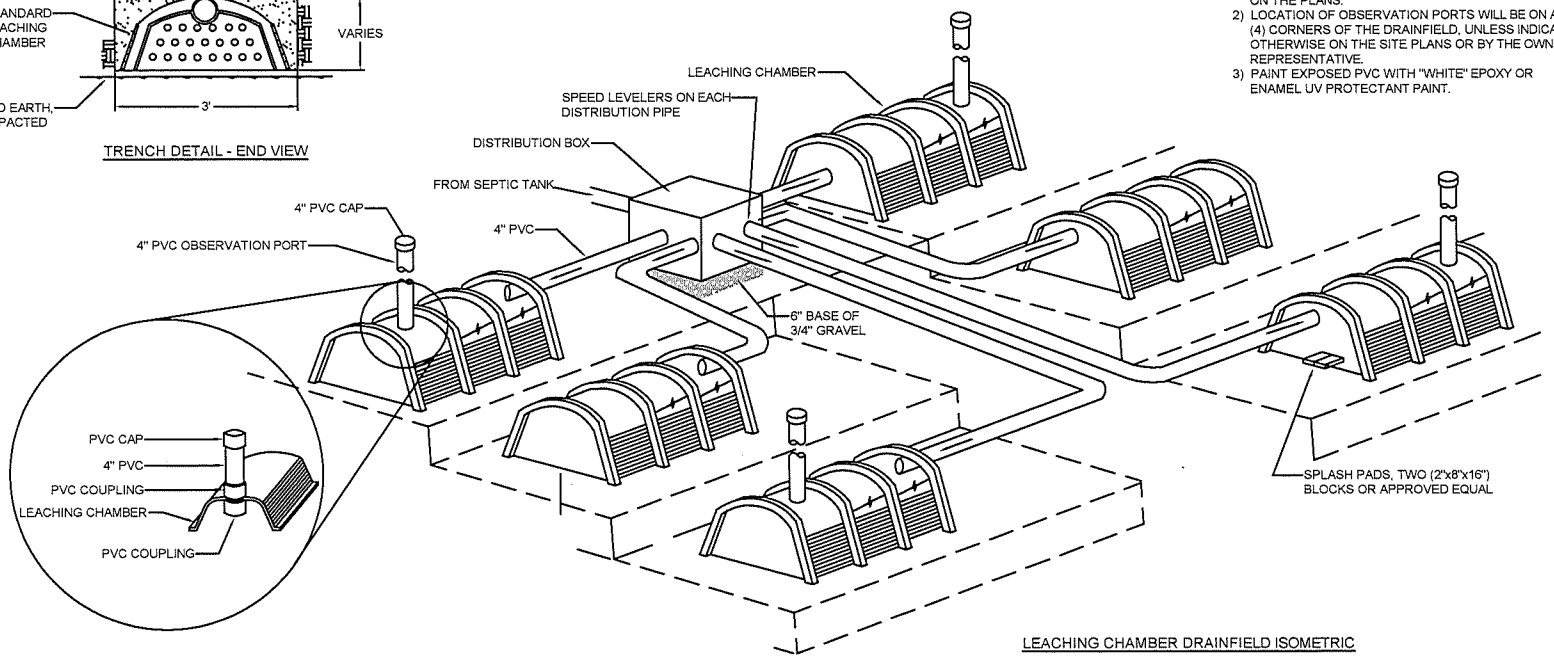


DRAINFIELD PROFILE VIEW



TRENCH DETAIL - END VIEW

NOTES:
1) ACTUAL NUMBER OF LEACHING CHAMBER ROWS, AND THE LENGTH OF EACH ROW FOR SPECIFIC SITES WILL BE BASED ON CALCULATIONS EVALUATING HOME SIZE AND SOIL LOADING RATES AND SHALL BE IDENTIFIED ON THE PLANS.
2) LOCATION OF OBSERVATION PORTS WILL BE ON ALL (4) CORNERS OF THE DRAINFIELD, UNLESS INDICATED OTHERWISE ON THE SITE PLANS OR BY THE OWNER'S REPRESENTATIVE.
3) PAINT EXPOSED PVC WITH "WHITE" EPOXY OR ENAMEL UV PROTECTANT PAINT.



LEACHING CHAMBER DRAINFIELD ISOMETRIC

12C-1 SEPTIC TANK & LEACHING CHAMBER DRAINFIELD (SLOPING SITE)

Scale: NTS

(WMAT)

DATE	REVISIONS	INITIALS
11-18	REVISED	LTS
12-18	REVISED	LTS
03-19	REVISED	LTS

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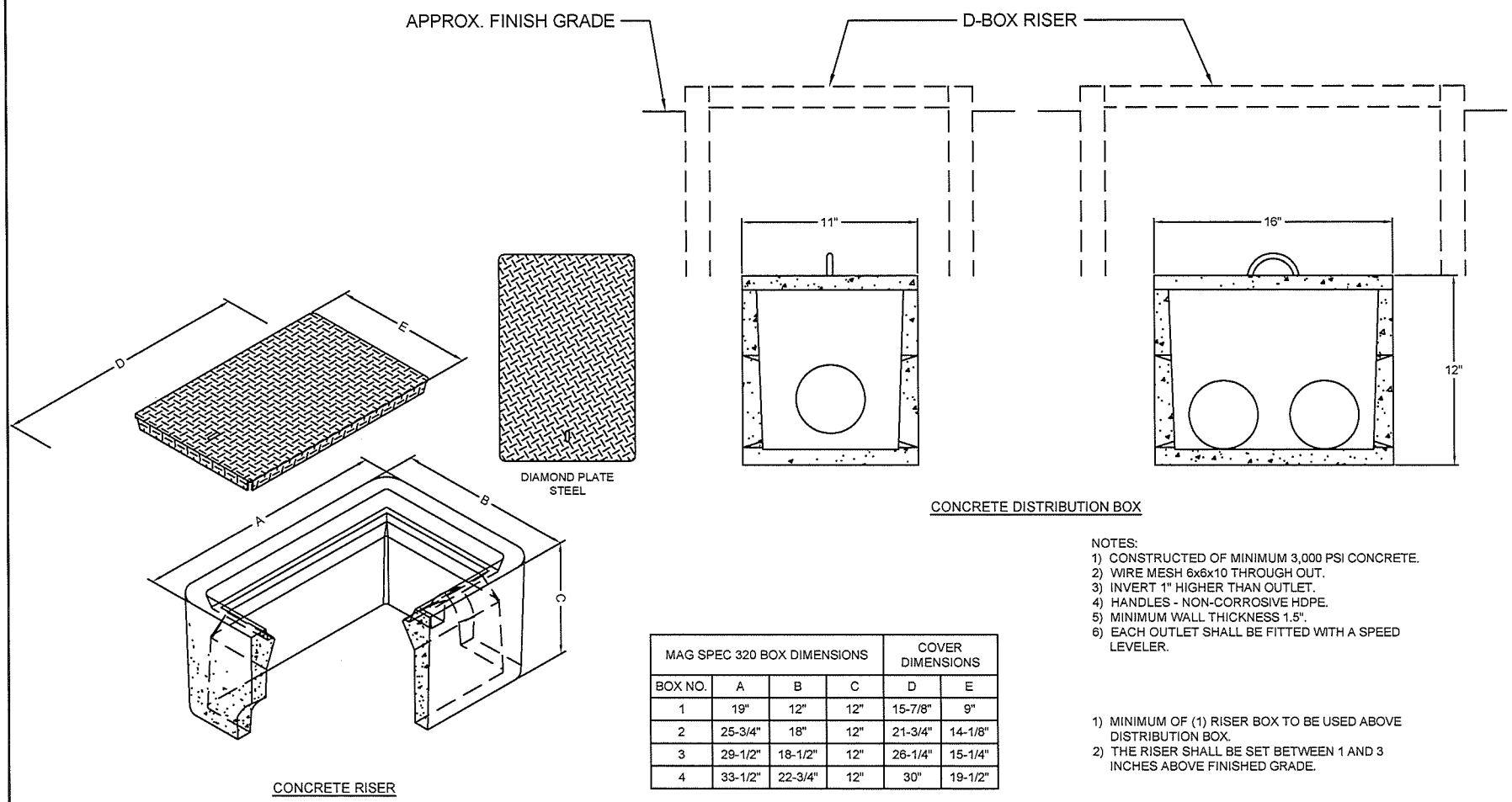
(928) 537-0578

THE WHITE MOUNTAIN APACHE TRIBE
WATER – SEWER – MISC DETAILS
SEPTIC TANK & LEACHING CHAMBER DRAINFIELD (SLOPING SITE)

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 12C-1 WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT



CONCRETE RISER

CONCRETE DISTRIBUTION BOX

MAG SPEC 320 BOX DIMENSIONS				COVER DIMENSIONS	
BOX NO.	A	B	C	D	E
1	19"	12"	12"	15-7/8"	9"
2	25-3/4"	18"	12"	21-3/4"	14-1/8"
3	29-1/2"	18-1/2"	12"	26-1/4"	15-1/4"
4	33-1/2"	22-3/4"	12"	30"	19-1/2"

NOTES:
1) CONSTRUCTED OF MINIMUM 3,000 PSI CONCRETE.
2) WIRE MESH 6x6x10 THROUGH OUT.
3) INVERT 1" HIGHER THAN OUTLET.
4) HANDLES - NON-CORROSIVE HDPE.
5) MINIMUM WALL THICKNESS 1.5".
6) EACH OUTLET SHALL BE FITTED WITH A SPEED LEVELER.

1) MINIMUM OF (1) RISER BOX TO BE USED ABOVE DISTRIBUTION BOX.
2) THE RISER SHALL BE SET BETWEEN 1 AND 3 INCHES ABOVE FINISHED GRADE.

(12E) CONCRETE DISTRIBUTION BOX & RISER
Scale: N.T.S.
(WMAT)

DATE	REVISIONS	INITIALS
12-18	REVISED	LTS
03-19	REVISED	LTS

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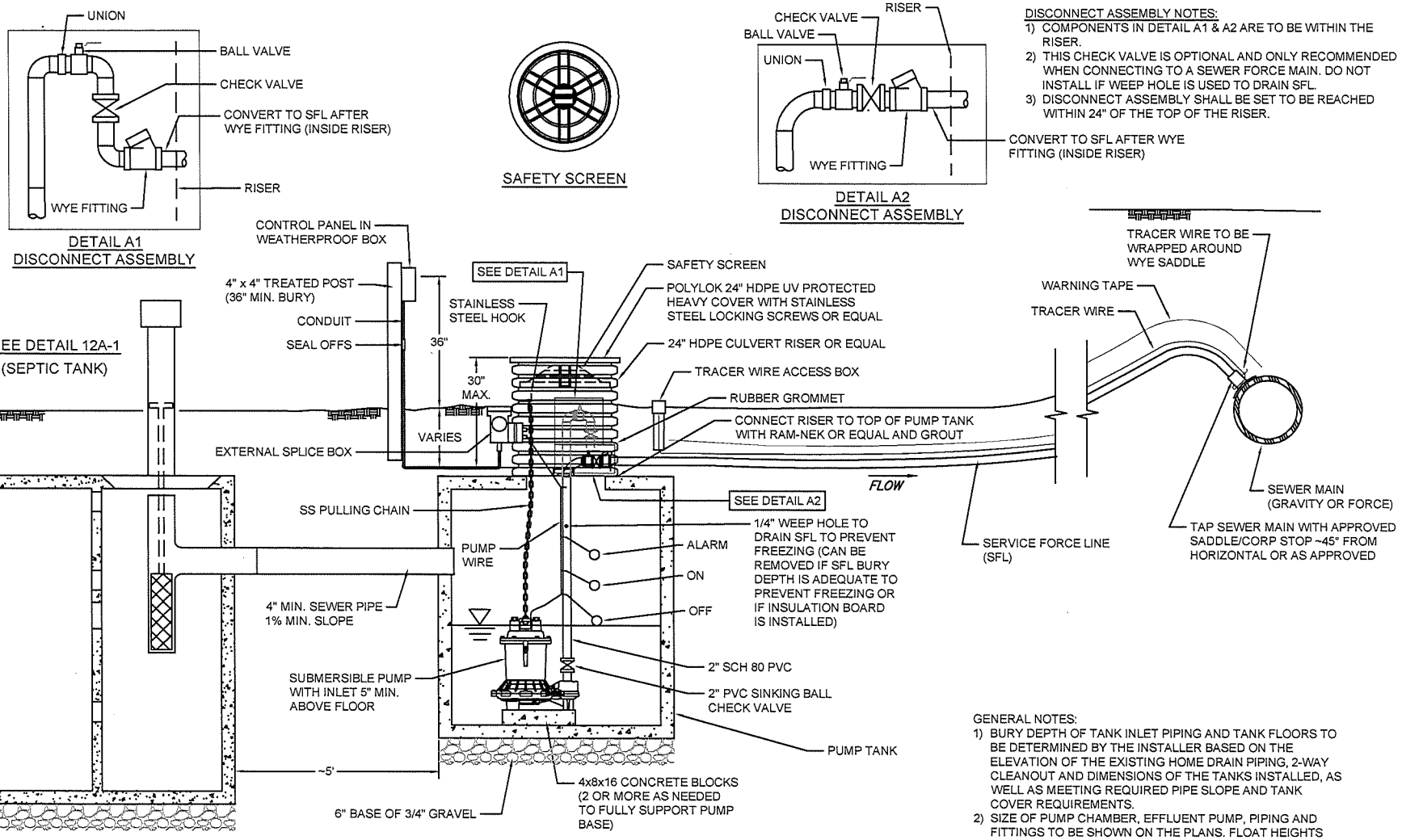
THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
CONCRETE DISTRIBUTION BOX & RISER

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 12E WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT



GENERAL NOTES:
1) BURY DEPTH OF TANK INLET PIPING AND TANK FLOORS TO BE DETERMINED BY THE INSTALLER BASED ON THE ELEVATION OF THE EXISTING HOME DRAIN PIPING, 2-WAY CLEANOUT AND DIMENSIONS OF THE TANKS INSTALLED, AS WELL AS MEETING REQUIRED PIPE SLOPE AND TANK COVER REQUIREMENTS.
2) SIZE OF PUMP CHAMBER, EFFLUENT PUMP, PIPING AND FITTINGS TO BE SHOWN ON THE PLANS. FLOAT HEIGHTS (ELEVATIONS) TO BE SHOWN ON THE PLANS.
3) USE BOLLARDS AS NEEDED OR SHOWN ON THE PLANS TO PROTECT PUMP TANK AND/OR CONTROL PANEL.
4) CONCRETE BLOCKS USED SHALL BE COMMON IN SIZE.
5) CONTROL PANEL AND POST TO BE LOCATED BY THE HOUSE OR AS SHOWN ON THE DRAWINGS.

16A-1 **SINGLE RESIDENCE LIFT STATION & SEPTIC TANK**
Scale: NTS
(WMAT)

DATE	REVISIONS	INITIALS
12-18	REVISED	LTS
03-19	REVISED	LTS
05-19	REVISED	LTS

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THE WHITE MOUNTAIN APACHE TRIBE
WATER - SEWER - MISC DETAILS
SINGLE RESIDENCE LIFT STATION & SEPTIC TANK

DRAWN BY: _____ DATE: _____
CHECKED BY: _____ DATE: _____

FILE NAME: WR-IDIQ DETAILS2
LAYOUT NAME: 16A-1 WMAT EADO
PROJ ENG: _____

INCORPORATED INTO THE CONTRACT

Standard Technical Details

Sheet List Table	
Layout	Sheet Title
SECTION 00	
00	SHEET SET TABLE
SECTION 01 - Trench & Backfill	
1A	TYPICAL TRENCH SECTIONS
1B	UTILITY LINE MARKER
1C	BOLLARD
1D	METAL MARKER POST
1E	ASPHALT PAVEMENT PATCH
1F	CONCRETE PAVEMENT PATCH
SECTION 04 - Water Mains	
4A	MECHANICAL RESTRAINTED JOINTS
4B	GATE VALVE WITH BOX
~~4C~~	~~FIRE HYDRANT WITH GATE VALVE~~
~~4D~~	~~BLOW-OFF & GATE VALVE~~
~~4E~~	~~BLOW-OFF VALVE WITH PORTABLE DISCHARGE RISER~~
4F	WATER AIR VALVE VAULT (OFFSET MAIN)
4G	WATER AIR VALVE VAULT (OVER MAIN)
4H	TAPPING SLEEVE AND VALVE
SECTION 05 - Water Service Lines	
~~5A~~	~~WATER SERVICE LINE CONNECTION~~
SECTION 06 - Gravity Sanitary Sewers	
~~6A~~	~~SHALLOW MANHOLE~~
~~6B~~	~~MANHOLE & MANHOLE FRAME & COVER~~
6C	DROP MANHOLE
6D	DIVERSION MANHOLE SLIDING GATE & GUIDE
6E	DIVERSION MANHOLE
6F	MANHOLE INVERTS
~~6G~~	~~SEWER MAIN CLEANOUT~~
SECTION 07 - Sewer Service Lines	
~~7A~~	~~SEWER SERVICE CLEANOUT~~
~~7B~~	~~SEWER SERVICE WITHOUT CONNECTION~~
7C	SEWER SERVICE SADDLE
SECTION 11 - Roadway & Special Utility Crossings	
~~11A~~	~~CASING DETAIL~~
SECTION 12 - Sewage Disposal Systems	
~~12A~~	~~TYPICAL TWO COMPARTMENT SEPTIC TANK~~
~~12B~~	~~SEPTIC TANK & LEACHING CHAMBER DRAINFIELD (FLAT SITE)~~
~~12C~~	~~SEPTIC TANK & LEACHING CHAMBER DRAINFIELD (SLOPING SITE)~~
12D	TYPICAL LOT PLAN

Sheet List Table	
Layout	Sheet Title
SECTION 13 - Individual Pressure Dosed Sewage Disposal System	
13A	MOUND SYSTEM PUMP TANK
13B	AT-GRADE OBSERVATION PIPE
13C	TYPICAL PERFORATED PIPE LAYOUT BED MOUND
13D	MOUND SYSTEM (SINGLE LATERAL IN GRAVEL MEDIA) DETAIL
13E	MOUND SYSTEM (DOUBLE LATERAL IN GRAVEL MEDIA) DETAIL
13F	MOUND SYSTEM (SINGLE LATERAL IN LEACHING CHAMBER MEDIA) DETAIL
13G	MOUND SYSTEM (DOUBLE LATERAL IN LEACHING CHAMBER MEDIA) DETAIL
SECTION 16 - Single Residence Lift Station	
~~16A~~	~~SINGLE RESIDENCE LIFT STATION & SEPTIC TANK~~
SECTION 30-31 - Water Storage Tank and Foundation	
30-31A	TYPICAL WATER TANK DETAILS
30-31B	WATER TANK OVERFLOW AND DRAIN
30-31C	WATER TANK OUTLET
30-31E	WATER TANK INDICATOR GAUGE
30-31F	WATER TANK LADDERS
30-31G	WATER TANK ROOF HATCH
SECTION 42 - Sewage Lift Station	
42A	LIFT STATION CONTROL PANEL STRUCTURE
42B	PORTABLE BOOM WITH WINCH
42C	PLATFORM SOCKET
42D	STAINLESS STEEL EMBEDDED SOCKET
42E	LIFTING - GRIP EYE
42F	TRASH BASKET GUIDERAIL
42G	TRASH BASKET DETAILS
42H	ACCESS DOOR FOR PUMP AND TRASH BASKET
42I	OPTIONAL LIFT STATION VALVE VAULT
42J	LIFT STATION WET WELL
42K	LIFT STATION JUNCTION BOX
42L	LIFT STATION ABOVE GROUND PIPING
SECTION 43 - Sewer Force Mains	
43A	FORCE MAIN CLEANOUT WITH MARKER POST
43B	WASTEWATER AIR VACUUM-RELIEF VALVE VAULT (OFFSET MAIN)
43C	WASTEWATER AIR VACUUM-RELIEF VALVE VAULT (OVER MAIN)
SECTION 56 - Horizontal Directional Drilling	
56A	TYPICAL HORIZONTAL DIRECTIONAL DRILLING DETAIL
SECTION 60 - Chain Link Fencing	
60A	FENCE POST

Sheet List Table	
Layout	Sheet Title
60B	FENCE AND GATE DETAIL
60C	DROP BAR LOCKING DEVICE
60D	GATE STOP
60E	GATE KEEPER

See WMAT Modified Details

1G
1H
1I
4C-1
4D-1
4E-1
5A-1
5B
5C
6A-1
6B-1
6G-1
6H
6I
6J
7A-1
7B-1
11A-1
12A-1
12B-1
12C-1
12E
16A-1

DATE	REVISIONS	INITIALS
06-18	REVISED	

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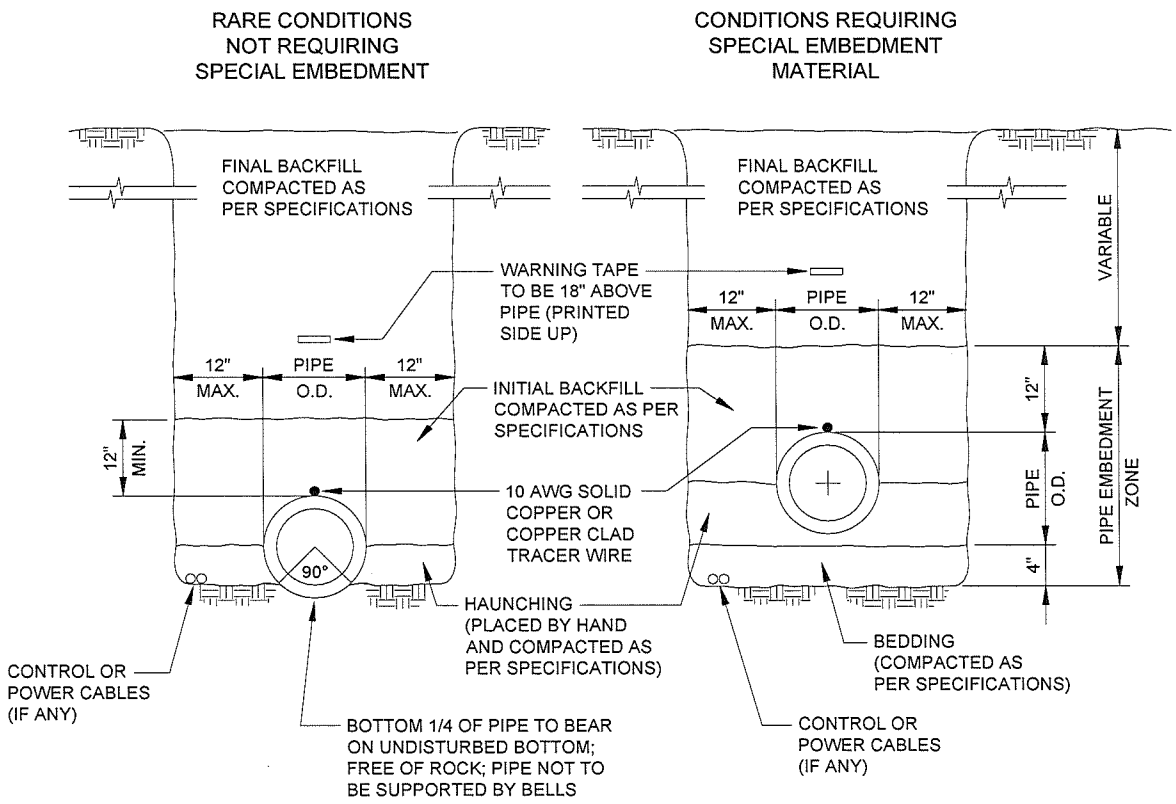
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
SHEET SET TABLE

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: PAO REVISED DETAILS LIST
LAYOUT NAME: 00
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT

NOTES:
1. SPECIAL IMPORTED BEDDING AND HAUNCHING MATERIAL SHALL MEET THE CRITERIA OF THE UNIFIED SOILS CLASSIFICATION SYSTEM FOR GW, GP, SW OR SP SOILS.
2. ATTACH TRACER WIRE TO PIPE 3 TIMES PER 20' PIPE LENGTH, MINIMUM.
3. BEDDING, HAUNCHING AND BACKFILL SHALL BE COMPACTED AS INDICATED IN TP 01.11 AND TABLE IN TP 01.12 A.



1A TYPICAL TRENCH SECTIONS

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	L.B.
01-19	REVISED	L.T.S.
03-19	REVISED	C.G.

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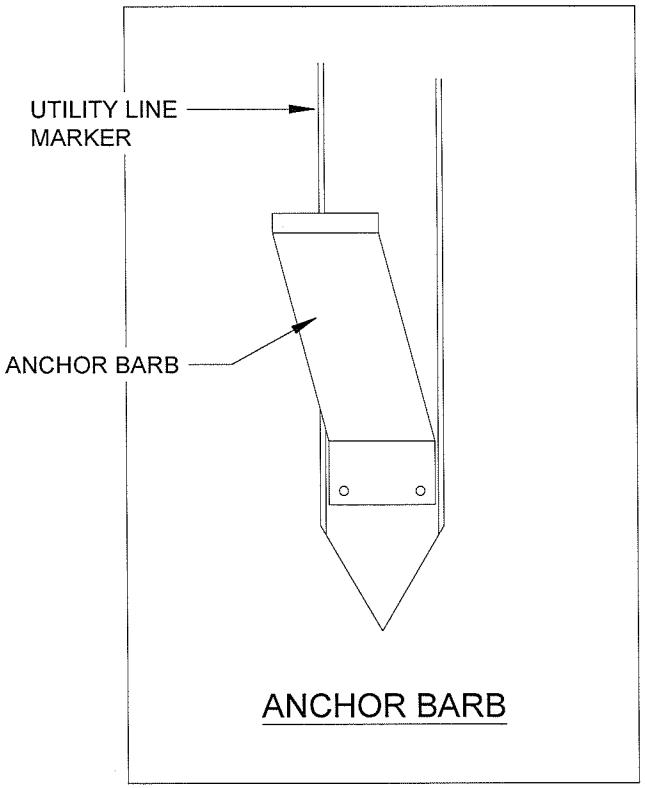
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
TYPICAL TRENCH SECTIONS

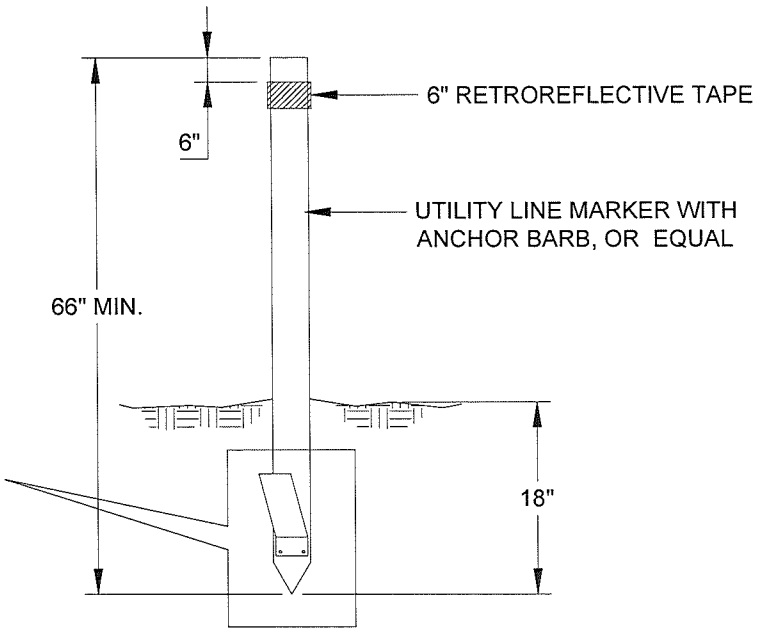
DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 1A
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



ANCHOR BARB



NOTES:
1. WATER MAIN MARKERS SHALL BE BLUE, 66" TALL MINIMUM, MARKED "CAUTION WATER PIPELINE".
2. SEWER MAIN & SEWER FORCE MAIN MARKERS SHALL BE GREEN, 66" TALL MINIMUM, MARKED "CAUTION SEWER PIPELINE".
3. UTILITY LINE MARKER SHALL BE INSTALLED WITHIN ROADWAY RIGHT-OF-WAYS.

1B UTILITY LINE MARKER

Scale: N.T.S.

DATE	REVISIONS	INITIALS
12-14	UPDATED	
03-18	REVISED	L.B.
01-19	REVISED	L.T.S.

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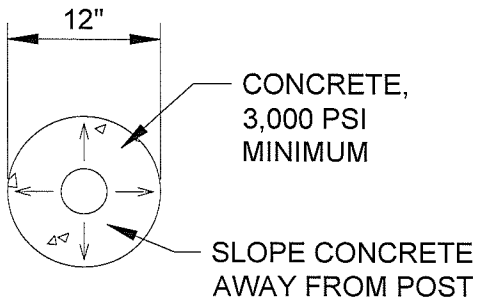
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
UTILITY LINE MARKER

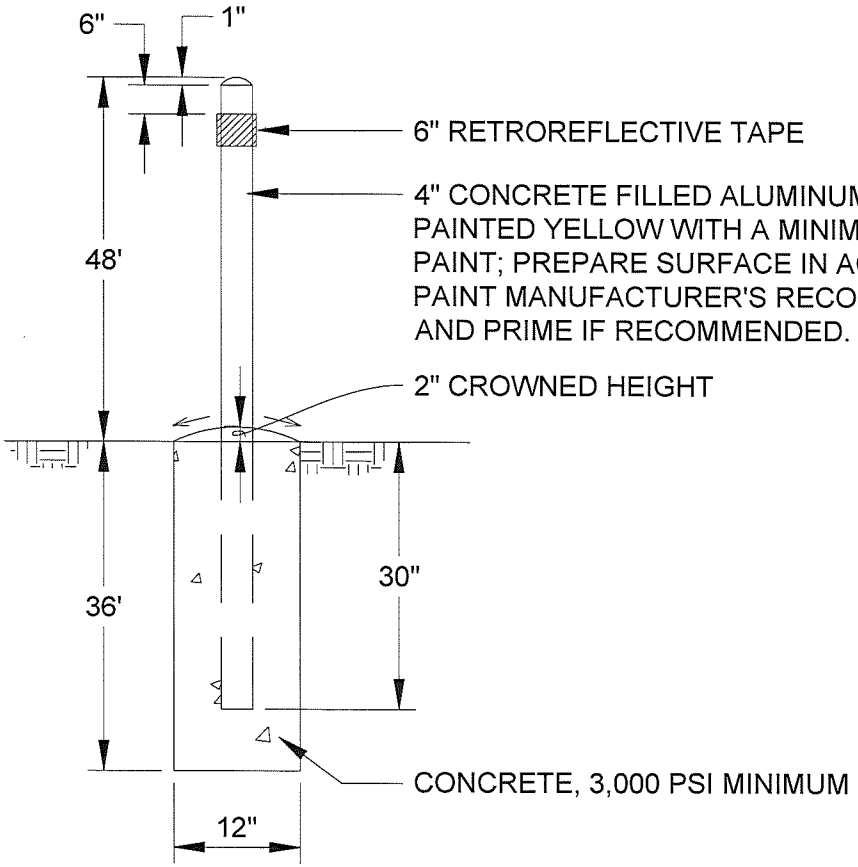
DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 1B
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



PLAN VIEW



1C BOLLARD

Scale: N.T.S.

DATE	REVISIONS	INITIALS
12-14	UPDATED	
03-18	REVISED	L.B.
01-19	REVISED	L.T.S.

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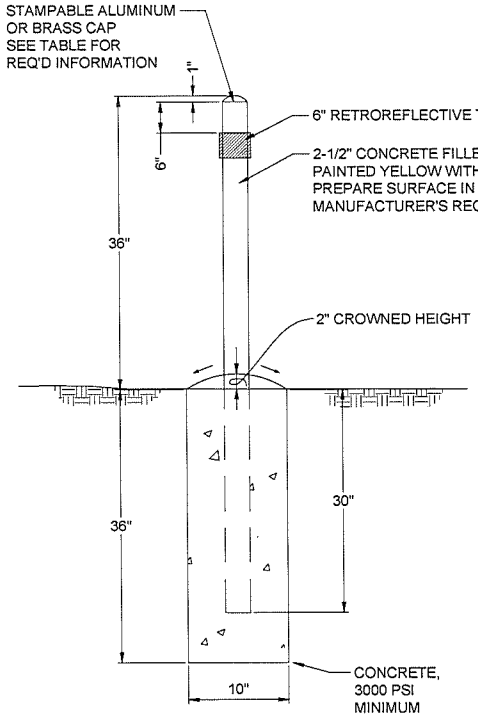
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
BOLLARD

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 1C
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT

NOTE:
MARKER POSTS SHALL NOT BE INSTALLED WITHIN THE RIGHT-OF-WAY OF ANY ROADWAYS. UTILITY LINE MARKERS SHALL BE INSTALLED WITHIN ROADWAY RIGHT-OF-WAYS (SEE DETAIL 1B)

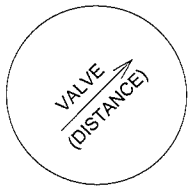


MARKER POST DETAIL

CAP SHALL BE STAMPED BY THE CONTRACTOR WITH THE FOLLOWING INFORMATION:

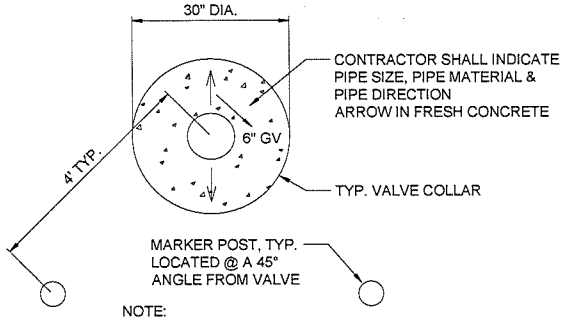
MARKER POST INDICATING	INFORMATION REQUIRED
GV OR ARV	ARROW TO GV OR ARV DISTANCE TO GV OR ARV
BENDS, TEES, AND ALL OTHER WATER SYSTEM FEATURES	PIPE SIZE DESCRIPTION OF BEND/TEE/ETC.

NOTE:
FOR MARKER POST INDICATING GATE VALVES, AIR RELIEF VALVES, BENDS, TEES, CROSSES, OR OTHER FACILITY FEATURES.



NOTE:
ARROW AND DISTANCE TO CENTER OF VALVE BOX OR ARV TO BE STAMPED ON CAP BY THE CONTRACTOR.

MARKER CAP DETAIL



NOTE:
2' SQUARE VALVE COLLARS MAY BE ALLOWED IN PAVED/ CONCRETED AREAS. (ROADS, DRIVEWAYS, ETC.)

EXAMPLE MARKER POST & TYP. VALVE COLLAR - PLAN VIEW

1D METAL MARKER POST

Scale: NTS

DATE	REVISIONS	INITIALS
12-14	UPDATED	
03-18	REVISED	L.B.
01-19	REVISED	L.T.S.

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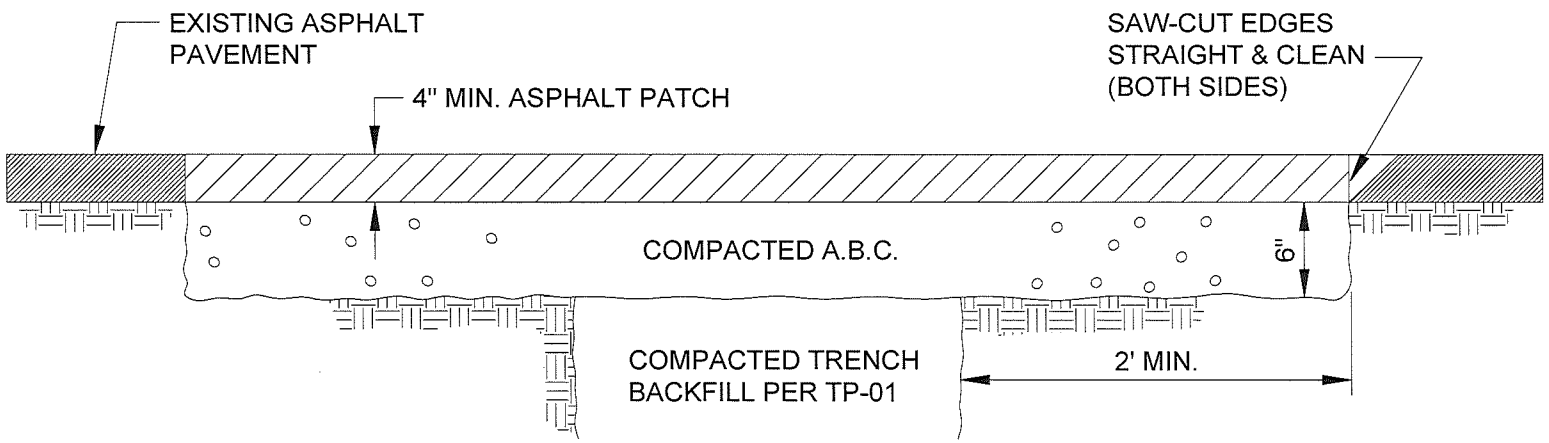
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
METAL MARKER POST

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 1D
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



1E ASPHALT PAVEMENT PATCH

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA
04-18	UPDATED MARCH REVISION	LB

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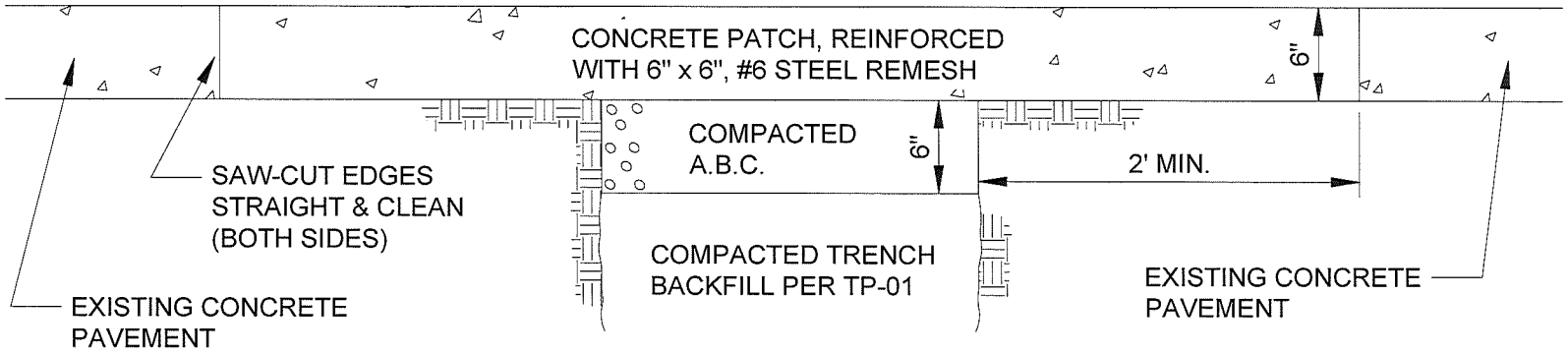
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
ASPHALT PAVEMENT PATCH

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 1E
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



1F CONCRETE PAVEMENT PATCH

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA
04-18	UPDATED MARCH REVISION	LB

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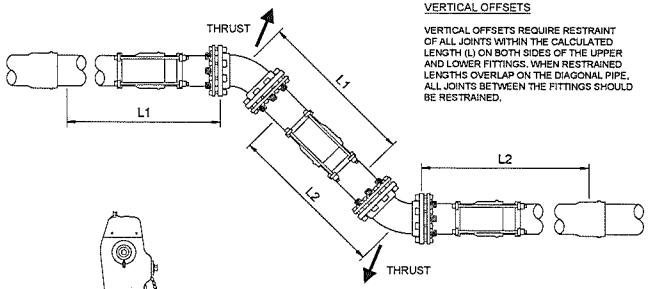
WATER - SEWER - MISC DETAILS
CONCRETE PAVEMENT PATCH

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

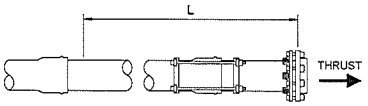
FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 1F
PROJ ENG: ____

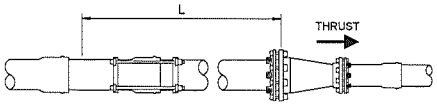
INCORPORATED INTO THE CONTRACT



VERTICAL OFFSETS

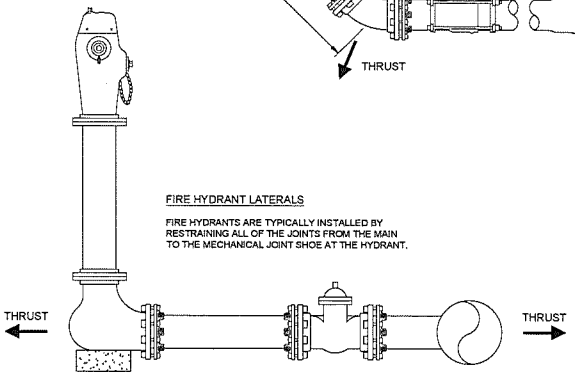
VERTICAL OFFSETS REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED LENGTH (L) ON BOTH SIDES OF THE UPPER AND LOWER FITTINGS. WHEN RESTRAINED LENGTHS OVERLAP ON THE DIAGONAL PIPE, ALL JOINTS BETWEEN THE FITTINGS SHOULD BE RESTRAINED.





DEAD ENDS (AND IN-LINE VALVES)

DEAD ENDS REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED LENGTH (L) EXTENDING FROM THE CAP. IN-LINE VALVES REQUIRE RESTRAINT OF ALL JOINTS WITHIN A DISTANCE (L) EXTENDING EITHER SIDE OF THE VALVE.

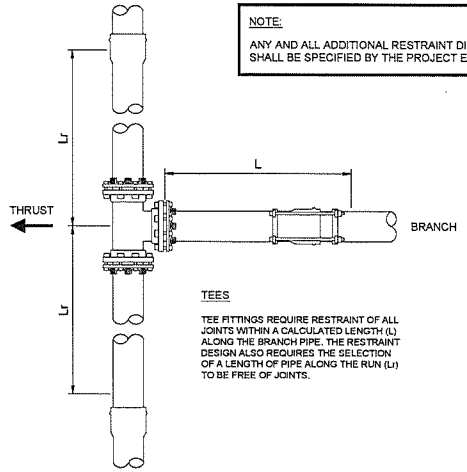


FIRE HYDRANT LATERALS

FIRE HYDRANTS ARE TYPICALLY INSTALLED BY RESTRAINING ALL OF THE JOINTS FROM THE MAIN TO THE MECHANICAL JOINT SHOE AT THE HYDRANT.

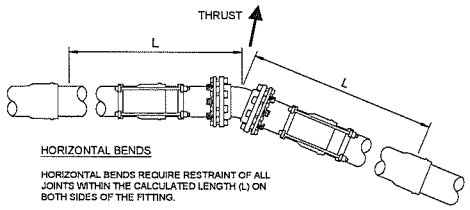
NOTE:

ANY AND ALL ADDITIONAL RESTRAINT DISTANCES (L, L1, L2, Lr) SHALL BE SPECIFIED BY THE PROJECT ENGINEER.



TEES

TEE FITTINGS REQUIRE RESTRAINT OF ALL JOINTS WITHIN A CALCULATED LENGTH (L) ALONG THE BRANCH PIPE. THE RESTRAINT DESIGN ALSO REQUIRES THE SELECTION OF A LENGTH OF PIPE ALONG THE RUN (Lr) TO BE FREE OF JOINTS.



HORIZONTAL BENDS

HORIZONTAL BENDS REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED LENGTH (L) ON BOTH SIDES OF THE FITTING.

RESTRAINT LENGTHS FOR PVC PIPE MATERIAL

PIPE SIZE	HORIZONTAL BENDS	L	VERTICAL OFFSETS	L1	L2	TEE	Lr	L	L FOR DEAD ENDS AND VALVES	REDUCERS	L
12"	90°	35'				12 x 12 x 12		17'		12 x 10	29'
	45°	15'	45°	41'	13'	12 x 12 x 10	15.0	1'	99'	12 x 8	52'
	22.5°	7'	22.5°	20'	7'	12 x 12 x 8		1'		12 x 6	72'
	11.25°	4'	11.25°	10'	3'	12 x 12 x 6		1'		12 x 4	86'
10"	90°	30'				10 x 10 x 12		54'		10 x 8	28'
	45°	13'	45°	35'	11'	10 x 10 x 10	10.0	30'	84'	10 x 6	52'
	22.5°	6'	22.5°	17'	6'	10 x 10 x 8		2'		10 x 4	68'
	11.25°	3'	11.25°	9'	3'	10 x 10 x 6		1'		10 x 3	73'
8"	90°	26'				8 x 8 x 10		50'		8 x 6	30'
	45°	11'	45°	29'	10'	8 x 8 x 8	8.0	27'	70'	8 x 4	50'
	22.5°	5'	22.5°	14'	5'	8 x 8 x 6		1'		8 x 3	57'
	11.25°	3'	11.25°	7'	3'	8 x 8 x 4		1'			
6"	90°	20'				6 x 6 x 10		58'		6 x 4	28'
	45°	8'	45°	22'	7'	6 x 6 x 8	8.0	38'	53'	6 x 3	36'
	22.5°	4'	22.5°	11'	4'	6 x 6 x 6		11'			
	11.25°	2'	11.25°	6'	2'	6 x 6 x 4		1'			
4"	90°	14'				4 x 4 x 6		25'		4 x 3	13'
	45°	6'	45°	16'	5'	4 x 4 x 4	8.0	1'	38'		
	22.5°	3'	22.5°	8'	3'	4 x 4 x 3		1'			
	11.25°	2'	11.25°	4'	2'						

RESTRAINED MECHANICAL PIPE JOINT APPLICATION CRITERIA

NOTES:

ALL ABOVE REFERENCED RESTRAINT LENGTHS, "L", SHALL BE CONSIDERED AS MINIMUM VALUES. ALL CALCULATED LENGTHS ARE BASED ON THE EBAA RESTRAINT LENGTH CALCULATOR AND ASSUME THE FOLLOWING:

1) SOIL TYPE IS SIMILAR TO GP (PER USCS), A POORLY GRADED GRAVEL-SAND MIXTURE WITH LITTLE OR NO FINES.
2) THE TEST PRESSURE IS 150 PSI.
3) THE FACTOR OF SAFETY IS 1.5 TO 1.
4) THE MINIMUM DEPTH OF BURY IS 3.0'.
5) THE PIPE IS PLACED IN A COMPACTED GRANULAR MATERIAL UP TO THE CENTERLINE OF THE PIPE, AND WITH A MINIMUM OF 4" BEDDING UNDER THE PIPE, AND COMPACTED SELECT MATERIAL UP TO THE TOP OF THE PIPE. ALL BEDDING AND COVER MATERIAL IS TO BE BACKFILLED AND COMPACTED IN ACCORDANCE TO TP 01.
6) TRENCH TYPE IS TYPE 4.
7) FOR VERTICAL OFFSETS, THE LOW SIDE DEPTH USED WAS 3.5 FT.
8) FOR ANY DIFFERENT VALUES OR CRITERIA, CONSULT WITH ENGINEER TO RECALCULATE REQUIRED RESTRAINT LENGTH.

4A **MECHANICAL RESTRAINED JOINTS**

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
06-18	REVISED	LTS

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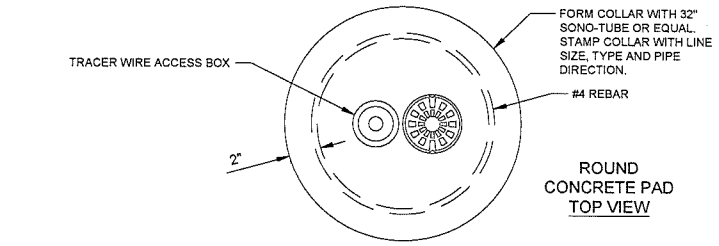
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
MECHANICAL RESTRAINTED JOINTS

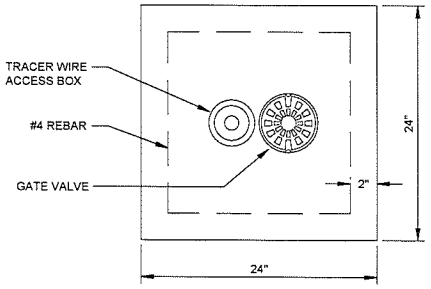
DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED WATER DRAWINGS
LAYOUT NAME: 4A
PROJ ENG: ----

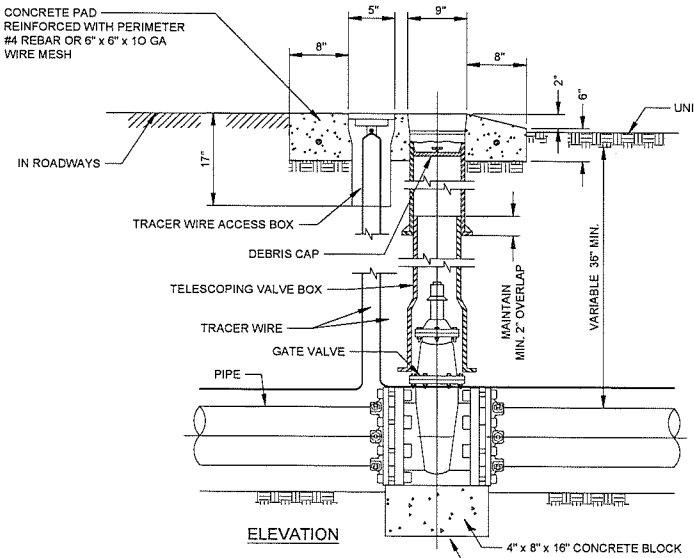
INCORPORATED INTO THE CONTRACT



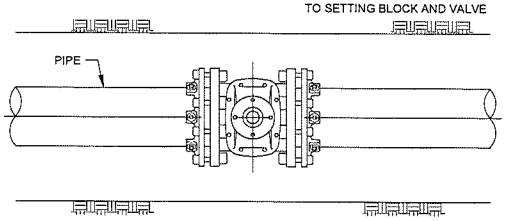
ROUND CONCRETE PAD TOP VIEW



SQUARE CONCRETE PAD TOP VIEW



ELEVATION



PLAN VIEW

NOTES:

1) IF INSTALLED IN PAVED ROADWAY, CONCRETE PAD SHALL BE FLUSH WITH PAVEMENT.
2) IF WIRE MESH IS USED INSTEAD OF REBAR, THE WIRE MESH SHALL EXTEND TO WITHIN 2-INCHES OF THE EDGE OF THE COLLAR.
3) CONCRETE BLOCKS USED SHALL BE COMMON IN SIZE

AGA

4B **GATE VALVE WITH BOX**
Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
07-18	REVISED	LTS
01-19	REVISED	LTS
03-19	REVISED	C.G.

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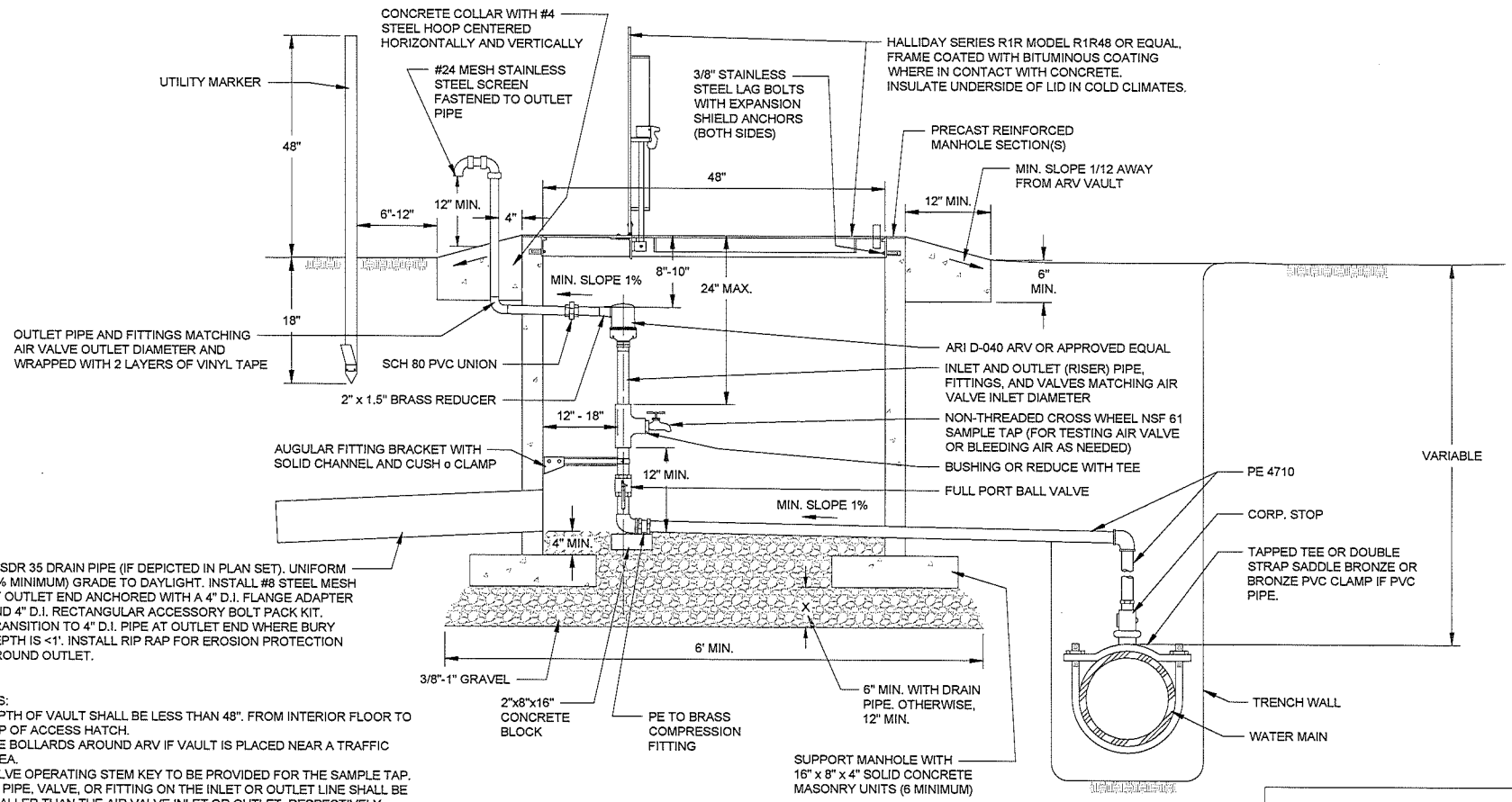
PAO REVISED DETAILS
WATER – SEWER – MISC DETAILS
GATE VALVE WITH BOX

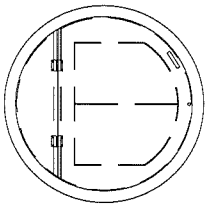
DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED WATER DRAWINGS
LAYOUT NAME: 4B
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



NOTES:
1) DEPTH OF VAULT SHALL BE LESS THAN 48". FROM INTERIOR FLOOR TO TOP OF ACCESS HATCH.
2) USE BOLLARDS AROUND ARV IF VAULT IS PLACED NEAR A TRAFFIC AREA.
3) VALVE OPERATING STEM KEY TO BE PROVIDED FOR THE SAMPLE TAP.
4) NO PIPE, VALVE, OR FITTING ON THE INLET OR OUTLET LINE SHALL BE SMALLER THAN THE AIR VALVE INLET OR OUTLET, RESPECTIVELY.
5) ALL PIPES, VALVES, AND FITTINGS ON INLET AND OUTLET LINES SHALL BE OF IDENTICAL MATERIAL PER THE SPECIFICATIONS. ALTERNATIVELY, DIELECTRIC UNIONS MAY BE SUBMITTED FOR APPROVAL PRIOR TO INSTALLATION.
6) ALL VAULT PENETRATIONS ARE TO BE SEALED WITH GROUT MATERIAL.
7) AVOID SETTING VALVE IN LOW LYING AREAS OF POTENTIAL FLOODING (DRAINAGE PATH OR PONDING).
8) FROM COMPRESSION FITTING TO SCH 80 UNION, PIPING AND FITTINGS SHALL BE BRASS. FROM SCH 80 UNION TO OUTLET, PIPING AND FITTINGS SHALL BE GALVANIZED STEEL.
9) ARV AND RELATED PIPING TO BE SIZED BY THE DESIGN ENGINEER.
10) CONCRETE BLOCKS USED SHALL BE COMMON SIZE.



ACCESS HATCH DETAIL

4F WATER AIR VALVE VAULT (OFFSET MAIN)

Scale: NTS

DATE	REVISIONS	INITIALS
07-18	REVISED	LTS
01-19	REVISED	LTS
03-19	REVISED	C.G.

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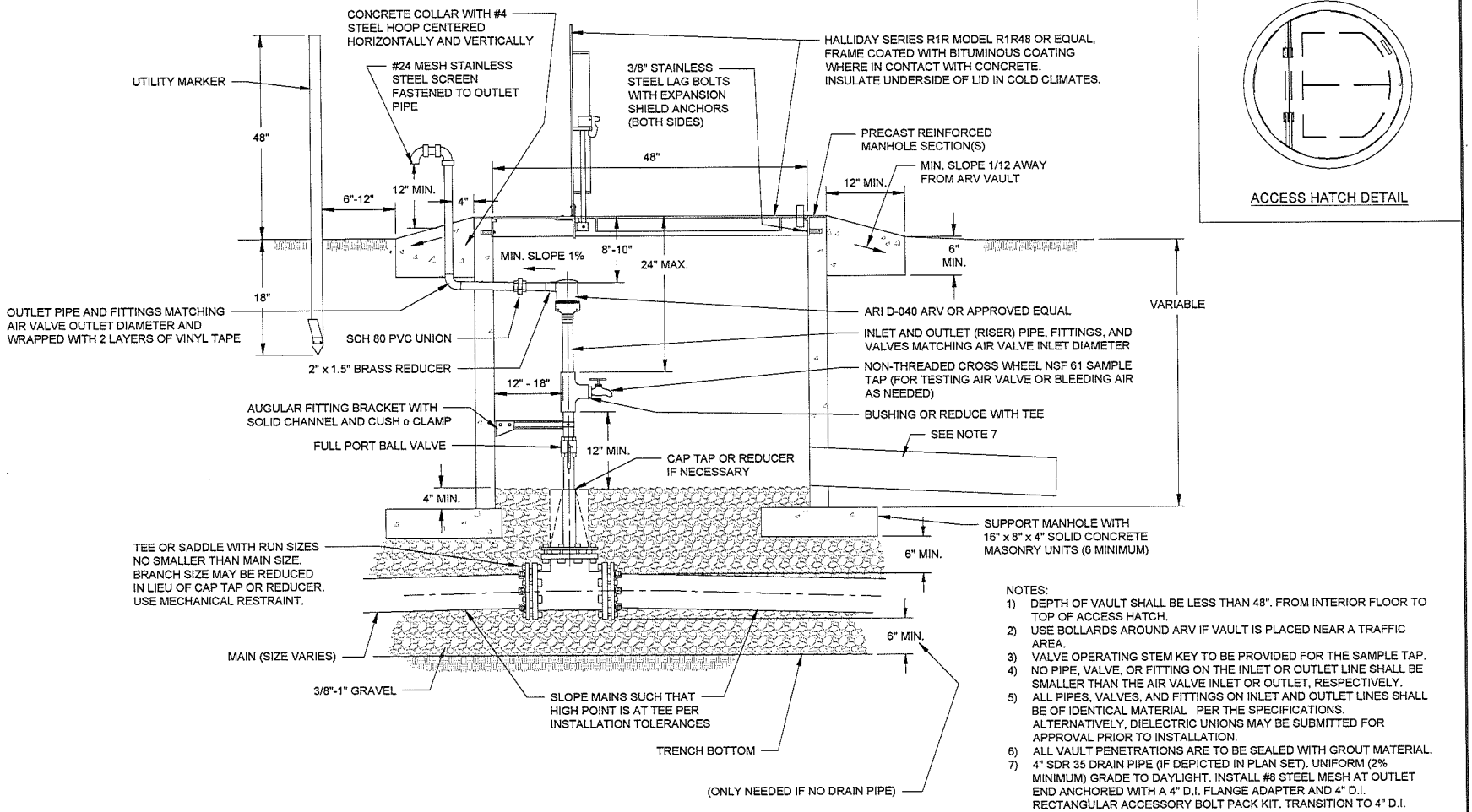
WATER - SEWER - MISC DETAILS
WATER AIR VALVE VAULT (OFFSET MAIN)

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED WATER DRAWINGS
LAYOUT NAME: 4F
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



ACCESS HATCH DETAIL

NOTES:
1) DEPTH OF VAULT SHALL BE LESS THAN 48". FROM INTERIOR FLOOR TO TOP OF ACCESS HATCH.
2) USE BOLLARDS AROUND ARV IF VAULT IS PLACED NEAR A TRAFFIC AREA.
3) VALVE OPERATING STEM KEY TO BE PROVIDED FOR THE SAMPLE TAP.
4) NO PIPE, VALVE, OR FITTING ON THE INLET OR OUTLET LINE SHALL BE SMALLER THAN THE AIR VALVE INLET OR OUTLET, RESPECTIVELY.
5) ALL PIPES, VALVES, AND FITTINGS ON INLET AND OUTLET LINES SHALL BE OF IDENTICAL MATERIAL PER THE SPECIFICATIONS. ALTERNATIVELY, DIELECTRIC UNIONS MAY BE SUBMITTED FOR APPROVAL PRIOR TO INSTALLATION.
6) ALL VAULT PENETRATIONS ARE TO BE SEALED WITH GROUT MATERIAL.
7) 4" SDR 35 DRAIN PIPE (IF DEPICTED IN PLAN SET). UNIFORM (2% MINIMUM) GRADE TO DAYLIGHT. INSTALL #8 STEEL MESH AT OUTLET END ANCHORED WITH A 4" D.I. FLANGE ADAPTER AND 4" D.I. RECTANGULAR ACCESSORY BOLT PACK KIT. TRANSITION TO 4" D.I. PIPE AT OUTLET END WHERE BURY DEPTH IS <1'. INSTALL RIP RAP FOR EROSION PROTECTION AROUND OUTLET.
8) AVOID SETTING VALVE IN LOW LYING AREAS OF POTENTIAL FLOODING (DRAINAGE PATH OR PONDING).
9) FROM TEE/SADDLE FITTING TO SCH 80 UNION, PIPING AND FITTINGS SHALL BE BRASS. FROM SCH 80 UNION TO OUTLET, PIPING AND FITTINGS SHALL BE GALVANIZED STEEL.
10) ARV AND RELATED PIPING TO BE SIZED BY THE DESIGN ENGINEER.
11) CONCRETE BLOCKS USED SHALL BE COMMON SIZE.

4G WATER AIR VALVE VAULT (OVER MAIN)

Scale: NTS

DATE	REVISIONS	INITIALS
07-18	REVISED	LTS
01-19	REVISED	LTS
03-19	REVISED	C.G.

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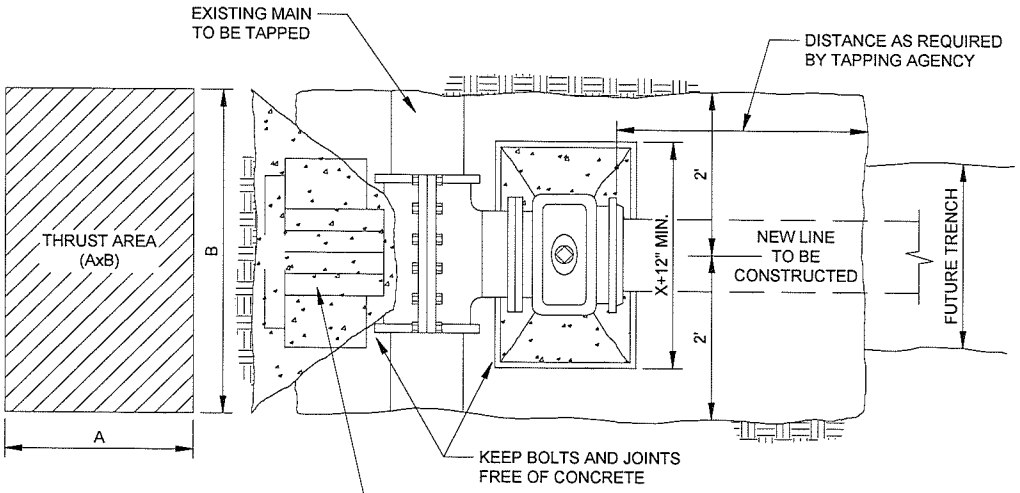
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
WATER AIR VALVE VAULT (OVER MAIN)

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

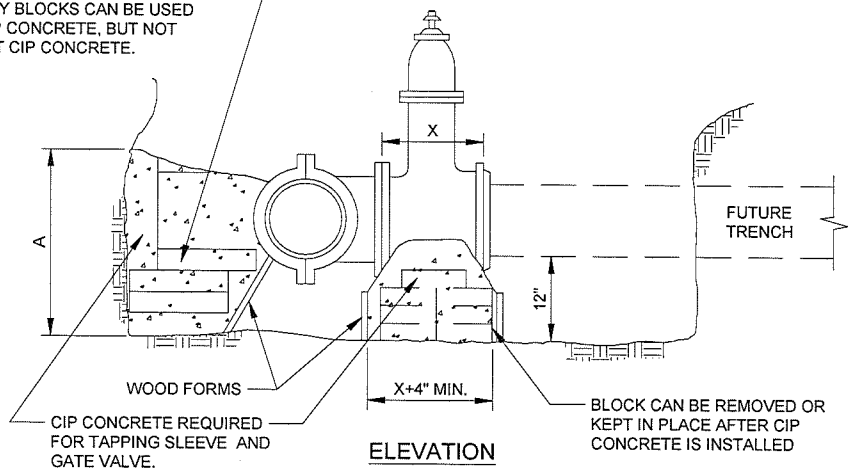
FILE NAME: REVISED WATER DRAWINGS
LAYOUT NAME: 4G
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



PLAN

4" x 8" x 12" SOLID CONCRETE MASONRY BLOCKS CAN BE USED WITH CIP CONCRETE, BUT NOT WITHOUT CIP CONCRETE.



ELEVATION

NOTES:
1) TAPPING SLEEVE TO BE PLACED A MINIMUM OF 18" FROM ANY BELL COUPLING, VALVE, FITTING OR OTHER OBSTRUCTION.
2) CONTRACTOR SHALL EXCAVATE AS SHOWN AND SHALL SET TAPPING SLEEVE AND VALVE AND TIGHTEN ALL BOLTS PRIOR TO THE PRESSURE TEST.
3) ALL TAPPING SLEEVES AND VALVES MUST BE PRESSURE TESTED PRIOR TO BLOCKING OR TAPPING. THE TEST MUST BE WITNESSED AND APPROVED BY THE INSPECTOR.
4) BLOCKS ARE TO EXTEND TO UNDISTURBED GROUND AND BE INSTALLED BEFORE THE TAP IS MADE. ALL FLANGE BOLTS SHALL BE FREE AND CLEAR OF CONCRETE.
5) THIS DETAIL COVERS TAPPING SLEEVES 4" THROUGH 16" IN SIZE ON DUCTILE IRON, CAST IRON AND ASBESTOS CEMENT PIPE. ANY OTHER SIZE OR TYPE OF PIPE WILL REQUIRE A SEPARATE SUBMITTAL AND APPROVAL BY THE ENGINEER.

SIZE OF PIPE BEING CONNECTED	MINIMUM THRUST AREA REQUIRED EQUALS (AxB) (SQUARE FEET)
4" AND LESS	3
6"	4
8"	6
10"	9
12"	13
16"	23

4H TAPPING SLEEVE AND VALVE

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
02-18	REVISED	LTS

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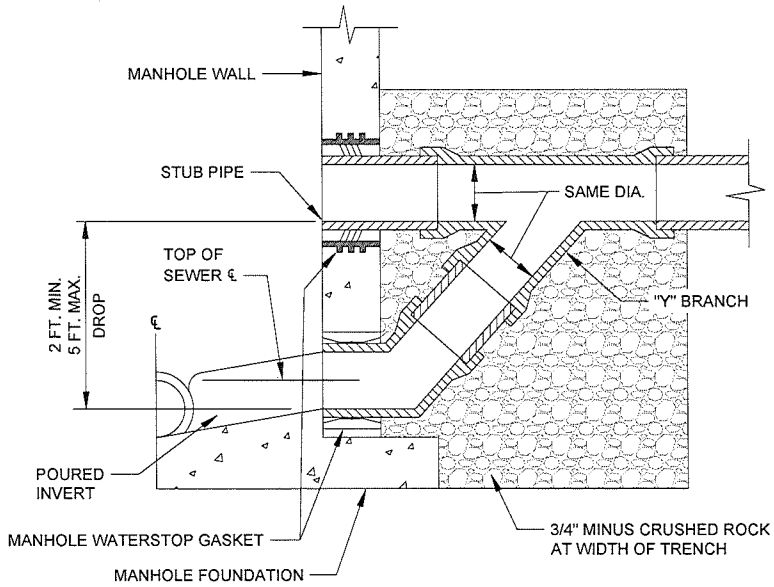
WATER – SEWER – MISC DETAILS
TAPPING SLEEVE AND VALVE

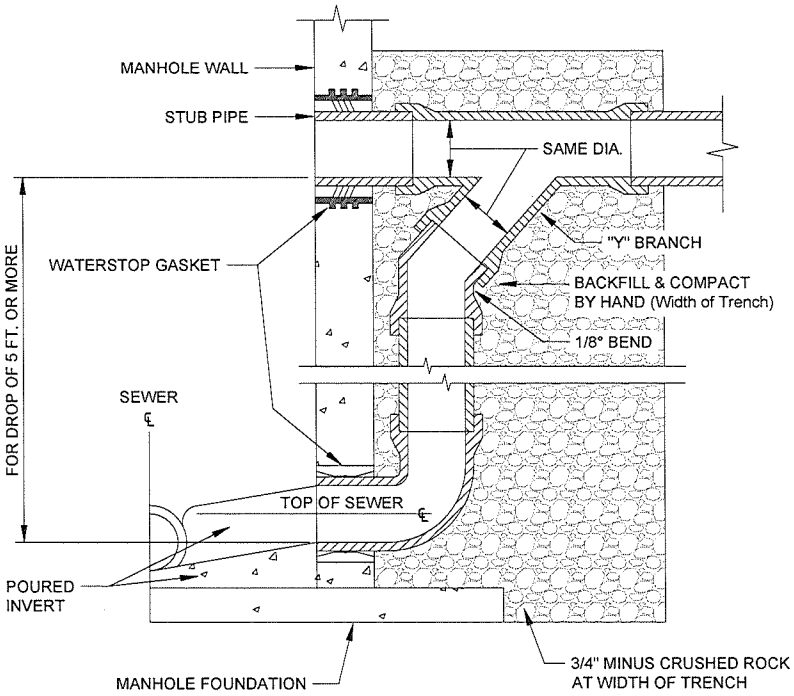
DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED WATER DRAWINGS
LAYOUT NAME: 4H
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



TYPE A
2 FT. - 5 FT. DROP



TYPE B
5 FT. OR MORE

6C DROP MANHOLE

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA
01-19	REVISED	L.T.S.
03-19	REVISED	C.G.

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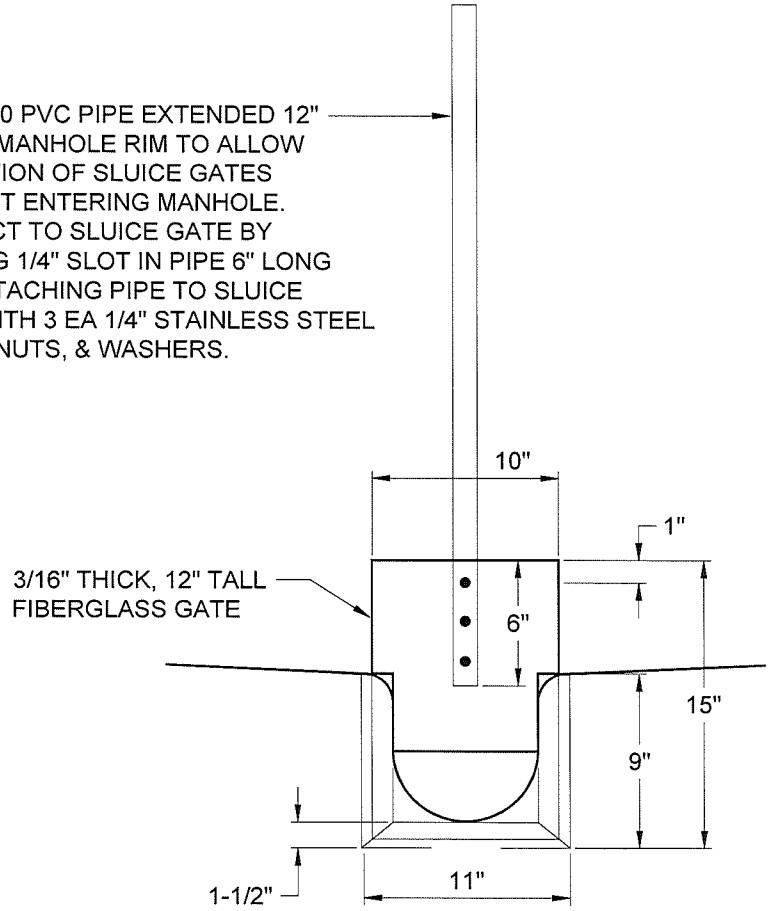
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
DROP MANHOLE

DRAWN BY: ----- DATE: -----
CHECKED BY: ----- DATE: -----

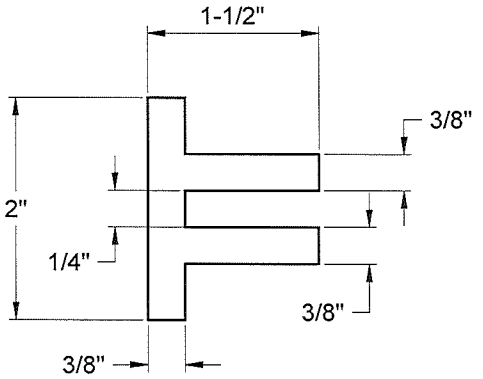
FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 6C
PROJ ENG: -----

INCORPORATED INTO THE CONTRACT

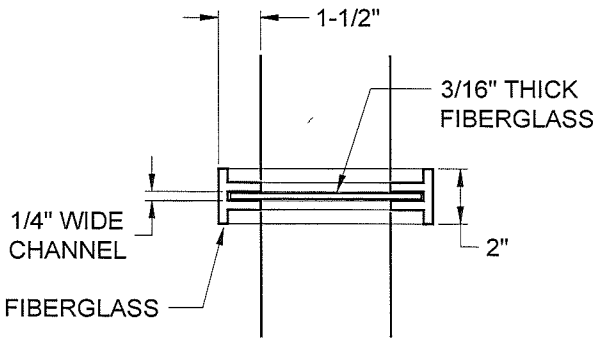
1" SCH 40 PVC PIPE EXTENDED 12" BELOW MANHOLE RIM TO ALLOW OPERATION OF SLUICE GATES WITHOUT ENTERING MANHOLE. CONNECT TO SLUICE GATE BY CUTTING 1/4" SLOT IN PIPE 6" LONG AND ATTACHING PIPE TO SLUICE GATE WITH 3 EA 1/4" STAINLESS STEEL BOLTS, NUTS, & WASHERS.



FRONT VIEW



GUIDE - ENLARGED VIEW



TOP VIEW

6D DIVERSION MANHOLE SLIDING GATE & GUIDE

Scale: N.T.S.

DATE	REVISIONS	INITIALS
12-14	UPDATED	
03-18	REVISED	DA

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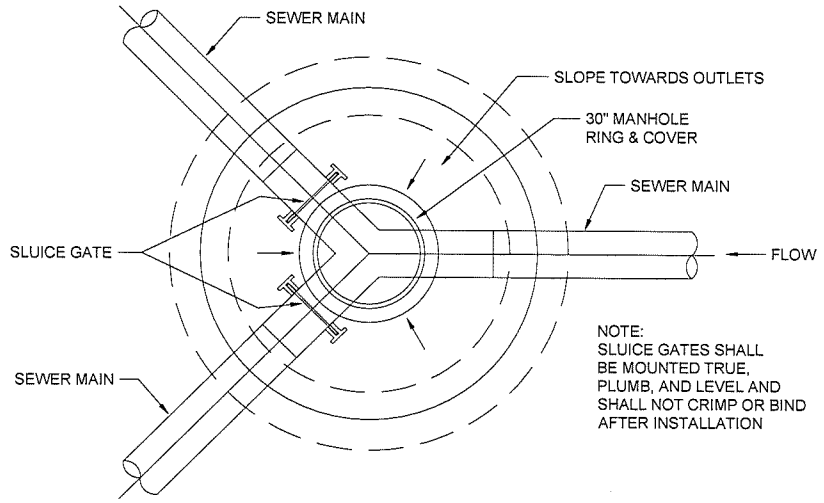
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
DIVERSION MANHOLE SLIDING GATE & GUIDE

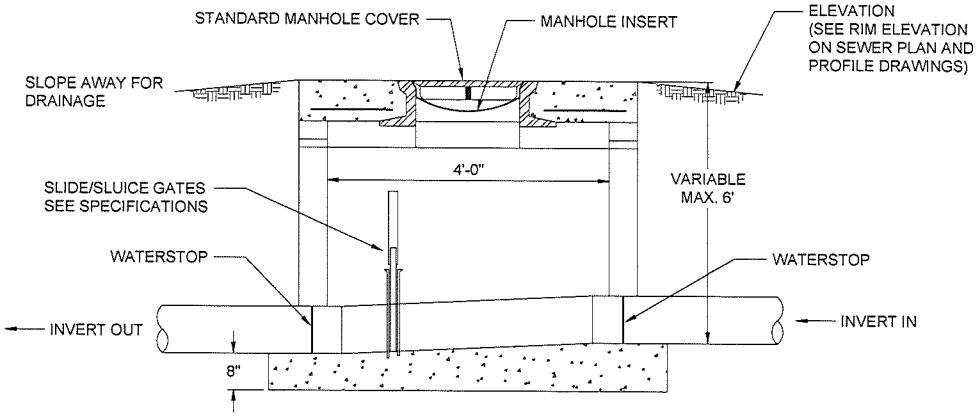
DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 6D
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



PLAN VIEW



SECTION VIEW

6E DIVERSION MANHOLE

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA

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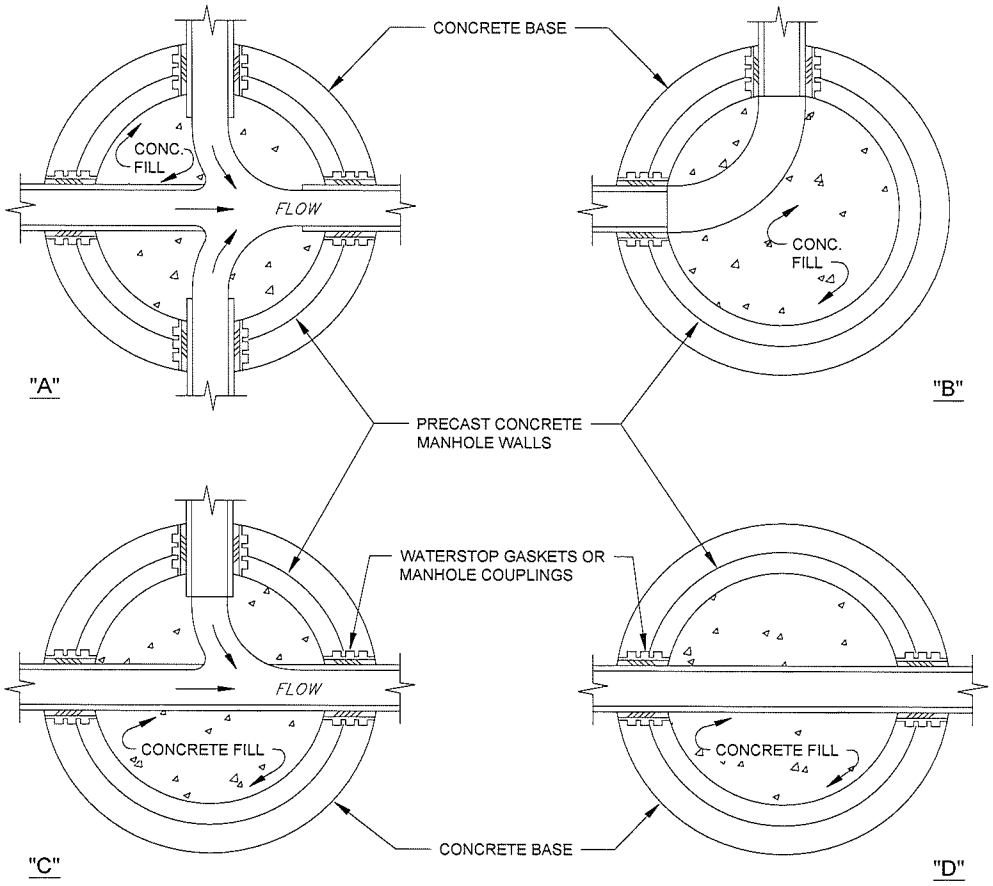
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
DIVERSION MANHOLE

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 6E
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



NOTE:
WATERSTOP GASKETS MUST BE USED ON ALL LINES CONNECTING TO MANHOLES.

6F MANHOLE INVERTS

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DA

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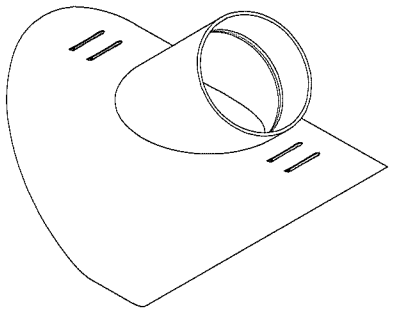
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
MANHOLE INVERTS

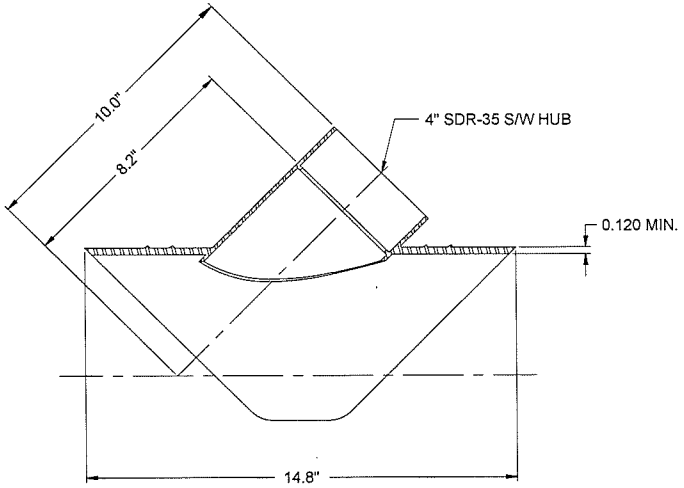
DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 6F
PROJ ENG: ----

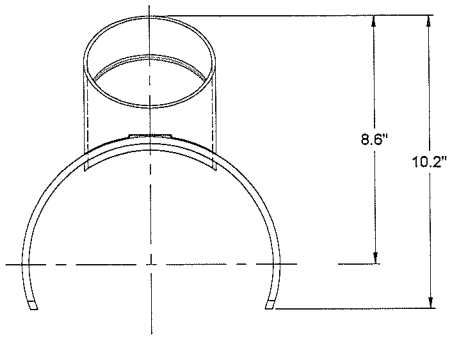
INCORPORATED INTO THE CONTRACT



ISO VIEW



PROFILE VIEW



END VIEW

7C SEWER SERVICE SADDLE

Scale: N.T.S.

DATE	REVISIONS	INITIALS
11-14	UPDATED	
05-18	REVISED	LTS

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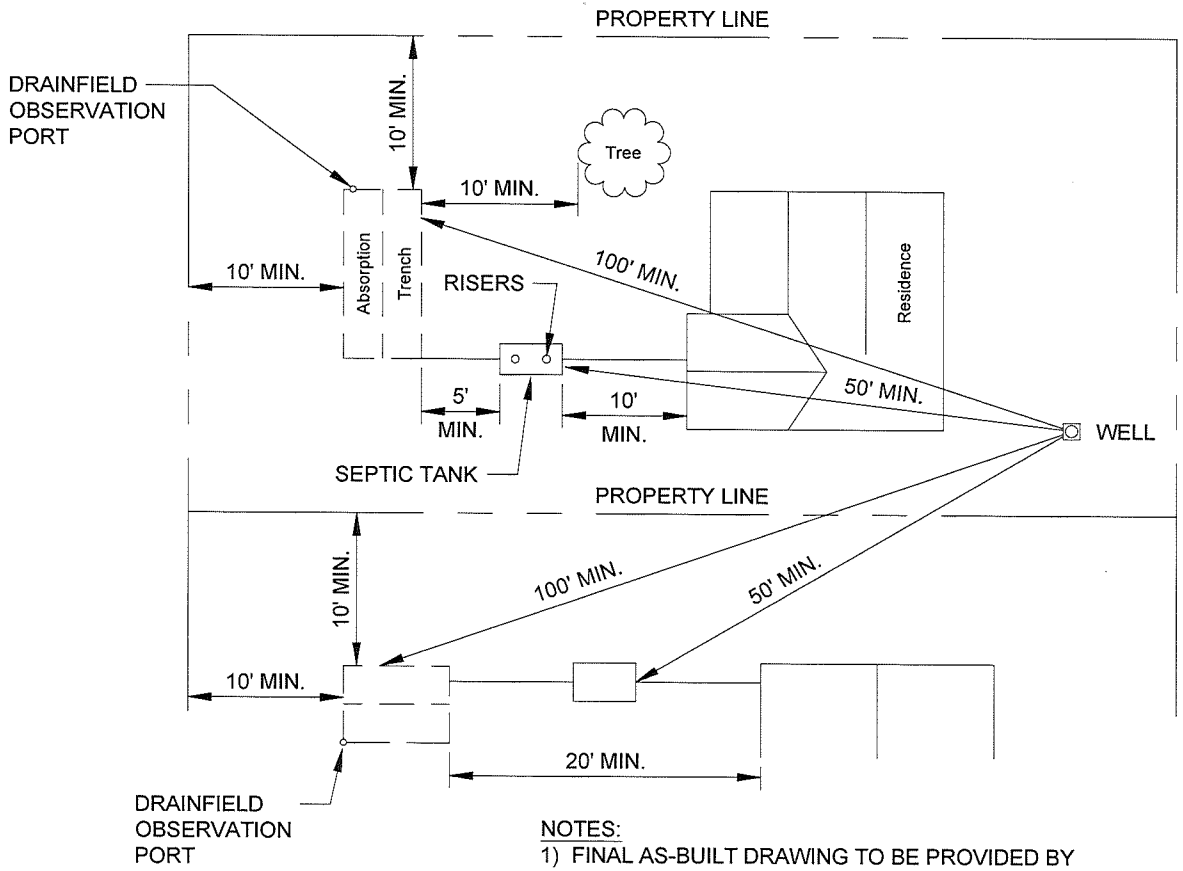
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
SEWER SERVICE SADDLE

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 7C
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



NOTES:

1) FINAL AS-BUILT DRAWING TO BE PROVIDED BY CONTRACTOR SHOWING RELATIVE LOCATIONS OF ALL FEATURES REFERENCED TO HOUSE CORNERS.
2) STREAM, LAKE OR WETLAND DISTANCES TO DRAINFIELD 100', TO SEPTIC TANK 50' AND TO PIPING 25'.

12D

TYPICAL LOT PLAN

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
05-18	REVISED	LTS
01-19	REVISED	LTS

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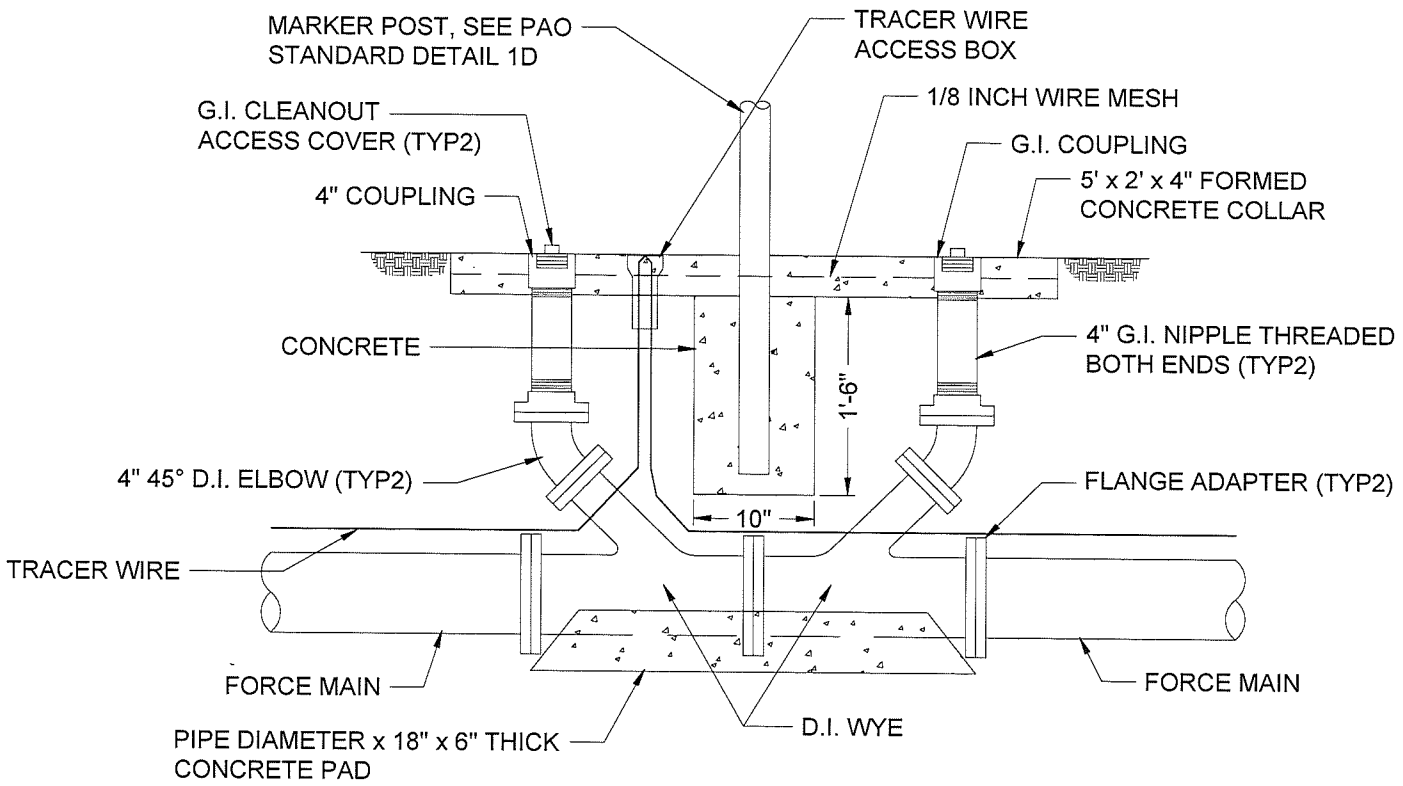
WATER – SEWER – MISC DETAILS
TYPICAL LOT PLAN

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 12D
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



43A FORCE MAIN CLEANOUT WITH MARKER POST

Scale: NTS

NOTES:

1) FORCE MAIN MATERIAL AND SIZE AS SHOWN ON THE PLANS AND BID SCHEDULE.
2) CLEANOUT LOCATIONS ARE IDENTIFIED ON THE PLANS.
3) CLEANOUT MARKER POST BURY DEPTH VARIES FROM STANDARD MARKER POSTS.
4) UNDER NO CIRCUMSTANCES SHALL STEEL MARKER POSTS BE INSTALLED WITHIN THE RIGHT-OF-WAY OF ROADS. UTILITY LINE MARKERS SHALL BE INSTALLED IN LIEU OF STEEL MARKER POSTS WITHIN THE RIGHT-OF-WAY OF ROADS (SEE DETAIL 1B).

DATE	REVISIONS	INITIALS
11-14	UPDATED	
03-18	REVISED	DSW
01-19	REVISED	LTS

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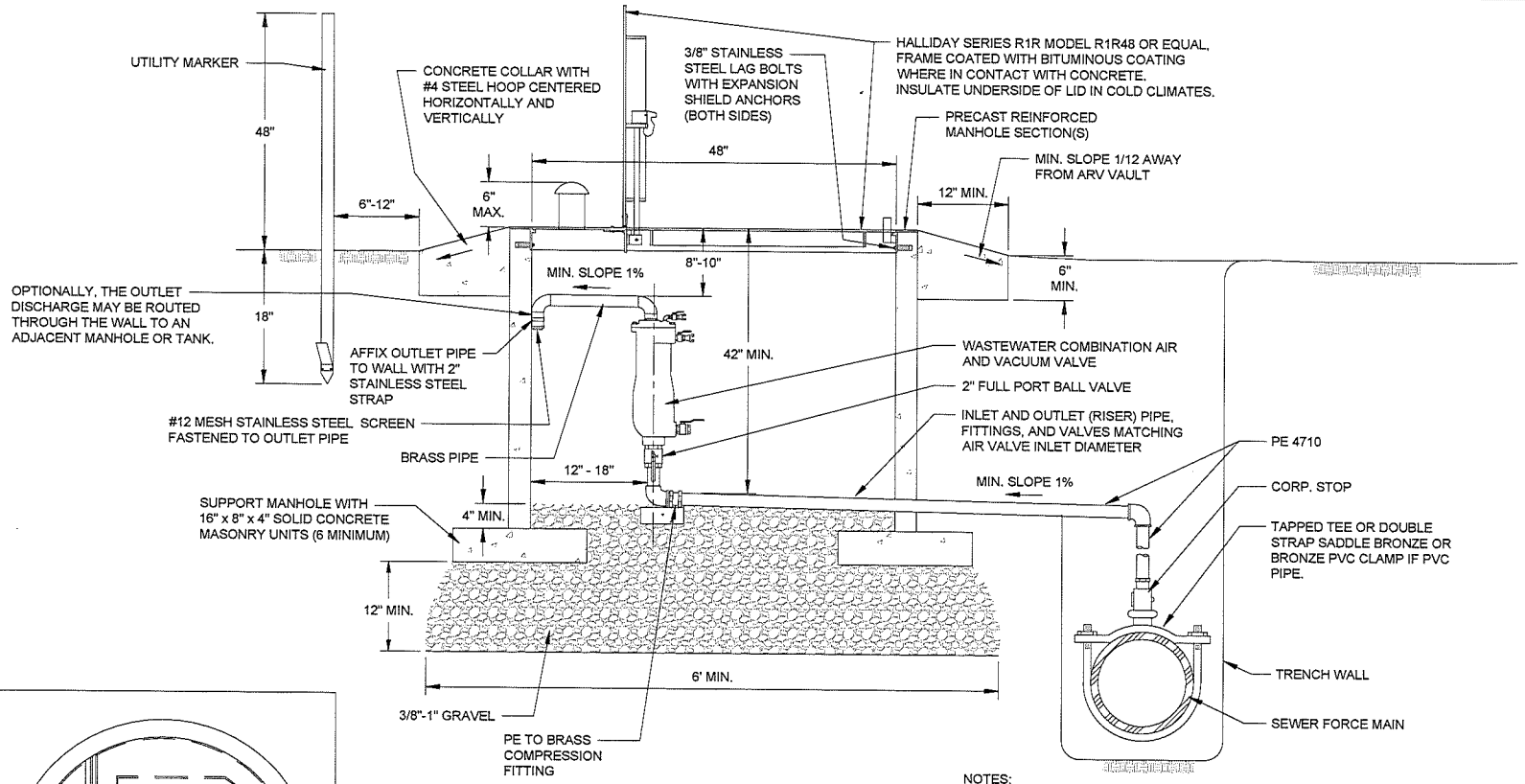
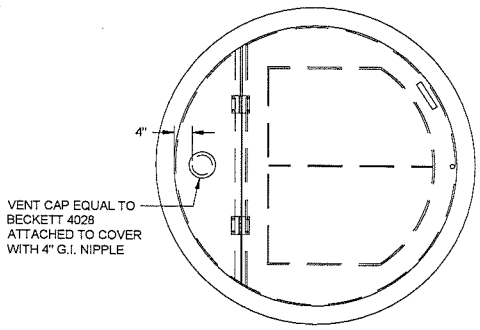
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
FORCE MAIN CLEANOUT WITH MARKER POST

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 43A
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT





ACCESS HATCH DETAIL

NOTES:
1) DEPTH OF VAULT SHALL BE LESS THAN 48". FROM INTERIOR FLOOR TO TOP OF ACCESS HATCH.
2) USE BOLLARDS AROUND ARV IF VAULT IS PLACED NEAR A TRAFFIC AREA.
3) NO PIPE, VALVE, OR FITTING ON THE INLET OR OUTLET LINE SHALL BE SMALLER THAN THE AIR VALVE INLET OR OUTLET, RESPECTIVELY.
4) ALL PIPES, VALVES, AND FITTINGS ON INLET AND OUTLET LINES SHALL BE OF IDENTICAL MATERIAL PER THE SPECIFICATIONS. ALTERNATIVELY, DIELECTRIC UNIONS MAY BE SUBMITTED FOR APPROVAL PRIOR TO INSTALLATION.
5) ALL VAULT PENETRATIONS ARE TO BE SEALED WITH GROUT MATERIAL. IN ACCORDANCE WITH TP 02.
6) AVOID SETTING VALVE IN LOW LYING AREAS OF POTENTIAL FLOODING (DRAINAGE PATH OR PONDING).
7) ARV AND RELATED PIPING TO BE SIZED BY THE DESIGN ENGINEER.
8) CONCRETE BLOCKS USED SHALL BE COMMON IN SIZE.

43B WASTEWATER AIR VACUUM / RELIEF VALVE VAULT (OFFSET MAIN)

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
07-18	REVISED	DSW
01-19	REVISED	LS
03-19	REVISED	C.G.

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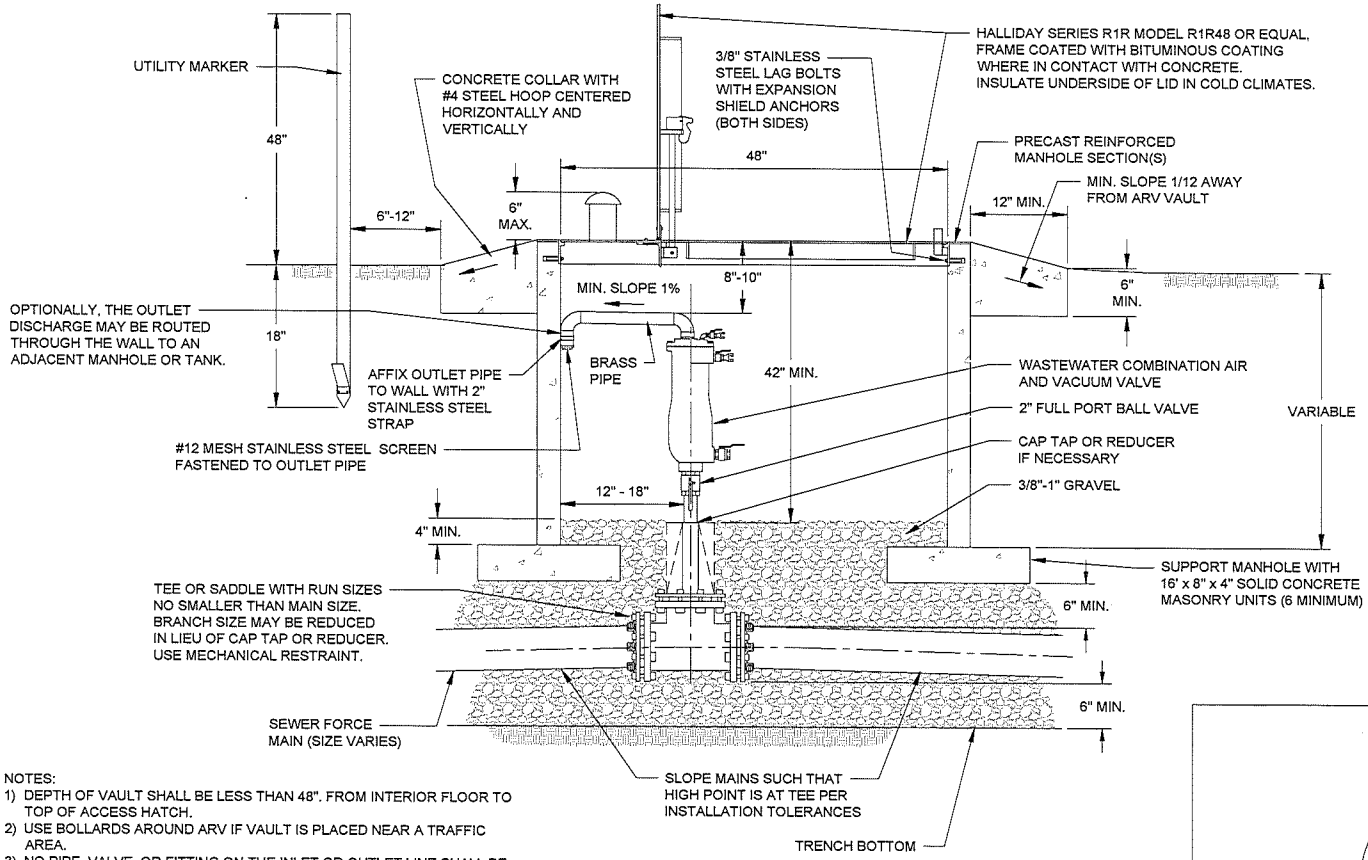
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
WASTEWATER AIR VACUUM-RELIEF VALVE VAULT (OFFSET MAIN)

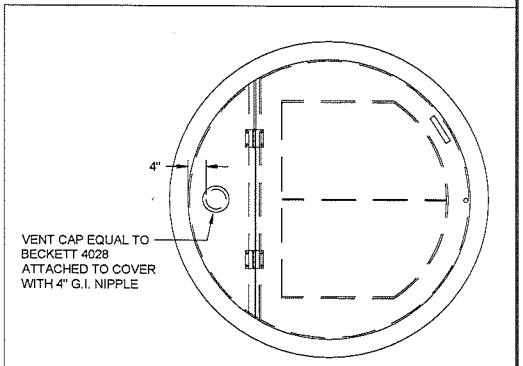
DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 43B
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



NOTES:
1) DEPTH OF VAULT SHALL BE LESS THAN 48". FROM INTERIOR FLOOR TO TOP OF ACCESS HATCH.
2) USE BOLLARDS AROUND ARV IF VAULT IS PLACED NEAR A TRAFFIC AREA.
3) NO PIPE, VALVE, OR FITTING ON THE INLET OR OUTLET LINE SHALL BE SMALLER THAN THE AIR VALVE INLET OR OUTLET, RESPECTIVELY.
4) ALL PIPES, VALVES, AND FITTINGS ON INLET AND OUTLET LINES SHALL BE OF IDENTICAL MATERIAL PER THE SPECIFICATIONS. ALTERNATIVELY, DIELECTRIC UNIONS MAY BE SUBMITTED FOR APPROVAL PRIOR TO INSTALLATION.
5) ALL VAULT PENETRATIONS ARE TO BE SEALED WITH GROUT MATERIAL. IN ACCORDANCE WITH TP 02.
6) AVOID SETTING VALVE IN LOW LYING AREAS OF POTENTIAL FLOODING (DRAINAGE PATH OR PONDING).
7) ARV AND RELATED PIPING TO BE SIZED BY THE DESIGN ENGINEER.
8) CONCRETE BLOCKS USED SHALL BE COMMON IN SIZE.



ACCESS HATCH DETAIL

43C **WASTEWATER AIR VACUUM / RELIEF VALVE VAULT (OVER MAIN)**

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
07-18	REVISED	DSW
01-19	REVISED	LTS
03-19	REVISED	C.G.

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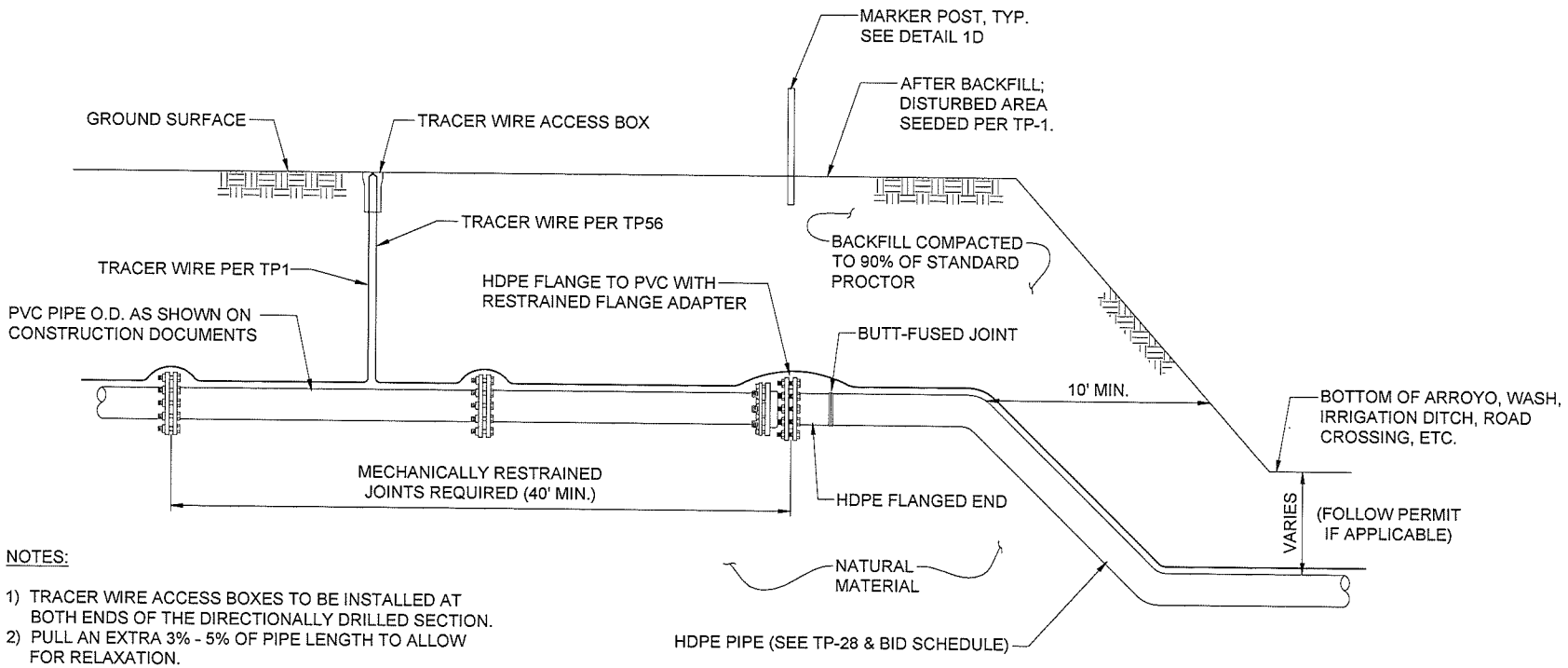
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
WASTEWATER AIR VACUUM-RELIEF VALVE VAULT (OVER MAIN)

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED SEWER DRAWINGS
LAYOUT NAME: 43C
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



NOTES:

1) TRACER WIRE ACCESS BOXES TO BE INSTALLED AT BOTH ENDS OF THE DIRECTIONALLY DRILLED SECTION.
2) PULL AN EXTRA 3% - 5% OF PIPE LENGTH TO ALLOW FOR RELAXATION.
3) ALLOW PIPE TO RELAX FOR A MINIMUM OF 12 HOURS BEFORE CONNECTING TO ADJACENT PIPE.

PROFILE VIEW

56A TYPICAL HORIZONTAL DIRECTIONAL DRILLING DETAIL (HDPE PIPE)

Scale: NTS

DATE	REVISIONS	INITIALS
12-14	UPDATED	
03-18	REVISED	DSW
01-19	REVISED	LTS

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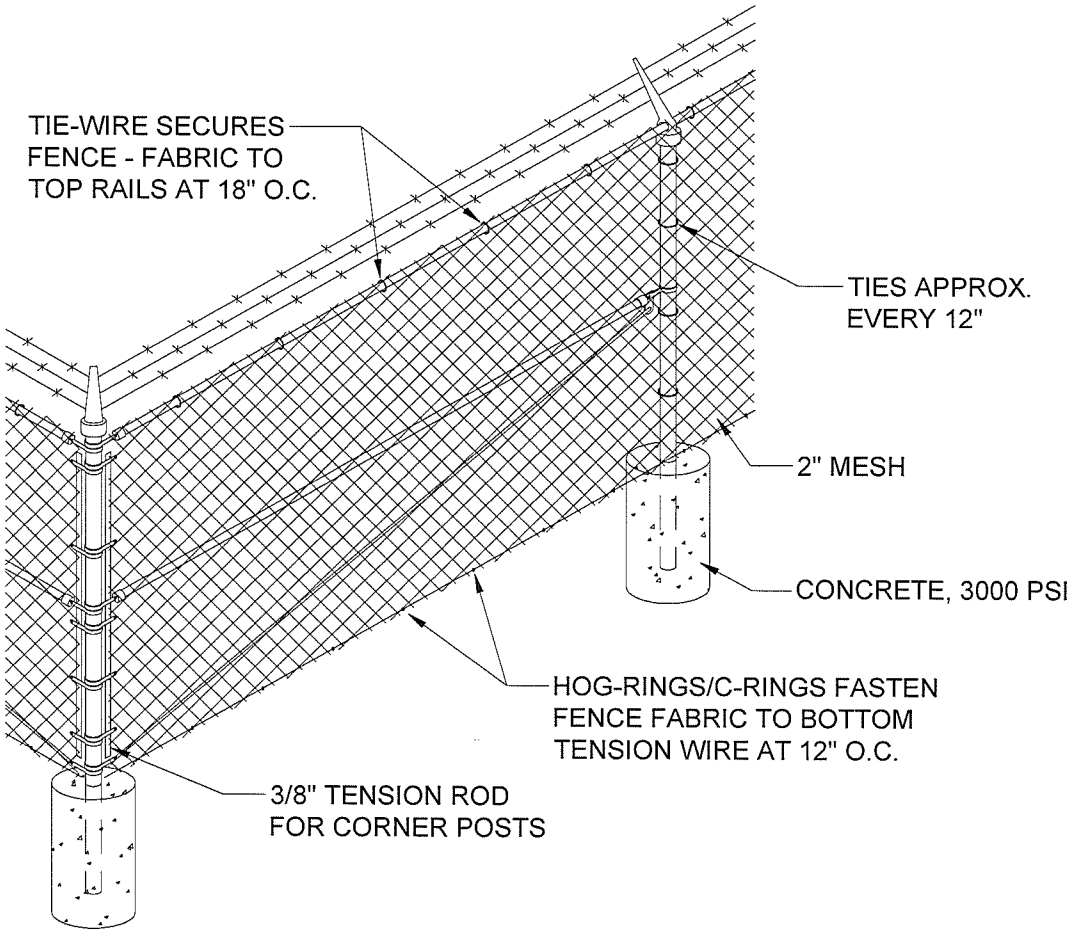
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
TYPICAL HORIZONTAL DIRECTIONAL DRILLING DETAIL

DRAWN BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 56A
PROJ ENG: ____

INCORPORATED INTO THE CONTRACT



60A **FENCE POST**

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
02-18	REVISED	BR

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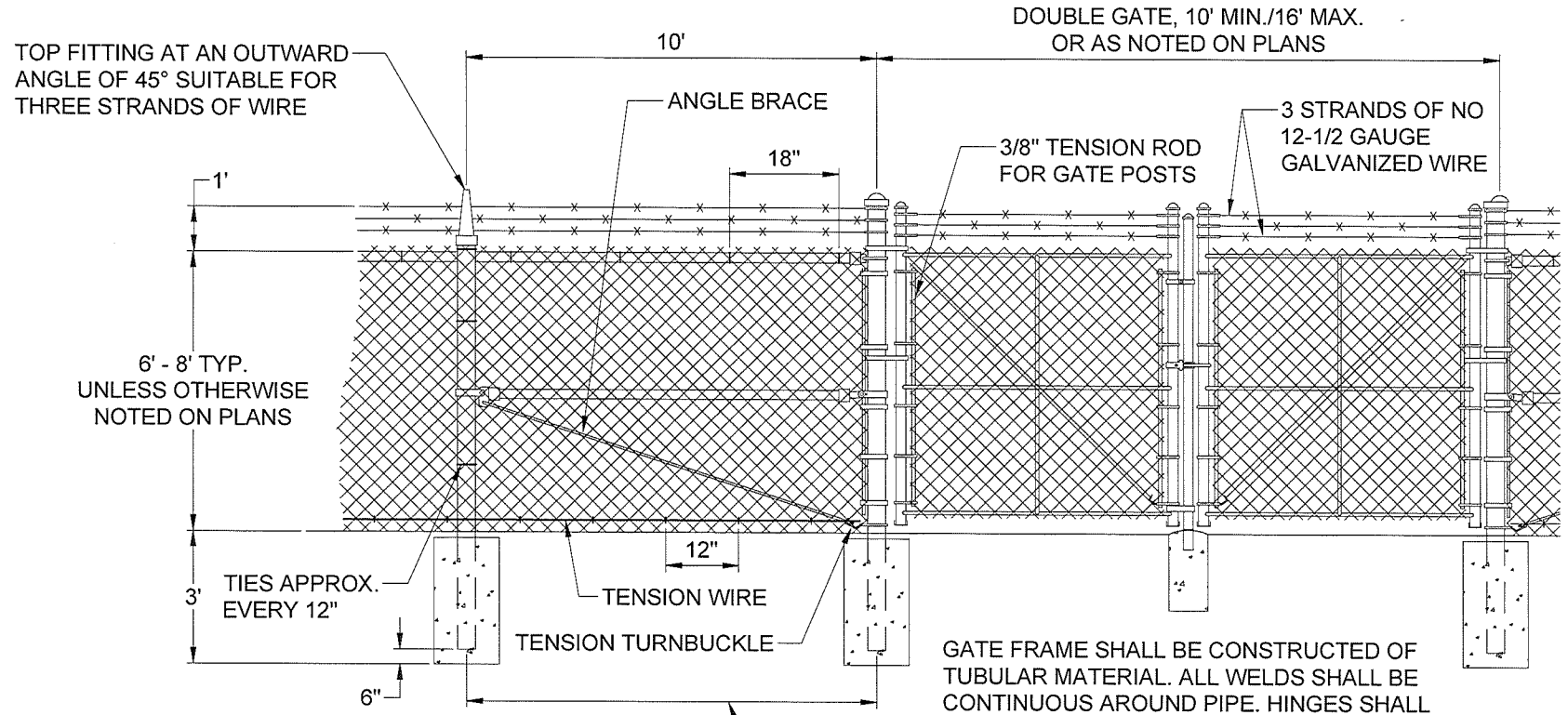
PAO REVISED DETAILS
WATER – SEWER – MISC DETAILS
FENCE POST

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 60A
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



60B FENCE AND GATE DETAIL

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
02-18	REVISED	BR

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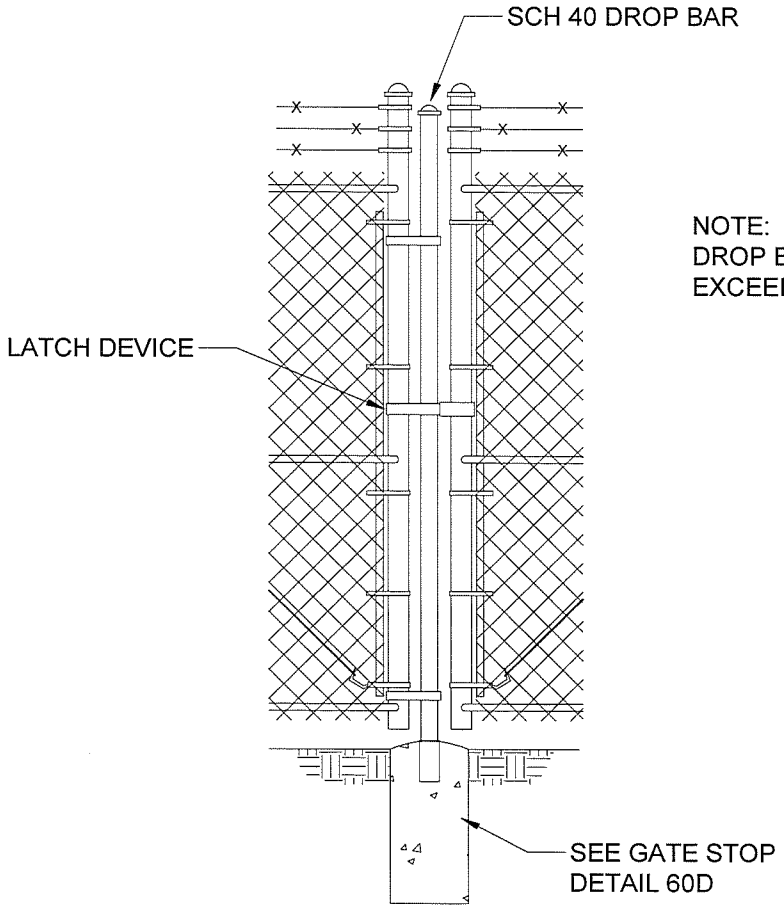
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
FENCE AND GATE DETAIL

DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 60B
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



NOTE:
DROP BAR O.D. MUST NOT EXCEED 1.9".

60C DROP BAR LOCKING DEVICE

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
02-18	REVISED	BR

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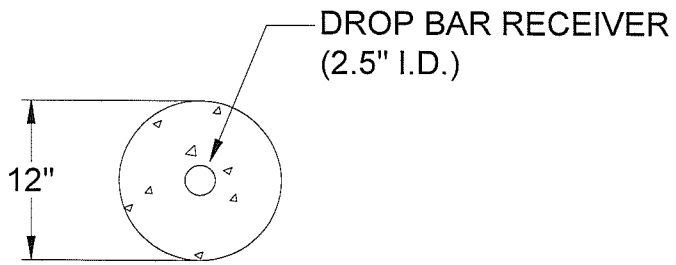
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
DROP BAR LOCKING DEVICE

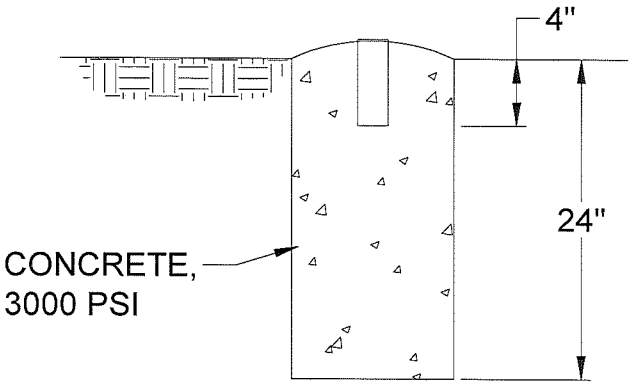
DRAWN BY: ---- DATE: ----
CHECKED BY: ---- DATE: ----

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 60C
PROJ ENG: ----

INCORPORATED INTO THE CONTRACT



PLAN VIEW



ELEVATION

60D GATE STOP

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
02-18	REVISED	BR

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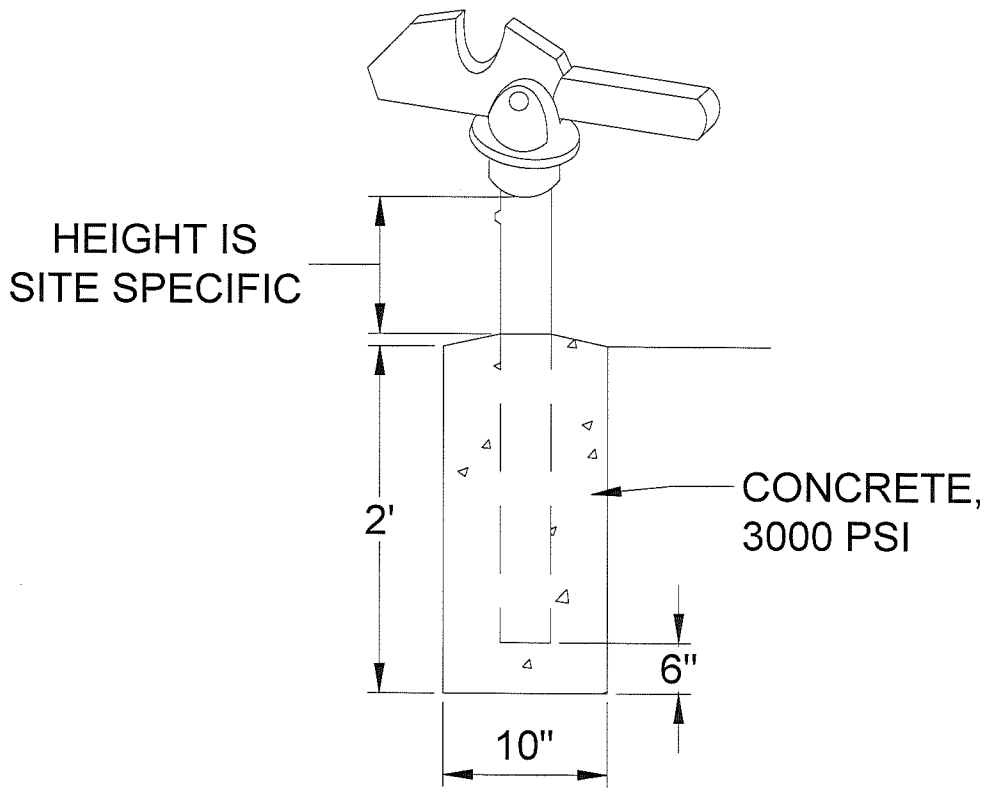
PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
GATE STOP

DRAWN BY: ----- DATE: -----
CHECKED BY: ----- DATE: -----

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 60D
PROJ ENG: -----

INCORPORATED INTO THE CONTRACT



60E GATE KEEPER

Scale: NTS

DATE	REVISIONS	INITIALS
11-14	UPDATED	
02-18	REVISED	BR

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PAO REVISED DETAILS
WATER - SEWER - MISC DETAILS
GATE KEEPER

DRAWN BY: ----- DATE: -----
CHECKED BY: ----- DATE: -----

FILE NAME: REVISED MISC DRAWINGS
LAYOUT NAME: 60E
PROJ ENG: ----

SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

B. The Commissioning Activities listed herein have been developed to support the United States Green Building Council's (USGBC) LEED rating program in accordance with the government requirements developed for the project to support the following credits:
   1. As detailed in Section 01 81 13 – "SUSTAINABLE DESIGN REQUIREMENTS," Commissioning Activities and documentation for the LEED V4 "Energy and Atmosphere" credits for:
      a. the prerequisite of "Fundamental Building Systems Commissioning"
      b. the requirements of "Enhanced and Monitoring Based Commissioning," including the requirements of "Envelope Commissioning"

1.2 RELATED DOCUMENTS

A. Related Sections:
   1. Section 01 33 00 – "SUBMITTAL PROCEDURES"
   2. Section 01 77 00 – "CLOSEOUT PROCEDURES"
   3. Section 01 78 00 – "OPERATION AND MAINTENANCE DATA"
   4. Section 01 78 39 – "PROJECT RECORD DOCUMENTS"
   5. Section 01 79 00 – "DEMONSTRATION AND TRAINING"
   6. Section 01 81 13 – "SUSTAINABLE DESIGN REQUIREMENTS"
   7. Section 01 91 19 – "BUILDING ENCLOSURE COMMISSIONING"
   8. Section 21 08 00 – "COMMISSIONING OF FIRE SUPPRESSION SYSTEMS"
   9. Section 22 08 00 – "COMMISSIONING OF PLUMBING SYSTEMS"
   10. Section 23 08 00 – "COMMISSIONING OF HVAC SYSTEMS"
   11. Section 25 08 00 – "COMMISSIONING OF INTEGRATED AUTOMATION"
   12. Section 26 08 00 – "COMMISSIONING OF ELECTRICAL SYSTEMS"
   13. Section 27 08 00 – "COMMISSIONING OF COMMUNICATION SYSTEMS"

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

C. The Commissioning Plan, as written by the CxA.

1.3 DEFINITIONS

A. Basis of Design (BOD) document: Prepared by each discipline of the Design Team. A document that records concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Owner's Project Requirements (OPR): A written document, prepared by Owner's Representative, which details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design

goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

D. TAB: Testing, Adjusting, and Balancing.

E. Contractor Cx Coordinator (CxC): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

F. Members Appointed by the Owner:
1. CxA: Commissioning Agent. The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the Facility: User, operation, and maintenance personnel. The operations and maintenance staff at a facility are essential for ensuring the smooth and efficient functioning of all systems and equipment. They conduct regular inspections, perform necessary repairs, and provide operational support to maintain optimal conditions. Additionally, they ensure safety compliance and keep detailed records of their activities.
3. Architect and engineering design professionals: responsible for creating the detailed plans and specifications for a construction project. The architect and engineers ensure that the design meets all regulatory standards and client needs, and they may also provide support during the construction phase to ensure the project is built according to their plans.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Provide utility services required to support commissioning activities.

B. Contractor is responsible for construction means, methods, job safety, and management function related to commissioning on the job site.

C. Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
1. Participate in commissioning coordination meetings.
2. Review and comment on construction commissioning documentation including pre-functional checklists and functional performance tests.
3. Attend any Commissioning Software training sessions.
4. Complete enrollment in any Commissioning Software’s hosted by the CxA.
5. Completion of commissioning documentation, such as Pre-Functional Checklists or Pre-Functional Tests.
6. Certify that Work is complete, and systems are operating according to the Contract Documents, including calibration of instrumentation and controls.
7. Complete a Certificate of Readiness prior to requesting CxA witness of functional testing.
8. Provide access to construction areas for the CxA during verification site walks.
9. Provide operation and maintenance manuals as indicated in other sections.

10. Provide operation and maintenance training as indicated in other sections.
11. Test and demonstrate operation of all commissioned equipment and systems.
12. Evaluate performance deficiencies identified in reports and, in collaboration with entity responsible for system and equipment installation, implement corrective action.
13. Review and comment on final commissioning documentation.

D. Contractor shall integrate all commissioning activities into Contractor's master construction schedule.

E. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
1. Participate in commissioning meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in procedures meeting for testing.
4. Participate in final review at acceptance meeting.
5. Attend any Commissioning Software training sessions.
6. Complete enrollment in any Commissioning Software's hosted by the CxA.
7. Completion of commissioning documentation, such as Pre-Functional Checklists or Pre-Functional Tests.
8. Provide information to the CxA for developing the commissioning plan and the final commissioning report.
9. Provide training sessions for Owner's operation and maintenance personnel.
10. Provide updated Project Record Documents to the CxA.
11. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Section 01 78 23 – "OPERATION AND MAINTENANCE DATA"
12. Provide technicians who are familiar with the construction and operation of installed systems to participate in testing of installed systems, subsystems, and equipment.
13. Demonstrate and functionally test commissioned equipment in the presence of the CxA.

1.5 CxA's RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Conduct a commissioning design review of the OPR, BOD, and design documents prior to mid-construction documents phase and back-check the review comments in the subsequent design submissions.

C. Prepare a commissioning plan. Collaborate with design team, Owner Representative, Contractor and with subcontractors to develop test and inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.

D. Work with the Owner's Representative to schedule commissioning activities. The Contractor shall integrate all commissioning activities into the master construction schedule. All parties will address scheduling issues in a timely manner in order to expedite the commissioning process.

E. Review and comment on submittals from Contractor for compliance with the OPR, BOD, Contract Documents, and construction-phase commissioning plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BOD. CxA submittal review comments and/or approval do not relieve the contractor of the requirements of the contract documents.

F. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants.

G. At the beginning of the construction phase, conduct an initial construction-phase "kick-off" coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.

H. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the OPR, BOD, and Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.

I. Prepare Project-specific test and inspection procedures and checklists.

J. Witness and document tests, inspections, and systems startup as required.

K. Maintain a Commissioning Issues Log for the tracking of deficiencies identified in the process of commissioning.

L. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BOD, and Contract Documents. Operation and maintenance documentation requirements are specified in Section 01 77 00 – "CLOSEOUT PROCEDURES."

M. Review Contractor's training program. Training Requirements are Specified in Section 01 79 00 – "DEMONSTRATION AND TRAINING"

N. Assemble the final commissioning documentation, including the final commissioning report and the systems manual.

O. Verify seasonal testing.

P. Verify all trend data needed for review is being captured and saved for the necessary time period.

Q. Review building operations 10 months after substantial completion.

R. Develop an on-going commissioning plan and monitoring based commissioning plan.

1.6 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by CxA, that details the prescribed commissioning activities and requirements for the projects. The Cx Plan shall include, but is not limited to, the following:

1. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
2. Identification of systems and equipment to be commissioned.

3. Description of testing procedures along with identification of parties involved in performing and verifying tests.
4. Description of responsibilities of commissioning team members.
5. Details of Cx activity forecasted durations.
6. Description of expected performance for systems, subsystems, equipment, and controls.
7. Details of design changes that impacted commissioned systems during the construction phase.
8. Procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

B. Pre-Functional Checklists: CxA shall develop pre-functional checklists for all equipment to be commissioned. The contractor and subcontractors shall review the documents for accuracy and provide comments. Once the comments are incorporated, the contractor and subcontractors shall complete pre-functional checklists in tandem with construction progress. The checklists shall be completed prior to the submission of the Certificate of Readiness.

C. Functional Performance Testing: CxA shall develop functional performance test procedures for all equipment and systems to be commissioned. Contractor and the subcontractors shall review the test procedures for accuracy and provide comments. Once the comments are incorporated, the contractor shall perform the functional tests in coordination with the CxA.

E. Certificate of Readiness: A Certificate of Readiness shall be prepared and signed by Contractor, Subcontractor(s), and Installer(s) certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed Pre-Functional checklists shall accompany this certificate.

F. Test and Inspection Reports: Contractor and sub-contractors shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

G. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Contractor shall retest systems and equipment requiring corrective action and CxA shall document retest results.

H. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BOD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues. The contractor will be provided access to the issues log to add updates.
   1. Creating an Issues Log Entry:
      a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
      b. Assign a descriptive title of the issue.
      c. Identify date and time of the issue.
      d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.

e. Identify system, subsystem, and equipment to which the issue applies.
f. Identify location of system, subsystem, and equipment.
g. Include information that may be helpful in diagnosing or evaluating the issue.
h. Identify commissioning team member responsible for corrective action.
i. Identify person documenting the issue.

2. Documenting Issue Resolution:
a. Log date correction is completed, or the issue is resolved.
b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
c. Identify changes to the OPR, BOD, or Contract Documents that may require action.
d. State that correction was completed, and system, subsystem, and equipment is ready for retest, if applicable.
e. Identify person(s) who corrected or resolved the issue.
f. Identify person(s) documenting the issue resolution.

I. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the OPR, BOD, and Contract Documents. The commissioning report shall include, but is not limited to, the following:
1. OPR and BOD documentation.
2. Commissioning plan.
3. Testing plans and reports.
4. Corrective modification documentation.
5. Issues log.
6. Completed Pre-Functional checklists.
7. Completed Functional Performance Tests.
8. Blank Functional Performance Test templates.
9. Listing of warranty phase commissioning activities planned and a schedule for their completion.
10. Training Documentation

J. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:
1. OPR and BOD, including system narratives, schematics, and changes made throughout the Project.
2. Project Record Documents as specified in Section 01 78 39 – “PROJECT RECORD DOCUMENTS”
3. Operation and maintenance data as specified in Section 01 78 00 – “OPERATION AND MAINTENANCE DATA”

1.7 SUBMITTALS

A. Commissioning Plan Pre-Final Submittal: CxA shall submit the construction phase pre-final commissioning plan electronically to the Owner Representative, Contractor, and Architect for review and comment. Review comments will be returned to the CxA for preparation of the final construction phase commissioning plan.

B. Commissioning Plan Final Submittal: CxA shall submit the final commissioning plan electronically to the Owner Representative. The final submittal must address previous review comments.

C. Commissioning Checklists: CxA shall electronically submit project specific pre-functional checklists and functional performance test forms to Contractor quality-control manager and subcontractors for review and comment.

D. Certificates of Readiness: Contractor shall submit Certificates of Readiness for each system to be commissioned prior to scheduling functional testing.

E. Test and Inspection Reports: Contractor shall submit test and inspection reports detailed in technical sections for review and comment.

F. Commissioning Issues Log: The CxA will maintain an online commissioning issues log for review and update by the commissioning team.

G. Pre-final Commissioning Report Submittal: CxA shall submit pre- final commissioning report electronically to the Owner Representative, Contractor, and Architect for review and comment. Review comments will be returned to the CxA for preparation of the final construction phase commissioning plan.

H. Final Commissioning Report Submittal: CxA shall submit the final commissioning report electronically to the Owner's representative, Contractor and Architect.

1.8 QUALITY ASSURANCE

A. Instructor Qualifications: Factory-authorized service representatives experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

1.9 SCOPE

A. The system to be commissioned are:
   1. HVAC&R
      a. Air Handling Units: Heat Recovery, Steam Humidifiers, Fan Arrays, MAU
      b. Terminal Units: Precision Air Valves, VAV, VAV w/ Reheat, Active Chilled Beams
      c. Chillers: Air-Cooled Chillers, Air Source Heat Pumps, CHWPs and CHBPs, Air Separator, Expansion Tank
      d. Electric Boilers: HHWPs, Air Separator, Expansion Tank
      e. Space Heating Units: Air Curtains, Cabinet Heater
      f. CRAC Units: Water-cooled w/ Reheat, Infrared Humidifier
      g. Air Conditioning Units: Outdoor CUs, Indoor FCUs
      h. Exhaust Fans
      i. Refrigeration equipment: Outdoor CUs, Evaporator units
      j. Building Management System
      k. Any additional HVAC&R equipment/systems that require LEED commissioning.
   2. Electrical
      a. Service and Distribution: Switchgears, Transformers, Distribution Boards and Panelboards
      b. Lighting and Emergency Lighting Systems: Interior, Exterior, Occupancy Sensors, Controls, Photocells

c. Emergency Power Supply: Generators, Automatic Transfer Switches, Uninterruptable Power Supply (UPS)
d. Electrical Meters
e. Any additional Electrical equipment/systems that require LEED commissioning.

3. Plumbing Systems
   a. Water Distribution System: Booster Pump, Decontamination Tank, Backflow Prevention
   b. Domestic Hot Water System and Controls: Electric Water Heaters, Circulating Pumps, Expansion Tank, Mixing Valves
   c. Water Treatment: RO Systems, Water Softeners, Filter Backwash
   d. Sump Pumps and Controls
   e. Grease Interceptors: Oil/Water Separator, Heat Trace
   f. Air Compressors: Air Pressure Regulators, Dessicant Air Dryers, Filters
   g. Vacuum Pumps
   h. Water Meters
   i. Any additional Plumbing equipment/systems that require LEED commissioning.
4. Building Envelope Systems
   a. Exterior Envelope: Exterior Walls, Exterior Windows, Exterior Doors, Louvers
   b. Foundations (Excluding Structural): Vapor Retarders, Below-grade Waterproofing
   c. Roof System: Roof Membrane, Green Roof, Roof Openings (Pipe Chases, Ducts, Equipment Curbs, etc.)
   d. Any additional Building Envelope components/systems that require LEED commissioning.
5. Fire Suppression Systems
   a. Fire Sprinkler System and Controls: Wet Standpipes, Backflow Preventors, Water Flow Alarm Switches, Automatic Air Venting Device
   b. Fire Pumps
   c. Flow Switches
   d. Heliport Suppression Systems
   e. Any additional Fire Suppression equipment/systems that require LEED commissioning.
6. Communication Systems
   a. Security System: Local Alarm Sounder, Emergency Call Stations, Intercom Stations, Video Intercom Stations, Panic Buttons
   b. Distributed Antenna Systems
   c. Integrated Audiovisual Systems
   d. Paging Systems
   e. Intercom System: ICT (Telecom/Multiservice) Devices
   f. Fire Alarm System: Voice Evacuation Panel, Annunciator Panel, Emergency Communication Units
   g. Nurse Call and Code Blue Systems: Nurse Call Devices, Medical ICT Devices
   h. Patient, Infant, and Equipment RFID Tracking Systems
   i. Any additional Communication equipment/systems that require LEED commissioning.

7. Electronic Safety and Security Systems
    a. Fire Detection and Alarm System: Smoke Detectors, Heat Detectors, Combination Fire/Smoke Dampers, Strobes, Control Panels, Manual Pull Stations
    b. Grounding and Bonding
    c. Security Access Control Systems: Security Doors, Card Readers, Card Readers w/ Keypad, Arming Keypads
    d. Video Surveillance System
    e. Intrusion Detection Systems
    f. Any additional Electronic Safety and Security equipment/systems that require LEED commissioning.
8. Site Utilities
    a. Electrical Microgrid: PV Array, Inverters, Switchgears
    b. Wastewater Process Equipment: Pumps, meters, valves, SCADA, Booster Stations, Lift Stations, Chemical Feed Systems, Instrumentation and Overflow Systems.
    c. Any additional Site Utilities equipment/systems that require LEED commissioning.
9. Equipment
    a. Medical Equipment: X-RAY Screen, Air and Oxygen Flow Meters, Fume Hoods and Biosafety Cabinets, Reach-in Refrigerators and Freezers,
    b. Medical Vacuum System: Vacuum Pumps
    c. Medical Gas Systems: Cylinder Gas Manifolds
10. Wastewater Treatment Equipment
    a. Cranes : Davit, Traveling Bridge
    b. Pumps : Influent, EQ Basis, RAS, Process, Non-Potable Water, Efficient, Sludge
    c. Blowers : Digester
    d. Membrane Bioreactor : Complete System
    e. Soudge Dewatering : Screw Press, Polymer Blending System, Screw Conveyor
    f. Screening : Coarse Screening, Fine Sceening, Grit Removal System
    g. Disinfection: UV, Chlorine
    h. Aeration Systems: EQ Basin

1.10 SAMPLING

A. The sampling rates for functional testing for the systems to be commissioned are as follows.
    1. HVAC&R
        a. Precision Air Valves will be sampled at a rate of 25% or 10 units, whichever is greater
        b. Terminal VAVs will be sampled at a rate of 25% or 10 units, whichever is greater
        c. Chilled Beams will be sampled at a rate of 25% or 10 units, whichever is greater
        d. Hydronics Pumps at a rate of 25% or 2 of each similar type, whichever is greater.
    2. Electrical
        a. Lighting controls will be tested at a rate of 50%.

b. Regular and K-type Transformers will be tested at a rate of 50%.

3. Life Safety Systems
   a. Fire sprinklers will be sampled at a 50% rate.
   b. Fire doors will be sampled at a 50% rate.
   c. Exit light fixtures will be sampled at a 50% rate.
   d. Emergency lighting will be sampled at a 50% rate.
   e. Smoke detectors and sensors will be sampled at a 50% rate.
   f. Horn/Strobe lights for the fire alarm will be sampled at a 25% rate.
   g. Manual pull stations will be sampled at a 25% rate.
4. Telecommunication Systems
   a. Network Drops will be sampled at a 10% rate.
   b. Other Network Equipment will be sampled at 25% rate.
5. Equipment
   a. Medical Gas system equipment, Fume Hoods, Biosafety Cabinets, and Reach-in Refrigerators and Freezers will be sampled at a rate of 20% or one (1) unit per unique type, whichever is greater.

B. Unless called out above, the prescribed sampling rate for equipment is 100%.

C. Sampling scheme: The prescribed % sample of each equipment group will be tested. Where an error is encountered, check an additional and equal % of equipment and repeat the process until either all equipment is checked, or no further errors are found.

1.11 COORDINATION

A. Coordinating Meetings: CxA shall conduct coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

B. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

C. Testing Coordination: CxA shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

D. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The contractor shall provide all standard and specialized testing equipment required to perform systems functional performance testing. Test equipment required for systems functional performance testing will be identified in the detailed system functional performance test procedure prepared by the CxA

B. Data logging equipment and software required to test equipment shall be provided by the contractor.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise

noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of +/- 1ºF and a resolution of 0.2ºF. Pressure sensors shall have an accuracy of +/- 2% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 START-UP, PRE-FUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned.

B. General. Pre-functional Checklists are developed and completed for all major equipment and systems being commissioned. The checklist captures equipment nameplate and characteristics data, confirming the as-built status of the equipment or system. These checklists also ensure that the systems are complete and operational, so that the functional performance testing can be scheduled. The checklists are drafted by the CxA and completed (filled out) by the installing Contractor.

C. Development of Pre-functional Checklists. Before checklists are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CxA shall develop specific line items to verify and document proper installation of each piece of equipment and system. Prior to approving the checklists for use, the CxA shall provide a copy of the checklists to the Contractor who shall review the tests for feasibility, safety, accuracy, and equipment/warranty protection.

D. Start-up Reports. Start-up testing reports, as required by technical sections, for equipment designated for commissioning, will be submitted for CxA review and comment.

E. Sensor Calibration. Calibration of all sensors shall be included as part of the pre-functional checklists performed by the Contractors.

F. Execution of Pre-functional Checklists and Startup.
   1. Sub-contractors and vendors schedule startup and checkout with the Owner Representative, Contractor, and CxA.
   2. The CxA shall observe the procedures for each piece of primary equipment.
   3. For lower-level components of equipment in non-sensitive areas of the Project, (e.g., VAV boxes, reheat coils), the CxA shall observe a sampling of the pre-functional and start-up procedures.
   4. The Contractor and vendors shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and pre-functional checklists.
   5. Only individuals that have direct knowledge and witnessed that a line-item task on the pre-functional checklist was performed shall initial or check that item off.

G. Deficiencies, Non-Conformance and Approval in Checklists and Startup.
   1. The Contractor shall clearly list any outstanding items of the initial start-up and pre- functional procedures that were not completed successfully, in the notes of the procedures form or on an attached sheet. The procedures form

and any outstanding deficiencies are provided to the CxA within two days of completion.

2. The CxA reviews the report and recommends action (approval or rejection) to the Owner Representative. The CxA shall work with the Contractor and vendors to verify the corrective actions or retests are completed. The CxA will involve the Owner Representative and others as necessary.

3.2 FUNCTIONAL PERFORMANCE TESTING

A. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

B. Development of Test Procedures. Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior to execution, the CxA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection. The CxA shall review contracted or factory testing which the CxA is not responsible to oversee and shall determine what further testing may be required to comply with the Contract Documents. Redundancy of testing shall be minimized.

C. The test procedure forms developed by the CxA shall include, at minimum, the following information:
   1. System and equipment or component name(s).
   2. Equipment location and ID number.
   3. Date.
   4. Project name and Project Number.
   5. Participating parties.
   6. Reference to the specification section describing the test requirements.
   7. A copy of the approved sequence of operations.
   8. Instructions for setting up the test.
   9. Special cautions, alarm limits, etc.
   10. Specific step-by-step procedures to execute the test.
   11. Acceptance criteria of proper performance with a Yes / No check box.
   12. A section for comments.
   13. Signatures and date block for the CxA.

D. Test Methods:
   1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The CxA will determine which method is most appropriate.

2. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Contractor executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
3. Sampling. Multiple identical pieces of non-life-safety or non-critical equipment may be functionally tested using a sampling strategy. For details on sampling, refer to the section “Sampling”.

E. Coordination and Scheduling. The Contractor shall provide no less than 14 calendar days notice to the CxA regarding their schedule for the completion of the pre-functional checklists and startup of all equipment and systems. The CxA will schedule functional tests through the Owner’s Representative. The CxA shall witness and document the functional testing of all equipment and systems and advise on any test steps when needed. The Contractor shall execute the tests.

F. Problem Solving. The CxA will recommend solutions to problems found; however, the burden of responsibility to solve, correct, and retest problems lie with the Contractor and their subcontractors.

3.3 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. The CxA shall review and provide comment on the training plans developed by the contractor, as specified in Section “01 79 00 – DEMONSTRATION AND TRAINING,” for alignment with the requirements of the OPR and BOD.

B. Functional testing will be completed and approved by IHS and the CxA prior to the scheduling of O&M Training.

C. The O&M manuals shall be submitted for review no less than 21 calendar days prior to functional testing.

D. Training Modules: Contractor shall develop an instructional program for review by the CxA that includes individual training modules for each system, subsystem, and equipment. Further detail can be seen in Section “01 79 00 – DEMONSTRATION AND TRAINING.”

3.4 WARRANTY PHASE SITE WALK REQUIREMENTS

A. A representative of the Contractor will attend the warranty-end commissioning site walk coordination meeting.

B. A representative of the Contractor will attend the warranty-end site walk, upon request of the commissioning team.

END OF SECTION

SECTION 019119 - BUILDING ENCLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building enclosure Cx process requirements for the above- and below-grade systems and assemblies:
Horizontal and vertical waterproofing.
1. Opaque walls.
2. Roofs.
3. Openings.
4. Interfaces.

B. Related Requirements:
1. Section 019113 "General Commissioning Requirements" for general requirements for Cx processes including definitions, Cx team membership, Owner's responsibilities, Contractor's responsibilities, and CxA's responsibilities.

1.2 DEFINITIONS

A. Building Enclosure: Materials, components, systems, and assemblies intended to provide shelter and environmental separation between interior and exterior, or between two or more environmentally distinct interior spaces in a building or structure. The building enclosure includes, but is not limited to, exterior walls, above and below grade, and roof assemblies.

B. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

C. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

D. First-Installation Mockups: Initial installation of specific enclosure materials, components, systems, and assemblies that are part of Work.

E. Integrated Exterior Mockups: Integrated mockups of the exterior enclosure erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

F. Laboratory Mockups: Full-size physical assemblies constructed at testing facility.

G. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

H. Water Penetration: Visible evidence of uncontrolled water penetration on or adjacent to the test specimen in a location not intended to collect and drain water to the building exterior.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Draft Construction Checklists: Draft Construction Checklists will be created by CxA for Contractor review.

C. Final Construction Checklists: Comply with requirements in Section 019113 "General Commissioning Requirements" for Construction Checklists:

D. Cx Process Submittals:
1. Shop Drawings: For mockups, including elevations, plans, sections, and full-size details. Show interface conditions, interconnections, and terminations.
2. Testing Program: Developed specifically for Project.
3. Test Reports: Prepared by a qualified testing agency for each test.
4. Record Drawings: As-built drawings of mockups showing changes made during testing.

E. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For building envelope systems and components to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated.

B. Build mockups to evaluate constructability and performance and demonstrate the coordination of trades and sequencing of work necessary to ensure functional and integrated performance of materials, components, systems, assemblies, and interfaces.
1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Notify Architect and CxA fourteen days in advance of the dates and times when mockups will be constructed and tested.

C. Laboratory Mockups: Build at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.

D. Integrated Exterior Mockups: Build at Project site on site at locations indicated on Drawings as directed by Architect.

E. First Installation Mockups: Prepare each major exterior enclosure system for testing when first installed and before proceeding with construction of additional similar assemblies. If in compliance, Work may remain as part of the completed construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONSTRUCTION CHECKLIST REVIEW

A. CxA will create required draft Construction Checklists for exterior enclosure systems, subsystems, equipment, and components and provide them to Contractor. Review and provide written comments on draft Construction Checklists. The goal of the review should

be to align the contractor's understanding of the installation requirements with the commissioning agent's.

B. Return draft Construction Checklist review comments within 10 days of receipt.

C. When review comments have been resolved, CxA will provide final Construction Checklists for use.

D. Complete the Construction Checklists developed by the CxA Complete and submit the finalized Construction Checklists. Use only Construction Checklists approved for use.

3.2 GENERAL TESTING REQUIREMENTS

A. If tests cannot be completed because of a deficiency outside the scope of the building enclosure systems, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

B. In the event of any conflict between the criteria detailed in other Contract Documents and that delineated herein, the more stringent shall govern.

C. Failure of Building Enclosure Field Testing
1. Upon failure of a test during building enclosure testing, the failed specimen is to be remediated and retested until the specimen passes.
2. For each failed test, two additional specimens of similar condition are to be chosen by the Architect for testing. These additional specimens are subject to the same requirements of this section.
3. All costs associated with retesting and increased sample rates will be the responsibility of the General Contractor. These increased costs will include increased Commissioning Agent's and Testing Agency costs.

D. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

E. Coordinate test schedule with the CxA. The CxA shall be notified of all functional testing.

3.3 LABORATORY MOCKUP TESTING

A. Not used.

3.4 INTEGRATED EXTERIOR MOCKUP TESTING

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Integrated Exterior Mockup Testing Program: Perform the following tests in the following order:
1. Window Air Infiltration: ASTM E783 at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
   a. Maximum air leakage of 0.09 cfm/sq. ft..
2. Smoke Testing: If window air infiltration testing fails, ASTM E1186 at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) may be conducted for troubleshooting purposes.
3. Water Penetration under Static Pressure: ASTM E1105 with minimum uniform static-air-pressure differential of 10 lbf/sq. ft. (480 Pa).

a. No evidence of water penetration.
4. Pull-off Strength of Adhered Air Barriers: ASTM D4541 as modified by ABAA T0002.
a. Minimum 16 lbf/sq. in. (110 kPa) adhesion to substrate.
5. Sealant Durability: ASTM C1193.
a. Must fail cohesively.

3.5 FIRST-INSTALLATION MOCKUP TESTING

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Wall Mockups: Perform the following tests in the following order:
1. Window Air Infiltration: ASTM E783 at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
a. Maximum air leakage of 0.09 cfm/sq. ft..
2. Window Smoke Testing: If window air infiltration testing fails, ASTM E1186 at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) may be conducted for troubleshooting purposes.
3. Window Water Penetration under Static Pressure: ASTM E1105 with minimum uniform static-air-pressure differential of 10 lbf/sq. ft. (480 Pa).
a. No evidence of water penetration.
4. Water-Spray Test: AAMA 501.2.
a. No evidence of water penetration.
5. Wall and Window Water Penetration under Dynamic Pressure: AAMA 501.1 at a test pressure of 10 lbf/sq. ft. (480 Pa).
a. No evidence of water penetration.
6. Pull-off Strength of Adhered Air Barriers: ASTM D4541 as modified by ABAA T0002.
a. Minimum 16 lbf/sq. in. (110 kPa) adhesion to substrate.
7. Sealant Durability: ASTM C1193.
a. Must fail cohesively.

C. Roof Mockup: Perform the following tests in the following order:
1. Flood Testing of Horizontal Waterproofing: ASTM D5957.
a. Plug roof drain, and flood sump only.
b. No evidence of water penetration for a minimum 48 hours.

D. Building Expansion Joint Mockups: Perform the following tests:
1. Water-Spray Test: AAMA 501.2.
a. No evidence of water penetration.

3.6 BUILDING ENCLOSURE TESTING

A. Building Enclosure Testing: Perform testing before installation of interior finishes unless otherwise indicated.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Building Enclosure Testing: Perform the following tests using the same test parameters and pass/fail criteria used in Section 3.6. First installation mock-ups may be counted toward the totals below.

1. Window Air Infiltration: ASTM E783 at a static-air-pressure differential.
   a. Perform a minimum of 4 tests per elevation.
   b. Perform a minimum of 1 test per window type.
   c. Perform a minimum of 1 test per window type per wall assembly.
2. Air Leakage Site Detection: ASTM E1186.
   a. For diagnostics.
3. Water Penetration under Static Pressure: ASTM E1105.
   a. Perform a minimum of 4 tests per elevation.
   b. Perform a minimum of 1 test per window type.
   c. Perform a minimum of 1 test per window type per wall assembly.
4. Water Penetration under Dynamic Pressure: AAMA 501.1
   a. Perform a minimum of 4 tests per elevation.
   b. Perform a minimum of 1 test per window type.
   c. Perform a minimum of 1 test per window-wall interface.
   d. Perform a minimum of 1 test per wall type.
5. Water-Spray Test: AAMA 501.2.
   a. Perform on minimum of 3% of weather seals by linear feet
   b. Perform on minimum of 3% of seismic joints by linear feet
   c. Specimen size to be 5 linear feet minimum
   d. Perform a minimum of 4 tests per elevation.
   e. Perform a minimum of 1 test per assembly type.
   f. No evidence of water penetration.
6. Flood Testing of Horizontal Waterproofing: ASTM D5957
   a. 100% of all green roof areas.
   b. No evidence of water penetration.
7. Location of Wet Insulation in Roofing Systems: ASTM C1153.
   a. No wet insulation.
8. Pull-off Strength of Adhered Air Barriers: ASTM D4541 as modified by ABAA.
   a. Perform a minimum of 4 tests per elevation.
9. Sealant Durability: ASTM C1193.
   a. Perform a minimum of 4 tests per elevation.
   b. Perform a minimum of 3 tests per membrane-substrate incidence.
10. Whole Building Air Leakage Rate by Fan Pressurization: ASTM E779/E1827.
    a. Maximum Air Leakage Rate: 0.40 cfm/sq. ft.

3.7 BUILDING ENCLOSURE TESTING MATRIX (MAIN BUILDING)

Property	Standard Designation	Title	Field Mockup Testing	In-Situ Field Testing
Air Infiltration				
Air Leakage	ASTM E779	Test Method for Determining Air Leakage Rate by Fan Pressurization	…	✓
Air Leakage	ASTM E1827	Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door	…	✓
Air Leakage	ASTM E783	Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors	✓	✓
Air Leakage	ASTM E1186	Practice for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems	✓	✓
Thermal Performance and Condensation Resistance				
Insulation	ASTM C1153	Practice for Location of Wet Insulation in Roofing Systems Using Infrared Images	…	✓
Water Penetration				
Water Penetration	ASTM D5957	Guide for Flood Testing Horizontal Waterproofing Installations	✓	✓
Static Water Penetration	ASTM E1105	Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference	✓	✓
Dynamic Water Penetration	AAMA 501.1	Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure	…	✓
Dynamic Water Penetration	AAMA 501.2	Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems	✓	✓
Durability and Appearance				
Adhesion and durability	ASTM D4541/ ABAA T0002	Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers	✓	✓
Sealant Durability	ASTM C1193-11a, Appendix X1-Method A	Guide for Use of Joint Sealants: Field-Applied Sealant Joint Hand Pull Tab	✓	✓

NOTE 1 - Areas of the table marked by leaders ("…") indicate test methods that are not applicable.
NOTE 2 - "(OF)" indicates an optional field test.

NOTE 3 - "✓" indicates a mandatory field test followed by the minimum number of tests required in accordance with unique material, component, system, or assembly.

3.8 BUILDING ENCLOSURE TESTING MATRIX (UTILITY CAMPUS)

Property	Standard Designation	Title	Field Mockup Testing	In-Situ Field Testing
Thermal Performance and Condensation Resistance				
Insulation	ASTM C1153	Practice for Location of Wet Insulation in Roofing Systems Using Infrared Images	…	✓
Water Penetration				
Static Water Penetration	ASTM E1105	Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference	✓	✓
Dynamic Water Penetration	AAMA 501.2	Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems	✓	✓
Durability and Appearance				
Sealant Durability	ASTM C1193-11a, Appendix X1-Method A	Guide for Use of Joint Sealants: Field-Applied Sealant Joint Hand Pull Tab	✓	✓

END OF SECTION 019119

SECTION 019200 FACILITY OPERATION, MAINTENANCE, AND TROUBLESHOOTING MOBILE GRAPHICAL INFORMATION MANAGEMENT PLATFORM

PART 1 - GENERAL

1.1 DEFINITIONS

A. Annotated Video: Emphasis within video content that includes captions, line drawing, arrows, and other visual effects to provide topic highlighting.

B. Annual Service Contract: An optional contract for ongoing support and update of platform.

C. Cellular Access: Wireless connection to the internet over cell phone data networks.

D. Digital Forms: Documents in.PDF format with pre-determined fields for data input including text fields and photo attachment on a mobile device.

E. Equipment Analysis Applications: Mobile computing applications to measure physical properties of equipment operation.

F. Facility: The organization that receives the information platform, services, and hardware described herein.

G. Internet Connectivity: All platform system access available for daily use without internet connectivity.

H. Knowledge Transfer Consulting: A field of practice specializing in transferring the knowledge, expertise, and skills supporting aspects of a functional system or organization.

I. Intuitive Graphical Access: Graphical interface that allows users to interact with mobile devices using visual indicators.

J. Long Format Video: Video file with nominal duration between 1.5 and 4 minutes.

K. Mobile Platform: Graphical Information Management Platform designed for use on mobile computing devices, specifically smartphones and tablets.

L. Remote Server: Data storage computer located independently of user’s local network.

M. Remote Synchronization: Download of digital content from a remote server such that only updated content is transferred.

N. Short Format Video: Video file with nominal duration between 0.25 and 1.49 minutes.

O. Standard Procedures: Procedures specific to operation, maintenance or troubleshooting that describe activities necessary to complete tasks.

P. Supplier: Mobile Platform provider who develops and provides fully operating mobile platform solution.

1.2 SCOPE

A. Provide hardware, software, and services to produce a Mobile Platform with content described herein.

1. Mobile Platform shall identify critical elements for operations, maintenance and troubleshooting performance of all systems listed below.
2. Mobile Platform shall consist of a graphically indexed information storage and retrieval system.
3. Mobile Platform shall provide a library with direct access to plans, documents, manuals, standard procedures, videos.
4. Mobile Platform shall provide layering of detail, beginning with general overall layout and then providing detail layers, accessible through embedded content links into processes and equipment. Related documents are to be interlinked with an icon-based user interface. Interconnection shall be provided within and between related systems.
5. Mobile Platform shall provide knowledge transfer to personnel at multiple skill levels of supporting information for performing sequential steps in operations, maintenance, troubleshooting, and emergency response tasks.
6. Mobile Platform shall include laboratory testing, compliance requirements, permits, emergency response, operations, maintenance, and troubleshooting information for all systems, subsystems, and equipment for the following, but not limited to:
   a. Building Systems: Mechanical, Electrical, Plumbing, Auxiliary Power
   b. Site Systems: Irrigation, Water Features, Stormwater
   c. Utilities: Potable and Non-potable Water Distribution, Sewer Collection, Pump and Lift Stations, Water Treatment, Wastewater Treatment
7. Mobile Platform shall include integration of the existing Master Utility Plan and supporting procedures, multi-media files, and documents.
8. Mobile Platform shall be prepared by company with a minimum of 5 years of experience with Knowledge Transfer Consulting, and 20 site implementations of the Graphical Information Management Platforms customized to each site. References shall be provided for each site implementation.
9. The Supplier shall provide a team that ensures that all onsite consulting, field work, content development, system procedures, multimedia production, and development of Graphical Information Management Platform are supported by a qualified staff. Supplier shall provide a project team with the minimum personnel and qualifications:

   a. **Professional Engineers (PEs**):
      1) Must hold active engineering licensure in an U.S. jurisdiction in a related field of mechanical, electrical, and/or civil systems.
      2) Minimum of 10 years of relevant experience in mechanical and treatment systems including design, construction, operations, maintenance, training, and commissioning.
      3) Responsible for onsite consulting, field support, technical accuracy, validation of system procedures, and oversight of engineering content.

   b. **Equipment Operations Specialists:**
      1) Minimum 5 years of field experience in water, wastewater, mechanical, or utility operations.
      2) Responsible for procedure development, field validation, and scenario-based troubleshooting content.

c. **Videographers / Multi-Media Technicians**:
   1) Minimum 3 years of experience producing professional technical video and multimedia instructional content for similar systems. Must be experienced with the use of multi-media to enhance knowledge transfer.
   2) Responsible for recording, editing, and annotating short and long videos, and capturing supporting audio and photographs.
   3) Proficient at techniques for integrating, editing and enhancing multi-media.
   4) Must comply with IHS security and privacy requirements for all captured site imagery or audio.

10. The Supplier shall coordinate with the Indian Health Service (IHS) security and information technology teams to ensure the Graphical Information Management Platform complies with all applicable data protection and cybersecurity requirements, including but not limited to:

    a. **Data Storage & Synchronization Requirements**
       1) All web-based storage, remote servers, and synchronization processes must meet IHS-approved security standards.
       2) No data shall be stored or transmitted using unapproved commercial cloud systems without written approval.
       3) Supplier must support configuration of platform content on IHS-controlled servers, networks, or approved cloud environments.

    b. **Security Review & Approval**
       1) The Supplier shall participate in required IHS security reviews, including documentation of data flows, authentication methods, and remote access mechanisms.
       2) Any platform updates or new releases that affect data handling or access must be reviewed with IHS IT/security prior to deployment.

    c. **Privacy & Access Control**
       1) All video, multimedia, digital forms, and field documentation must comply with federal information security guidelines.
       2) Supplier shall ensure that no Personally Identifiable Information (PII) or sensitive facility security details are stored or transmitted outside IHS-compliant systems.

    d. **Ongoing Coordination**
       1) Supplier must designate a security liaison to coordinate with IHS IT staff throughout development, testing, deployment, and ongoing updates.
       2) Supplier shall comply with IHS directives related to vulnerability mitigation, patching, and secure configuration.

11. Master files shall be fully functional on the Owner controlled network. Master files shall be fully functional on a mobile computer so that no wireless access is required to use the system in the field.
12. Information for all equipment shall consist at a minimum of:
    a. Installation, Operation, and Maintenance manual content
    b. Equipment commissioning and training including multi-media files
    c. Contact information for technical support, parts reordering
    d. As-Built Mechanical and Electrical drawings
    e. Assembly drawings
    f. Bills of materials
    g. Scopes of Supply
    h. Warranty statements
    i. Recommended spare parts
    j. Parts ordering physical and web addresses and phone numbers
13. Standard Procedures shall be created using multi-media as needed for clarity for critical operation, maintenance, troubleshooting, and laboratory procedures.
14. Video content shall be presented in high-definition, elapsed-time with segments of 4 minutes or less.
    a. Digital field fillable forms shall be formatted for mobile tablet use. Forms shall be .pdf format, with mathematical calculation ability, pull down menus, check boxes, integration of photos from camera or photo library. Final form format shall be .pdf and file size that allows form to be sent as email attachment.

1.3 GUARANTEE

A. A 90-day guarantee commences on acceptance of the Digital Information Management Platform product against omissions from content as specified in the Scope of Work. A one-year guarantee against omissions from content applies to work performed under Annual Service Contracts, commencing on the date of posting to the remote server for downloading.

1.4 SUBMITTALS

A. For compliance with these specifications, the Supplier shall provide not less than three independent example products that demonstrate all elements of the Scope of this document. Submittals can be provided on a mobile tablet computer that will be returned to the Supplier. Mobile tablets will be retained by the Owner for not more than 60 days. The following submittals are required:
    1. Provide examples of graphical information platform showing what the mobile platform will look like and how it will function on the mobile platform.
    2. Provide examples showing how information will be organized for retrieval.
    3. Discuss internet requirements for using and updating platform.
    4. Provide resumes and references upon request for company all critical team members working on this project.
    5. Discuss the resources and coordination required by our utility to work with your team.
    6. Provide a description and costs for all annual ongoing fees.
    7. Provide description of licensing agreement for use of platform.
    8. Provide discussion of privacy and security of all information on platform.

9. Provide a minimum of four references for customers from utilities with first hand knowledge and implementation of Digital Information System.
10. Provide a listing of all Digital Information System Installations.

1.5 TRAINING

A. Supplier shall provide to all employees of the Facility. Training is to include on-site description and hands-on demonstration of the items listed below. Training shall be video-recorded and provided to the Facility as multi-media files linked to the Digital Information Management Platform on the mobile tablet. Digital content shall be made available to the owner via secure cloud server.
   1. Accessing information for daily rounds.
   2. Identifying when conditions are outside of normal and accessing information for next step.
   3. Using fillable forms.
   4. Using mobile computing as a tool for our group.

PART 2 - PRODUCTS

2.1 VENDOR

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other vendors offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. Digital Mentor, Inc. (digitalmentorinc.com)

2.2 HARDWARE

A. Provide three of the latest models of Apple iPad Pro:
   1. 512 GB Storage
   2. M5 Chip minimum
   3. 9-core CPU
   4. 16-Core GPU with Neural Engine
   5. LIDAR Scanner
   6. Wi-Fi and Cellular
   7. Apple Pro Stylus
   8. Full Apple Care for two years

B. Mobile Platform shall be integrated with the Facility’s existing eight Microsoft Surface tablets.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 024100 - SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Demolition necessary or required so that the new construction, alterations, remodeling and related work can be performed and completed in accordance with the Contract Documents.

1.2 RELATED DOCUMENTS

A. Section 011000 – SUMMARY

1.3 SUBMITTALS

A. Submit the following in accordance with Division 01 Administrative Requirements:
   1. Copies of permits and notices authorizing building demolition as may be required by law, including permits to transport and dispose of debris.
   2. Shop Drawings: Drawings of temporary structural support locations and calculations sealed by a Structural Engineer registered in the State where the project is located.

B. Submit project record documents which accurately record actual locations of capped utilities, and concealed obstructions in accordance with Division 01 Administrative Requirements.

1.4 QUALITY ASSURANCE

A. Demolition Firm Qualifications:
   1. Specializing in performing the Work required by this Section.
   2. Minimum five (5) years documented experience.
   3. Utilizing workers experienced in disconnecting and capping utilities, if applicable.

B. Regulatory Requirements
   1. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff control and disposal.
   2. Obtain required permits from authorities.
   3. Conform to applicable regulatory procedures if hazardous or contaminated materials are discovered.
   4. Test soils around buried tanks for contamination.

1.5 PROJECT CONDITIONS

A. The existing buildings which are to be demolished and remodeled may have asbestos containing building materials (ACBM) which will be removed under a separate contract with the Owner.

B. The Contractor for this project shall coordinate Work activities with the Owner in those locations where asbestos abatement Work is in progress.

C. No extra compensation will be considered for the coordination Work which may be required.

1.6 SEQUENCING

A. The Contractor shall sequence activities to maintain site operations throughout construction, as defined in Subsection 011000.1.5.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Unless specifically scheduled for reuse or salvage, demolished materials shall become the property of the Contractor and immediately removed from the site

B. Carefully remove materials (in whole or in part as required) that are scheduled for reuse or salvage. Store and protect for reinstallation or salvage to Owner the materials as indicated on Drawings.

C. Fill materials at excavations: as specified in Section 312300, “Excavation and Fill”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions and notify the Architect in writing of discrepancies before proceeding with the Work.

B. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

3.2 PREPARATION

A. Notify affected utility companies before starting Work and comply with their requirements.
   1. Mark location of utilities.
   2. Identify, disconnect, remove and cap designated utilities within demolition areas.

B. Provide, erect, and maintain temporary barriers and security devices where required and as indicated on drawings.

C. Protect existing landscaping materials, appurtenances, and structures which are not to be demolished.

D. Protect benchmarks and existing Work from damage or displacement.

E. Prevent movement or settlement of adjacent structures.

F. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

G. Protection of existing building exterior:
   1. Erect weatherproof closures for exterior openings. Maintain exit requirements.
   2. Protect from weather openings cut in existing roof for new Work, or where existing roofing is removed to allow new construction to join existing.
   3. Install a temporary deck of exterior grade plywood and wood skids, or other material approved by Architect, for material and personnel traffic over existing roofing, to protect existing roof and surrounding surfaces from damage. Repair damage caused to the roof and other items.

H. Dustproof Partitions:
   1. Erect and maintain as required to prevent the spread of dust, fumes and smoke to other parts of the building.
   2. On completion, remove partitions and repair damaged surfaces to match adjacent surfaces.

I. Roofing Removal: During the removal of the existing parapets and roofing, provide proper protection from falling objects. Maintain rain and water protection of the interior of the building.

3.3 GENERAL DEMOLITION

A. Carry out demolition Work to cause as little inconvenience as possible to any adjacent occupied building or site area and with minimum interference to public or private accesses. Maintain protected egress and access at all times.
   1. Work shall adhere to phasing plans provided in the project documents and to phasing as defined in Subsection 011000.1.5.

B. Perform the removal, cutting, drilling, etc., of existing Work with extreme care, and using small tools in order not to jeopardize the structural integrity of the building.

C. Shore existing construction whenever existing supports are removed to allow the installation of new Work.

D. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction and Architect. Do not resume operations until directed by Architect.

E. Rebuild existing Work which must be removed to allow the installation of new Work as indicated on the Drawings.

F. Perform cutting of existing concrete and masonry with saws and core drills. Do not use jackhammers.

G. Provide hoses and water connections for sprinkling of debris as necessary to limit dust to the lowest practicable level.

H. Material Disposal:
   1. Remove materials from site and dispose of in a legal manner at no additional expense to Owner.
   2. Materials shall not be sold on, or adjacent to, the site. Signs advertising the sale of materials shall not be allowed.
   3. Burning materials on site is not permitted.
   4. Break concrete and masonry into sections less than 3 feet in any dimension.
   5. Remove from the site contaminated, vermin infested, or dangerous materials encountered, and dispose of by safe means so as not to endanger the health of workers and public.
   6. Debris from the demolition shall not be allowed to accumulate within the building or on the site.
   7. Some demolished materials shall be removed carefully enough that they can be salvaged and turned over to the Owner for future use. Refer to plans for materials that shall be salvaged and turned over to Owner.

3.4 STRUCTURE DEMOLITION

A. Begin demolition at top of building and proceed to lowest level, without using explosives.

B. Demolish the structure above each floor level without damaging supporting members on lower levels.

C. Remove foundation walls and footings to a minimum of 2 feet below finished grade within area of new construction. Review current design documents for finished grade elevations for new construction.

D. All utilities and building components within the depth of over excavation shall be demolished.

E. Remove concrete slabs on grade.

F. Empty buried tanks located within demolition area. Remove buried tanks, components, and piping from site. Prior to bidding, verify with Owner if testing for soil contamination is required. Testing and removal of contaminated soil and disposal shall be the responsibility of the Contractor.

G. Backfill areas excavated, and open pits and holes caused as a result of demolition in accordance with Section 312333, “Trenching and Backfill.”

H. Rough grade and compact areas affected by demolition to maintain site grades and contours unless noted otherwise on drawings.

END OF SECTION

SECTION 028200 - ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. The work in this Specification outlines the requirements for the removal of Asbestos Containing Materials (ACM) for the Indian Health Services, Whiteriver Hospital, 200 W Hospital Drive Whiteriver, Arizona, Demolition of Buildings 200, 217 and 710. The contractor shall be required to perform the abatement in accordance with all applicable federal, state, tribal and local laws, rules and regulations.

B. Related Documents
   1. Hazardous Building Materials Survey Report, Building 200, 217 and 710, Mabbett & Associates, Inc, Mabbett & Associates, Inc., dated June 25, 2024.

C. Scope of Work: The intent of this project is the demolition of building 200, 217 and 710. Refer to Abatement drawings HA.0, HA.1, HA.2, HA.3, HA.4 and HA.5.

1.2 SCOPE OF WORK

A. Main Hospital
   1. The asbestos work includes the demolition and removal of all layers of asbestos containing 12" x 12" tan flooring tile, mastic, adhesive and leveler located in Zone E, room 250 and Zone D rooms 170, 170A, 176, 177, 178 and 710 (approximately 4,000 square feet), 12" x 12" Gray flooring tile, mastic, adhesive and leveler located throughout Zone B, (approximately 2,700 square feet), Residual mastic under vinyl flooring in Zones B, D, and E corridors, (approximately 7,500 square feet).
   2. The asbestos work includes the demolition and removal of asbestos containing red duct seam sealant in Zone E, (approximately 200 square feet).
   3. The asbestos work includes the demolition and removal of asbestos containing sprinkler pipe thread sealant throughout main hospital, (approximately 6,500 linear feet).
   4. The asbestos work includes the demolition and removal of asbestos containing fire doors/insulation throughout main hospital and power plant (approximately 60 doors).

B. Penthouses 1, 2, 3, 4, and 5
   1. The asbestos work includes the demolition and removal of asbestos containing stick pin adhesive associated with fiberglass insulation in all penthouses (approximately 5,000 square feet).
   2. The asbestos work includes the demolition and removal of asbestos containing gray floor caulk and perimeter floor black sealant in all penthouses (approximately 1,000 square feet).
   3. The asbestos work includes the demolition and removal of asbestos containing sealant and tape associated with air handling equipment and ducts in all penthouses (approximately 1,200 square feet).

C. Roof
   1. The asbestos work includes the demolition and removal of asbestos containing penetration sealant on the roof (approximately 1,800 square feet).

D. Building Exterior
   1. The asbestos work includes the demolition and removal of asbestos containing exterior wall footer black coating (approximately 20,000 square feet).

E. Central Plant
   1. The asbestos work includes the demolition and removal of all layers of asbestos containing flooring, tile, mastic, adhesive and leveler located in office and bathroom (approximately 100 square feet),

F. Sample results and locations of asbestos in accessible building materials are provided in the Mabbett & Associates, Inc. Hazardous Building Materials Survey Report for Buildings 200, 217 and 710 dated June 25, 2024.

G. The Asbestos Removal Portion of this Project shall be in accordance with the Occupational Safety and Health Act (OSHA) Section 29 CFR 1926.1101 Asbestos.

H. Air Monitoring for Class I and Class II shall follow OSHA requirements for perimeter verification during work in addition to the OSHA personal monitoring of asbestos abatement workers.

I. The removal of asbestos containing material shall be performed in accordance with Arizona Department of Environmental Quality (ADEQ), Title 49-The Environment, Chapter 3- Air Quality, Chapter 4 – Solid Waste Management and Chapter 5 – Hazardous Waste Disposal. All Arizona Hazardous Materials regulation can be found at https://azdeq.gov/LawsAndRules.

1.3 SECTION INCLUDES

A. Requirements for the removal of asbestos-containing materials. All asbestos material shall be disposed of as asbestos-containing material waste.

B. The definitions of specific terms used in these Specifications are verbatim with those of the OSHA Section 29 CFR 1926.1101 Asbestos

1.4 OWNER'S RIGHT TO CARRY OUT THE ASBESTOS ABATEMENT WORK

A. If the Contractor defaults or neglects to carry out the activities applicable to the Asbestos Abatement Work in accordance with the Contract Documents and fails within a 24-hour period after receipt of a written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness (collectively the "deficiencies"), the Owner may, without prejudice to other remedies the Owner may have, act to correct such deficiencies.

B. If the Contractor conducts the Work in a manner which would cause endangerment to public health or safety, the Owner may, without written notice, or prejudice to other remedies the Owner may have, require the Contractor to remedy the situation, or the Owner may act to correct same at the Contractor's expense.

C. In the above cases, an appropriate Change Order or Construction Change Directive shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Owner’s Consultants additional services and expenses made necessary by such deficiencies. Such action by the Owner and amounts charged to the Contractor are both subject to prior direction and approval of the Owner’s Consultants. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

1.5 LIABILITY FOR DELAYS ASSOCIATED WITH INSUFFICIENT WORK SCOPE

A. It is the Contractor's sole responsibility to arrange for the Asbestos Abatement Work scope to be completed in an expeditious and cost-effective manner. A critical consideration is the definition of the Work to be sufficient to allow for all Asbestos Abatement Work to be completed as scheduled and prior to the start of other Work on this contract. The Owner shall not be held responsible for delays and duplicative costs associated with the possible eventuality that the Contractor needs to arrange for some Asbestos Abatement Work to be completed at a time following the initial Asbestos Abatement Work due to the Contractor's failure to properly define and execute the Asbestos Abatement Work as part of that first mobilization. The Contractor shall be responsible for all consultant fees incurred by the owner due to insufficient work scope or failure to comply with the schedule defined elsewhere in these contract documents.

1.6 QUALIFICATIONS OF CONTRACTOR

A. The Contractor must follow the Arizona Department of Environmental Quality (ADEQ) regulation as an Asbestos Abatement Contractor and complete all removal activities in accordance with ADEQ requirements and procedures.

1.7 INSURANCE

A. In addition to the insurance requirements in the General Provisions, the Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project site is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contractor and for which the Contractor may be legally liable, whether such operations be by the Contractor or by anyone directly employed by any of them, or by anyone for whose acts any of them may be liable:
   1. Contractor's asbestos abatement liability insurance in the occurrence form, $3,000,000.00 per occurrence, $5,000,000.00 aggregate.

B. The existence of the above insurance shall in no way relieve any Contractor or any Subcontractor of any responsibility for which they are liable in excess of the amount recoverable under the insurance provided above.

C. Any increase of limits of liability of any type of insurance not described above that any Contractor may require for its protection or on account of statute, shall be its own responsibility and at its own expense. Any policy covering any Contractor's own equipment against loss by physical damage shall include an endorsement providing that the underwriters waive their right of subrogation against the Owner, Architects, Construction Managers, Consultants, other Contractors or Subcontractors.

D. All insurance required by this Section or any other insurance required by the Contract Documents shall be provided by insurers acceptable to the Owner.

E. All insurance required by this Section or any other insurance required by the Contract Documents shall identify the Owner, the Owner's Architect, the Owner's Construction Manager, and Owner's Consultants, each as an "additional insured".

1.8 CLEANING UP

A. The Contractor is notified that the work area shall be maintained in an orderly condition as possible during the entire Contract period. Unsalvageable materials and debris

(non-asbestos or non-asbestos contaminated) resulting from the project operations shall be promptly disposed of, off property, in approved areas.

B. No pay estimates will be processed while the Contractor is in nonconformance with the above requirements. Furthermore, before final inspection and acceptance of the Contract and all areas occupied by the Contractor in connection with the work shall be cleaned of all rubbish, excess materials, temporary structures and equipment, and all parts of the work shall be left in an acceptable condition.

C. No separate payment will be made for the work of cleaning up, but all cost thereof shall be included under the lump sum bid for this project.

1.9 CONTROL OF WORK

A. The Contractor shall provide a contact phone number that will be reachable 24 hours a day - 7 days a week in case of an emergency.

B. Complete all of the Work specified in the time frame submitted and approved by the Owner. The Work shall begin on a date determined at the Owner's sole discretion and may require work outside normal weekdays, Monday through Friday, and extended work hours.

C. Due to the critical time frame allowed for this project, the contractor shall provide a sufficient number of abatement workers during prep, removal and cleanup. The contractor shall assign an asbestos supervisor to each work area. The supervisors shall be onsite at all times during work activities.

1.10 RESTRICTIONS AND QUALITY CONTROL

A. ACM shall be properly handled, packaged, and transported for disposal in an asbestos-only landfill.

B. The Contractor shall be responsible for monitoring his own construction safety work practices for compliance with OSHA regulations.

C. Obtain appropriate permit and variances from regulatory agencies as required to complete the safe removal of asbestos containing material.

D. Noise Controls: Provide mufflers on all equipment. Observe local laws.

E. Wastewater: All water used during asbestos abatement activities shall be collected and placed in the asbestos waste bags.

F. Health and safety:
   1. Toxic Effects: Assume all responsibility for any toxic effects to workers from the air supplied to respirators, or from toxic or damaging vapors or residues resulting from the use of encapsulant and/or wetting agents or other substances used during construction.
   2. Chemical/Biological hazards: The known chemical and or biological hazards on site are asbestos-containing material and lead in paint. Provide materials, equipment and training to ensure worker protection from these and any other chemical/biological hazards that may be identified during the course of this work.

G. Work Supervision and Coordination:
   1. From the start of work through completion, provide an on-site responsible and competent supervisor possessing valid Asbestos Supervisor certification.

2. Quality of Work: Asbestos Supervisor shall supervise, inspect and direct the Work.

H. Minimum Experience: Experience with abatement work, as evidenced through participation in at least two asbestos abatement projects of size and complexity comparable to this project.

I. Experience and Training: Supervisors, foremen, and workers shall be adequately trained and knowledgeable in the field of asbestos abatement. All personnel engaged in asbestos abatement or related activities shall have a state permit and/or EPA accreditation.

J. Skilled craftsman experienced in each respective trade shall execute all phases of the work. Proof of such experience shall be submitted upon request. Improperly trained, untrained, or inexperienced personnel shall not be allowed in the work areas.

K. On-Site job supervisor shall have experience with abatement work, as evidenced through participation in at least two asbestos abatement projects of size and complexity comparable to this project.

L. Job supervisors and foremen shall be thoroughly familiar with and experienced in asbestos removal and related work and shall meet the requirements of a competent person set forth in OSHA Standard 29 CFR 1926.1101.

M. All asbestos abatement workers shall be knowledgeable, qualified, and trained in the removal, handling, and disposal of asbestos material and in subsequent cleaning of the affected environment. All asbestos abatement workers shall be certified as having attended and satisfactorily completed asbestos worker training in accordance with OSHA standard 29 CFR 1926.1101(k)(3).

N. Asbestos abatement workers shall have a state permit and/or EPA accreditation.

O. Prior to commencement of the work, all personnel who are to enter the work area shall be instructed in and shall be knowledgeable of the appropriate procedures for personnel protection and asbestos abatement. On-site training in the use of equipment and facilities unique to this job site shall be performed. Emergency evacuation procedure from the work area shall also be included in worker training.

P. Worker Medical Examinations: Provide medical examinations for all employees engaged in asbestos removal and disposal operations in accordance with OSHA Standard 29 CFR 1910.134(b), 1926.1101, and applicable State regulations. Ensure that all employee examination results are on file, available for review and maintained in accordance with OSHA Standard 29 CFR 1926.1101 (n)(3).

1.11 SUBMITTALS

The Contractor shall prepare the following submittals due before the actual start of the fieldwork:

A. Copy of the Contractor’s Asbestos License or accreditation.

B. Schedule of Work Phases with estimated times of completion.

C. A copy of the Contactor’s “Work Procedures and Asbestos Abatement Plan”.

D. A copy of the Contractor’s “Health and Safety Plan”.

E. A copy of the Contractor’s “Asbestos Mitigation Plan”.

F. Hazard Communication: Procedure on how physical and health hazards associated with the ACM abatement and removal are identified and communicated to employees,

and name of the person responsible for implementation of a Hazard Communication Program.

G. Proof of written notifications required for permits, state licenses and notifications and proof that all required permits and variances have been obtained.

H. Proof of written notification to the Owner that asbestos abatement work is being conducted. As a minimum, the notification letter shall include the address of the project, dates work is to be performed, and drawings indicating the areas to undergo abatement.

I. Proof that the job supervisor, foremen, and asbestos abatement workers meet state license requirements or EPA accreditation.

J. Proof of a current medical surveillance program for all personnel.

K. Completed and notarized Certificate of Worker's Release for each asbestos abatement worker, workers of other trades, or supervisory personnel who enter the work area or otherwise contact ACM.

L. Proof of a respiratory protection program: Submit level of respiratory protection intended for each operation required by the project.

M. Proof of historic airborne fiber data: Submit airborne asbestos fiber monitoring data from an independent air-monitoring firm to substantiate selection of respiratory protection proposed. Data shall include the following for each procedure required by the work:
   1. Date of measurement.
   2. Type of work task monitored.
   3. Methods used for sample collection and analysis.
   4. Number, duration, and results of samples taken.

N. Waste Transportation: Submit information on the asbestos waste hauler, including; names, address, telephone number, and EPA identification number.

O. Waste Disposal: Submit information on the approved waste disposal site that will be used including; name, address, telephone number, and EPA identification number, contact name and facility name. Also submit any required generator certification forms for review.

P. Manufacturer's literature for all proposed equipment and products. Include Safety Data Sheets (SDS) for encapsulant, fire retardant plastics, and other chemicals.

Q. Specimen of the daily log proposed for use including the dates and times when all personnel enter and leave the work areas.

R. Results of all air monitoring, posted within 24 hours for all workers to see. A copy of the results shall also be given to the Owner or his representative.

S. Certified, signed, and completed copy of each "Waste Shipment Record" form and receipts from the landfill operator that acknowledge the delivery of material, within 30 days following removal of ACM.

T. Copies of a daily log showing the dates and times of entrance to and exit from the work areas for all persons.

U. Compilation in chronological order of all air monitoring records.

V. Compilation of all completed and signed Waste Shipment Record forms, bills of lading, or disposal receipts.

W. Copies of notifications and checks to applicable agencies that the asbestos abatement project has been completed.

X. Notifications: Copies of notifications (and all correspondence with government regulatory agencies) to the necessary governmental agencies in accordance with regulatory requirements, including 10 or 20 day pre-notification requirements. All notifications shall include the following information:
   1. Name, Address, designated contact person and telephone number of facility Owner.
   2. Name, Address, designated contact person, telephone number, EPA numbers and license numbers of the Asbestos Abatement Contractor.
   3. The address and description of the facility where the Work will take place.
   4. Construction Contract Number.
   5. Description of the type and quantity of asbestos-containing material that will be abated and the procedures that will be used.
   6. Schedules for the Project including start and finished dates for abatement work.
   7. Name, Address, telephone number, EPA, DOT and DEP numbers and license numbers of the Asbestos Waste Hauler.
   8. Name, Address, telephone number, EPA numbers and license numbers of the Asbestos Waste Disposal Site.

1.12 LAWS TO BE OBSERVED

A. Occupational Safety and Health Act of 1970 (OSHA).

B. Licenses – The Contractor must follow USEPA, OSHA, NIOSH and the Arizona Department of Environmental Quality (ADEQ) regulation as an Asbestos Abatement Contractor. The contractor must complete all removal activities in accordance with ADEQ requirements and procedures and all native American tribal regulations, local statutes, ordinances and codes and any other applicable native American tribal, federal, state and local government regulations and guidelines.

1.13 DOCUMENTS

The current issue of each document incorporated by reference herein shall govern. Where conflict among requirements or with the specification exists, the more stringent requirements shall apply.

A. OSHA Regulations: Provide special attention the following:
   1. CFR 1910 (general industry).
   2. CFR 1910.134 (respiratory protection)
   3. CFR 1910.141 (sanitation)
   4. CFR 1910.300-399 (electrical)
   5. CFR 1910.1001 (asbestos)
   6. CFR 1910.1200 (hard communication)
   7. CFR 1926 (construction safety)
   8. CFR 1926.52 (noise)
   9. CFR 1926.62 (lead)
   10. CFR 1926.1101 (asbestos)
   11. CFR 1926.59 (hazard communication)

12. CFR 1926.40-449 (electrical)
13. CFR 1926.450-452 (ladders and scaffolding)

B. U.S. Environmental Protection Agency (EPA) including but not limited to:
1. NESHAP Asbestos National Emission Standards for Hazardous Air Pollutants. 40 CFR 61, Subparts A (General Provisions, Sections 01-10) and M (Asbestos, Sections 140-157).

C. DOT Regulations: Provide special attention to the Hazardous Materials Regulations, 49 CFR 171-180, in particular:
1. 49 CFR 171.14(b)(4) (placarding)
2. 49 CFR 172.300-308, 324 (marking)
3. 49 CFR 174.400, 466 (labeling)
4. 49 CFR 172.500, 504, 560 (placarding)

D. Other Standards
1. American National Standards Institute
   a. ANSI Standard Z9.2: Fundamentals Governing the Design and Operation of Local Exhaust Systems.
   b. ANSI Standard A40.8: National Plumbing Code.
2. National Fire Protection Association
3. NFPA 70: National Electrical Code
4. NFPA 70E: Standard for Electrical Safety Requirements for Employee Workplaces.

E. Arizona Regulations;
1. ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY (ADEQ) REGULATION.1.14 HEALTH AND SAFETY PROVISIONS

F. Personal Monitoring:
1. The Contractor shall perform Personal Air Monitoring in accordance with OSHA Standards, 29 CFR 1926.1101 (and 29 CFR 1926.62 Lead). Such records shall be made available to any authorized personnel and copies will be submitted to the Contracting Officer.

G. Progress Monitoring:
1. The Asbestos Contractor or a firm retained by the Contractor shall perform Progress Air Monitoring as required by OSHA for Class I and Class II work.
2. Progress air samples will be analyzed by Phase Contrast Microscopy (PCM) at an accredited laboratory or onsite.

H. Clearance Monitoring:
1. The Asbestos Contractor or a firm retained by the Contractor shall perform Clearance Air Monitoring in accordance with OSHA for Class I and Class II work.
2. Clearance air samples for full containment shall be analyzed by Transmission Electron Microscopy (TEM) by an accredited laboratory. Limited containment activities may be cleared by PCM.

I. Emergency Procedures:
1. The Contractor shall establish written emergency procedures to be posted within each work area. These procedures shall include plans for medical emergencies, fire evacuations, temporary loss of electrical power or water, and procedures for repair and clean-up following temporary breach of containment barriers.

J. Training:
1. In accordance with 29 CFR 1926.1101 and other pertinent regulations, all employees shall receive training in the proper methods to handle asbestos-containing materials including proper work procedures and equipment and methods.
2. Each employee shall participate in a medical monitoring program and shall understand the importance of monitoring airborne asbestos fibers as related to the proper of respiratory equipment. The training program shall comply with Federal and State regulatory requirements.

K. Protective Clothing:
1. Work clothes shall consist of fire retardant disposable full-body coveralls, head covers, boots, rubber gloves, non-skid boots or equivalent.
2. In addition, eye protection and hard hats shall be available to all Workers according to applicable Federal and State regulations.
3. The Contractor shall provide all Authorized Visitors with required protective clothing, including coveralls, respirator, hardhat, eye protection and footwear.

1.14 BARRICADES AND WARNING SIGNS

A. Caution Signs and Warning Labels:
1. The Contractor shall provide and display Caution signs so that said signs may be read from a distance so as to prevent accidental entry into the work area(s). The signs shall comply with OSHA and EPA regulations. In addition, warning labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other materials containing asbestos fibers, or to containers. The signs at entrances to the facility and work areas shall be removed upon project completion.

PART 2 - PRODUCTS

2.1 MATERIALS

The Contractor shall furnish, supply, provide and utilize the following materials or their quality equivalent in the performance of this Contract. No materials, equipment or tools belonging to the Owner shall be used by the Contractor.

A. Utilize only material (e.g., polyethylene sheeting, lumber, etc.) shall be rated to be fire retardant, as tested by ASTM Standard E-84. Additionally, utilize only polyethylene sheeting conforming to the requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Firms.

B. Materials shall be standard products of manufacturers regularly engaged in the production of the items and shall conform to OSHA Standard 29 CFR 1926.1101; EPA Standard 40 CFR 61, Subpart M; Department of Transportation Standards 49 CFR 171, 172, and 173; and applicable state regulations.

C. Plastic: Fire retardant, 6-mil thickness provided in rolls of sizes that minimize joints, for plasticizing the enclosed work area, preparation of the decontamination enclosure system, and waste packaging.

D. Reinforced Fire Retardant Plastic: Reinforced polyethylene sheet for the floor area of the decontamination enclosure system; 19 mil, 3-ply, high density flame resistant.

E. Duct Tape: Capable of sealing joints of adjacent sheets of plastic and attaching plastic sheeting to finished surfaces without damage to existing finish; capable of adhering under both dry and wet conditions, including use of amended water. When used on windows the tape shall be ultra violet light stable, shall not leave residue when removed and shall be Nashua 357 Black Duct Tape or approved equal.

F. Surfactant: Resin materials in a water base that have been tested to ensure materials are non-toxic and non-hazardous.

G. Lockdown Sealants: Use after asbestos removal to lockdown fugitive fibers; Class “A” fire resistance rating with an ASTM E-162 flame spread index of 15 or less.

H. Caulking Sealant: Single component, non-sag elastomer with 1,600% elongation capacity. Meet the requirements of Federal Specification TT-S-00230C, Class A type II. Sealant shall be used to form an airtight seal around plywood separation barriers or temporary partitions, seal along the seams of the decontamination enclosure system’s plywood sheathing, and seal around piping or other small penetrations of the work area.

I. Foam Sealant: Expanding urethane Class 1 with a UL 723 flame spread index of 25 or less, smoke developed index of 0, and a minimum operating temperature range between -30 ^{0} F and 250 ^{0} F.

J. Plywood: Use for separation barriers, temporary partitions, decontamination enclosure systems, and tunnels; exterior grade and a minimum 1/2-inch thick.

K. Spray Adhesive: Aerosol, specially formulated to stick to sheet polyethylene (3M 76, 3M 77, or approved equal).

L. Disposal Bags: The waste disposal bags shall be, at a minimum, six (6) mil polyethylene bags, labeled according to Federal and State regulations. Fiber Drums will be utilized to contain ACM material and any materials which may puncture waste disposal bags. The fiber drums shall be labeled in accordance with State and Federal Regulations.

M. Shipping Containers: Impermeable, suitable to receive and retain any asbestos-containing or asbestos-contaminated materials until they are disposed of at an approved landfill. Containers shall be labeled in accordance with this Section and shall be both airtight and watertight and conform to DOT Standard 49 CFR 178.224. Each container shall be constructed of fiber, hard plastic, or metal, with locking, airtight lids.

N. Markings and Labels: Disposal bags and shipping containers shall bear danger labels, transportation packaging labels, and generator identification information. Labels shall be permanently affixed to all bags and shipping containers containing ACM, in accordance with OSHA Standard 29 CFR 1926.1101(k)(2), DOT Standard 49 CFR Part 171 and 172, and EPA Standard 40 CFR Part 61.150(a)(1)(v).

2.2 EQUIPMENT

A. Spraying Equipment: To apply amended water or removal encapsulant shall be of a low-pressure type to prevent disturbance of the asbestos prior to physical controlled removal. Airless spray equipment shall be provided for the application of asbestos encapsulant.

B. Digital Manometer with Continuous Printout - The Contractor must utilize a sufficient number of Digital Manometers to monitor the pressure differential between the work

area and the area outside the work area and within pressurized seals. Digital Manometers shall have audio and visual alarms that indicate a drop in pressure below the project set limit. One additional back-up digital manometer shall be on-site should any one fail during the project. Additional digital manometers will be required if the Contractor needs to utilize make-up air from any window, door, etc., within the work area.

C. Vehicles: Trucks or vans used for the transportation of asbestos waste shall be enclosed and suitable for loading, temporary storage, transit, and unloading of asbestos-contaminated waste without exposure to persons or property.

D. Fall Protection equipment: certified and approved to be used by trained personnel when working elevated to protect against falling from an elevated work area.

E. Fire Extinguisher: Type ABC dry chemical extinguisher or a combination of NFPA recommended types for the fire hazard exposures in each location. Minimum size of extinguisher shall be 4-A, and 40-B:C. Supply a minimum of one extinguisher for every 1,000 SF of floor area, with a maximum travel distance to an extinguisher of 75 feet. Supply at least one extinguisher in each decontamination enclosure equipment room and clean room.

F. First Aid: First Aid Supplies shall comply with governing regulations and recommendations recognized within the construction industry.

G. Ladders: The Contractor shall provide all ladders and staging equipment, as necessary, to complete the Work of this Contract. All ladders and staging materials shall comply with all applicable OSHA regulations.

H. Warning Labels and Signs: All warning signs and labels will comply with 29 CFR 1910.1001, 29CFR 1926.1101 and/or other Federal and State Regulations.

I. Waste Container: A secure and lockable container for the storage of the double bagged asbestos waste shall be provided prior to removal operations begin, and shall be utilized on a daily basis of waste generated during the work shift. An open topped dumpster with a tie down tarp is not acceptable.

J. Power Tools: When used directly for asbestos removal, equip with a dust collection system. Attach a shroud connected to a HEPA vacuum system for capture of dust.

K. Electrical Service
   1. General - The Contractor shall comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.
   2. Temporary Power - Provide service to Work Area subpanel with minimum 60 amp, 2 pole circuit breaker. Subpanel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the Work. The contractor shall arrange service connections with the Owner and/or the local power utility. Portable generators may only be used for short term (8 hours or less) O&M work.
   3. Voltage Differences - Provide identification warning signs at power outlets that are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets. Dry type transformers shall be provided where required to provide voltages necessary for Work operations.

4. Ground Fault Protection - Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.
5. Electrical Power Cords - Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords if single lengths will not reach Work Areas.
6. Lamps and Light Fixtures - Provide general service incandescent lamps of wattage indicated or required for adequate illumination. Protect lamps with guard cages or tempered glass enclosures, where fixtures are exposed to breakage by construction operations.

L. Water Service/Sanitary
1. Temporary Water Service Connection - All connections to the Owner's water system shall include backflow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered. After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water will not damage existing finishes or equipment.
2. Water Hoses - Employ heavy-duty abrasion-resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system to provide water into each Work Area and to each Decontamination Unit. Provide fittings, as required, to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles, and other equipment.
3. Hot Water - The Contractor shall provide a hot water system.

2.3 PROTECTIVE CLOTHING AND EQUIPMENT

2.3.01 RESPIRATORS

A. General
1. The Contractor shall instruct and train each worker in the proper use of respirators. The Contractor shall require that each worker always wear a respirator in the Work Area, properly fitted on the face, from the start of any operation that may cause the release of airborne asbestos fibers. In addition, the Contractor shall provide a copy of the Respiratory Protection Program to the Owner’s Consultants prior to the beginning of Work as well as maintain a copy of the program on the job site throughout the performance of the Work.

B. Standards
1. Respiratory protective equipment is required in accordance with the 29 CFR 1910.1001, 29 CFR 1910.134, and 29 CFR 1926.1101 regulations and any State regulations, unless specified elsewhere.

C. Contractor Responsibility
1. The Contractor shall assure that workers always wear a respirator, properly fitted on the face, in the Work Area, from the initiation of the Asbestos Abatement Work until all areas have been cleared by means of TEM clearance air samples. All clearance samples must be below the regulatory limit of 0.01 f/cc.

2. The Contractor shall provide Authorized Visitors with suitable respirators and respirator training whenever they are required to enter the Work Area. Provide at least two (2) extra air hoses when supplied-air respirators are required.

2.3.02 PROTECTIVE CLOTHING

A. Coveralls - The Contractor shall provide, at a minimum, fire retardant disposable full-body coveralls and head covers, and require that they be worn by all workers in the Work Area. Provide a sufficient number for the number of employees and their required changes.

B. Foot Coverings - The Contractor shall provide foot coverings with non-skid soles, and where required by OSHA, foot protection for all workers. Do not allow shoes to be removed from the Work Area for any reason after being contaminated with asbestos fibers. The shoes will either be disposed of as asbestos-containing waste or placed in double poly bags and removed from the site.

C. Hard Hats - The Contractor shall provide head protection (hard hats) as required by OSHA for all workers, and provide additional units for use by authorized personnel.

D. Goggles - The Contractor shall provide eye protection as required by OSHA for all workers involved with grinding, spraying, or any other type of process or activity that may potentially cause eye injury.

2.4 AIR FILTRATION SYSTEM

A. The Contractor shall supply the required number of air filtration systems equipped with a HEPA filter capable of creating a pressure differential of 0.02 inches of water column or greater to the work areas and seals of separation barriers in accordance with the following specifications. Each unit shall include the following:
   1. A cabinet able to withstand damage from rough handling and transportation.
   2. The final filter assembly shall be HEPA type.
   3. The unit shall have a minimum of a two-stage pre-filter to protect the HEPA filter from damage resulting from impact with large particles.
   4. The unit shall have at a minimum, the instrumentation described below:
      a. Magnehelic gauge (pressure differential meter) or manometer to measure pressure drop between filters.
      b. A table indicating usable air-handling capacity for various static pressure readings.
      c. A meter that keeps track of the time that the unit has been in operation.
      d. A mechanical or electrical lockout to prevent the unit from operating without a HEPA filter in place.
      e. An alarm system consisting of lights and an audio alarm to warn of a major rupture in the HEPA filter, blocked air discharge, or abnormal pressure drop.
   5. The unit shall be approved by the National Electrical Manufacturers Association (NEMA) and the Underwriters Laboratory (UL).

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that the substrates are in suitable condition to receive the work.

3.2 SPECIAL CONDITIONS

A. The Contractor shall not begin Asbestos Abatement Work until all tools and equipment and materials are on hand, all notices and permits have been obtained, and locking waste storage containers are on-site.

B. The contractor shall provide onsite, locking waste storage container(s) for the asbestos waste, with the required warning signs, until transportation for offsite disposal is arranged.

C. The Contractor shall protect all wiring during removal activities.

3.3 DECONTAMINATION AND ENCLOSURE SYSTEMS

A. Personnel Decontamination Unit shall be contiguous to the Work Area, consisting of three (3) totally enclosed chambers as described in the following. A minimum of two layers of polyethylene sheeting shall be required for floors, walls, and the ceiling. The on-site constructed decontamination unit shall be constructed of 2 x 4 frames. Disposable/pop-up decontamination units may **not** be used.

B. Waste/Equipment Decontamination Unit System: Locate adjacent to the work area. The waste/equipment decontamination unit shall consist of two totally enclosed spaces. The waste/ equipment decontamination unit shall be sized for the removal of all waste.

C. Optional Attached /Combined Personal / Waste Decontamination Unit: For full containment areas, provide an attached, combined, personal / waste decontamination unit, in compliance with OSHA Standard 29 CFR 1926.1101.

3.3.01 EXECUTION

The Contractor shall follow and adhere to the following procedures for the construction of a Decontamination Unit for an Asbestos Abatement Project:

A. The Contractor shall construct one chamber to be classified as an Equipment Room with an airlock doorway between it and the work area and another airlock doorway between it and the Shower Room. This Room shall contain provisions for the storage of contaminated clothing and equipment. Each airlock doorway shall consist of three alternating flaps, each flap shall be sealed at the top and at one side to the wall, in the alternating “Z” pattern. The bottom of each flap shall be weighted.

B. The Contractor shall construct one chamber to be classified as a Shower Room with an airlock doorway (three alternating flaps) between it and the Clean Room. This Room shall possess a shower with provisions for hot and cold running water (heated water to be provided by the Contractor) that allows for the complete showering of workers during decontamination.

C. The Contractor shall construct one chamber to be classified as a Clean Room with an airlock doorway (three alternating flaps) at its entrance. This Room shall contain provisions for the storage of the worker's street clothing and unused protective clothing and equipment.

3.3.02 EXECUTION OF EQUIPMENT/WASTE-OUT UNIT

The Contractor shall follow and adhere to the following procedures for the construction of an Equipment Decontamination/Waste-Out Unit for this Asbestos Hazard Abatement Project:

A. The Contractor shall construct one chamber to be classified as a Wash Room with an airlock doorway between it and the Work Area and an airlock doorway between it and the Holding Area.

B. The Contractor shall construct one chamber to be classified as a Holding Area with an airlock doorway at its entrance. This Room will be used to temporarily store the bags and/or drums of asbestos waste prior to transporting to the disposal container.

3.4 PERSONAL PROTECTION AND DECONTAMINATION

A. Take all safety measures and precautions necessary to protect employees in accordance with OSHA Standard 29 CFR 1926, EPA Standard 40 CFR, Part 61, Subpart M, and applicable state regulations.

B. Provide authorized visitors with suitable properly fitting protective disposable clothing, headgear, hard hats, eye protection, respiratory protection, and footwear (up to four sets per 8-hour shift) whenever they are required to enter the work area.

3.5 SEQUENCE OF WORK - EXECUTION

3.5.01 Operations & Maintenance Activities (Not Anticipated)

A. The following procedures shall be followed while performing the O&M activities:

1. No asbestos O&M work including preparation shall be performed or continued without having proper notification and a certified supervisor at the site.
2. Provide and display danger signs at every entrance to the work areas in clearly visible locations indicating that asbestos removal work is being conducted and unauthorized and not protected persons should not enter.
   Signs must use the following legend:

   DANGER
   ASBESTOS
   CANCER AND LUNG DISEASE HAZARD
   RESPIRATORS AND PROTECTIVE CLOTHINGS
   ARE REQUIRED IN THIS AREA

   Signs shall be posted which meet the specifications set forth in 29 CFR 1926.1101 at all approaches to the work area. Signs shall be posted at a sufficient distance from the work area to permit a person to read the sign and take precautionary measures to avoid exposure to asbestos.
3. A contiguous space surrounding the work area shall be roped off and regulated to allow only certified workers and authorized visitors to enter.
4. All asbestos handlers shall wear disposable suits, including gloves, hood and footwear, and appropriate respiratory equipment, prior to entering the containment area.
5. Damaged plaster shall be wetted and loose pieces removed/picked up and placed in a plastic waste bag. Plaster to be removed for installation of ducts, pipes and wires shall; have a sheet of plastic placed on the ground below the

area to be cut; the material shall be wetted; if power tools are used to cut the plaster, appropriate attachments to a HEPA vacuum shall be used; all waste shall be doubled bagged for disposal; and the work area shall be HEPA vacuumed and wet washed.

6. The O&M cleanup of the floors of crawlspaces shall include: sealing all penetrations from the crawlspace to the floor above; a hygiene facility/equipment room shall be constructed above the hatchway into the crawlspace, an airlock shall be attached to the hygiene room with three curtains separating the rooms and at the exit/entrance to the air lock; HEPA air filtration shall be installed at the exterior vents to the crawlspaces (special attachments to the HEPA air units will be required); thermal system insulation on the floors of the crawlspaces shall be wetted, picked up and placed in plastic bags; the ground surface shall be raked to ensure no pieces of TSI remain; and all waste shall be doubled bagged for disposal. Workers will HEPA vacuum their coveralls in the hygiene room and remove and dispose of before exiting the air lock.

3.5.02 LIMITED CONTAINMENT ENCLOSURE WITH GLOVE BAG REMOVAL

A. The following procedures shall be followed while performing limited containment removals:
   1. The work area shall consist of a limited containment “tent” or an area sealed off and appropriate caution and/or danger signs posted on the perimeter to prevent unauthorized personnel from entering the work area.
   2. All necessary materials and supplies shall be brought into the work area before any removal begins.
   3. Remove the asbestos containing materials utilizing two person teams. The insulation shall be removed within a glove bag. The contractor shall provide a suitable number, size and configuration of glove bags for the project.
   4. The substrate shall be washed with a damp cloth and sealed with a lockdown sealant.
   5. All waste shall be doubled bagged for disposal.
   6. The work area shall be HEPA vacuumed and wet washed following the bag out of the waste material.

3.5.03 FULL CONTAINMENT WORK AREA

The Contractor shall follow and adhere to the following procedures for the Work Area preparation of this Asbestos Hazard Abatement Project.

A. FIRST - The Contractor shall construct the decontamination chamber and waste decontamination chamber, prior to any other onsite activity.

B. SECOND -The Contractor shall clean the work areas prior to the installation of the polyethylene, using HEPA vacuum equipment and wet-cleaning methods as appropriate. Air filtration units will be utilized during this clean-up phase of work. All carpeting shall be removed and disposed as asbestos contaminated waste. Any item that may disturb ACM during its removal shall be removed/cleaned by the contractor.

C. The Contractor shall isolate the Work Area for the duration of the project with a minimum of two layers of six (6) mil polyethylene as critical barriers secured to cleaned surfaces.

D. All electricity shall be shut down in the Work Area.

E. All grossly contaminated objects located within the Work Area will be treated as asbestos-containing material and will be disposed of in the appropriate manner.

F. The Contractor shall seal any sump pits or floor drains to prevent asbestos contaminated water from entering.

G. The Contractor shall construct temporary walls with 2 x 4 and plywood as needed where no walls are present to hang the wall and ceiling polyethylene.

H. The Contractor shall cover floors with a minimum of two (2) layers of six (6) mil polyethylene. Other horizontal surfaces shall be covered in accordance with federal, state and local requirements. Vertical surfaces shall be covered with a minimum of one (1) layer of six (6) mil polyethylene. Sheeting shall be sized to minimize the number of seams. No seams shall be allowed within 12 inches of corners or where floor and wall join. Seams shall overlap at least 12 inches between seams of adjacent layers. Second layer floor seams shall be offset at least 12 inches from the first layer floor seams. The exception to the above is where Floor Covering will be removed.

I. The Contractor shall seal all wall, plumbing, duct and other openings with an additional layer of polyethylene or other suitable material to prevent materials from entering such cavities.

J. The Contractor shall regularly check all isolation barriers for punctures, loose seals, and contact with heat-generating devices, and general integrity. Any problems shall be remedied immediately.

K. The Contractor shall maintain emergency and fire exits from the Work Areas. The Contractor will provide fire extinguishers.

L. The Contractor shall provide lighting and power to the work areas, ensure safe and proper installation according to codes and have a backup source of power available if needed.

M. The Contractor shall install and maintain air pressure differential equipment during the removal and decontamination phases of the project until the Clearance Tests have been analyzed and fiber levels are within acceptable limits. The Contractor shall have a sufficient number of units to maintain a pressure differential of 0.02 inches of water column. The Contractor shall have at least one backup unit on site should any one unit fail. Additional units will be required where separation barriers seals are required.

N. Prior to removal, the Contractor shall spray asbestos materials with Amended Water. The asbestos materials shall be sufficiently saturated without causing excessive dripping to prevent emission of airborne fibers. Asbestos containing materials shall be sprayed repeatedly during the Work Process to maintain a wet condition. If the materials are not easily saturated, then the Work Area shall be constantly misted to keep fiber emission minimal.

O. The Contractor shall remove asbestos in manageable sections and/or volumes by a multi-person team. Any material that falls to the floor shall be wetted and picked up immediately. ACM shall not be allowed to dry out. Prior to the start of the next area, the asbestos waste must be packaged in an approved manner in an approved waste container appropriately marked according to regulations and this Contract.

P. The Contractor shall keep and maintain the Work Area in a clean and orderly manner. All waste materials shall be placed in the proper containers and labeled accordingly.

Q. The Contractor shall clean and store all waste packages in a Holding Area until that time when moved to the waste container for storage until transported to the disposal site. The packages shall be stored in piles no higher than four (4) feet or in a manner that will result in damage to the packages or drums.

R. The Contractor shall clean all surfaces of contaminated equipment thoroughly by wet sponging or wiping and sealed in polyethylene before moving such items into the Washroom of the Equipment Unit (Equipment Room of the Decontamination Unit if Equipment Unit is not required) for final cleaning and removal into uncontaminated areas.

3.6 ASBESTOS ABATEMENT DECONTAMINATION AND CLOSEOUT

A. The Contractor shall be responsible for the proper and complete decontamination of the Work Area and contaminated equipment as well as any area that may become contaminated through the performance of this Contract. The Work described in this section includes the decontamination of the air in the Work Area, which has been contaminated by airborne fibers through abatement activities.

3.6.01 EXECUTION

The Contractor shall follow and adhere to the following procedures for the decontamination of the Work Area:

A. Remove all visible accumulations of asbestos material and debris. Wet Clean all surfaces inside the Work Area to remove asbestos residue.

B. After Wet Cleaning, the Contractor shall perform a complete visual inspection of the Work Area to ensure that the Work Area is free of all asbestos residue or debris.

C. Upon successful review, the Contractor shall apply sealant to all surfaces where ACM has been removed. All surfaces within ceiling (e.g., the tops of the wood joints, beams, etc.) and other accessible cavities where asbestos materials have been removed shall also be sealed. Apply sealant in sufficient amounts to render the affected surface tacky to the touch. The sealant shall be compatible with the existing substrate and shall be rated to withstand the temperature of the items to which it is applied.

D. Upon completion of the sealant work and allowing the sealant to dry, the Contractor shall conduct clearance testing.

E. All sealed drums, bags, and other equipment used in the Work Area shall be included in the clean-up and shall be removed from the Work Area at the appropriate time in the cleaning sequence.

F. Upon written notification from the Contractor that the Work Area has passed the Clearance Tests, the Contractor shall remove the plastic sheeting within the Work Area. In the event that the work area does not pass clearance Tests, the area shall be fully re-cleaned as per this section.

G. Upon notification, the Owner or his representative shall make a final visual inspection of the Work Area. Evidence of ACM identified during the review will necessitate further cleaning as heretofore specified at the Contractor’s expense.

H. After written notification from the Owner or his representative, the Contractor shall remove the containment barriers and proceed with any remaining repairs or refinish work.

3.7 TESTING AND INSPECTION

A. Visual inspections and air monitoring, if required, shall be performed during and after asbestos abatement to document airborne asbestos fiber concentrations.

B. Should a delay occur due to failures of clearance air testing, all associated expenses such as PCM and TEM analysis, and air testing, shall be the responsibility of the Contractor.

C. Provide OSHA monitoring and all other tests required by specified applicable regulations, codes, and standards. The use of a testing laboratory shall not release the Contractor from providing tests required for the protection and safety of his employees.

D. Collect and analyze (OSHA) personal air monitoring samples, repeated during each different work activity, from each work area. Sample collection and analysis shall be performed using the OSHA Reference Method outlined in 29 CFR 1926.1101, Appendix A.

E. Results of all air monitoring shall be posted within 24 hours of the abatement after collection for all workers to see. A copy of the results shall be submitted to the Owner.

F. Perform an inspection of the Work to evaluate completeness prior to requesting an inspection by the Owner.

G. Where visual inspections are performed by the Owner, the Contractor shall allow for the following response time for completion of the inspection.

3.8 CLEAN-UP

A. Asbestos Related Clean Up: All clean-up work related to asbestos abatement work shall be in strict accordance with general technical requirements.

B. Final Site Cleaning: Upon completion of the work, remove all temporary construction and decontamination facilities; put the premises in a neat and clean condition; and sweep, clean, and wash to restore the condition of the site to its original condition.

3.9 CONTINGENCY PLAN

A. Air Monitoring will occur during the project and around the work area. The air monitoring will be performed in accordance with Federal and State requirements. This contingency plan has been prepared in order to address appropriate response actions in the event of a failure in the containment system or in the event of a release or suspected release of asbestos fibers.

3.9.01 PRESSURE LOSS

A. In the event that the pressure differential drops below 0.02 inches w.c.:
   1. The contractor supervisor shall investigate and evaluate the engineering controls to determine the source of the pressure loss.
   2. The contractor shall institute corrective action such as: additional sealing, critical barrier maintenance and construction, changing of exhaust unit filters, adjustment of make-up air, operation of additional exhaust units or other necessary measures to reestablish an acceptable pressure differential.

B. If the pressure differential drops below 0.01 inches w.c., the following procedures shall be implemented:
   1. The contractor shall cease abatement activity in the work area.

2. The contractor supervisor shall investigate and evaluate the engineering controls and determine the source of the pressure loss.
3. The contractor shall institute corrective action such as: additional sealing, critical barrier maintenance and construction, changing of exhaust unit filters, adjustment of make-up air, operation of additional exhaust units or other necessary measures to reestablish an acceptable pressure differential.
4. Abatement work will not resume until a pressure differential of 0.02 inches w.c. or greater is not reestablished.

3.9.02 ELEVATED AIR SAMPLE

A. In the event that an air monitoring sample result is elevated (>0.01 f/cc (plus background) outside of containment or >0.02 f/cc inside clean room):
   1. The contractor supervisor shall investigate and evaluate the engineering controls to determine the source of the high air level.
   2. An additional/second PCM air sample shall be taken at each place at which a high air level was obtained. The additional/second PCM sample may be split, and if the result of the air sample is less than 0.010 f/cc the contingency plan is terminated. If the result of the air sample exceeds 0.010 f/cc, the contractor shall choose the option of cleaning and retesting by PCM analysis or analyzing the split sample by TEM analysis. If the result of the TEM analysis exceeds 0.010 f/cc, then cleaning shall be undertaken.
   3. Cleaning shall include, but not be limited to, wet wiping and misting the air. Cleaning the affected area shall be continued outside of containment and PCM sampling shall also be continued until the result in the area is less than 0.010 f/cc by either PCM or TEM
   analysis.
   4. If laboratory analysis of air samples does not yield a reading less than 0.010 f/cc within 24 hours of receipt of the first test result above 0.010 f/cc, all abatement work will cease until acceptable results are obtained.

3.09.03 POWER OUTAGE

A. If a power outage occurs during active abatement work, all work will stop until power is restored.

END OF SECTION 028200

SECTION 028313 - LEAD HAZARD CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall comply with the requirements regarding lead including lead based paint of all applicable federal, state, tribal and local laws, codes, and regulations including but not limited to the regulations of the United States Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA) and the local authority even if they are not specifically referenced herein. If an applicable law, code or regulation is more restrictive than any of the requirements, the Contractor shall follow the more restrictive requirements.

1. No painted surfaces have been identified as having lead concentrations in excess of the U.S. Department of Housing and Urban Development definition of Lead-based paint (LBP) of 0.5% lead by weight. The Contractor shall note that there are surfaces that contain lead paint below 0.5% lead by weight. The Contractor shall comply with all applicable regulations, including but not limited to the OSHA Lead in Construction Standard.
2. The Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1926.62 Lead in Construction, states that workers must be protected through use of engineering controls, personal protective equipment, and personal exposure monitoring during each phase and task of the project. It is the Contractors responsibility to familiarize themselves with existing conditions and the extent of painted surfaces to be remedied at the project site.
3. The Contractor shall not soley rely on the information provided by owner but shall treat all existing coatings which will be disturbed, affected or demolished by the work of this Contract as potential hazards for lead and other heavy metals unless the Contractor has received the Contracting Officer's prior written approval to treat them otherwise based upon the Contractor's comprehensive survey and testing which demonstrate that no such hazards exist at a particular location.

B. Related Documents

1. Hazardous Building Materials Survey Report, Building 200, 217 and 710, Mabbett & Associates, Inc, dated June 25, 2024.

C. OSHA Construction Standard for Lead

The OSHA Construction Standard for lead is cited as Title 29 Code of Federal Regulations 1926.62 (29 CFR 1926.62). This regulation requires employers to protect their employees from exposure to lead during demolition, renovation (including maintenance) and construction projects.

1. Construction work is defined as work for construction, alteration and/or repair, including painting and decorating. It includes but is not limited to the following:
   a. Demolition or salvage of structures where lead or materials containing lead are present;
   b. Removal or encapsulation of materials containing lead;
   c. New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead;
   d. Installation of products containing lead;

e. Lead contamination/emergency cleanup;
f. Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed; and
g. Maintenance operations associated with the construction activities described in this paragraph.

2. The Standard has set an airborne Action Level of 30 ug/m^3 of lead. Employees that are exposed above the action level must then participate in a medical and biological monitoring program and receive training on lead that includes health effects, proper handling and protective actions that should be utilized.
3. Until the employer performs an employee exposure assessment as required by the regulations and determines actual employee exposure, the employer shall provide to employees performing the tasks with interim protection as follows:
   a. Appropriate respiratory protection (refer to 29 CFR1926.62) and training per 29 CFR 1910.134;
   b. Appropriate personal protective clothing and equipment;
      1) Coveralls or similar full-body work clothing;
      2) Gloves, hats, and shoes or disposable shoe coverlets; and
      3) Face shields, vented goggles, or other appropriate protective equipment, which complies with 29 CFR 1910.133.
   c. Change areas;
   d. Hand washing facilities;
   e. Biological to consist of blood sampling and analysis for lead and zinc protoporphyrin levels, and
   f. Training regarding:
      1) 29 CFR 1926.59 - Hazard Communication;
      2) 29 CFR 1926.62 - Lead:
      3) 29 CFR 1926.21 - Safety training and education.
4. Exposure assessment: Each employer who has a workplace or operation covered by the OSHA standard shall initially determine if any employee may be exposed to lead at or above the action level. Employee exposure is that exposure which would occur if the employee were not using a respirator. The employer shall collect personal samples representative of a full shift including at least one sample for each job classification in each work area either for each shift or for the shift with the highest exposure level. Full shift personal samples shall be representative of the monitored employee's regular, daily exposure to lead.
5. Note that the requirements for employees that are exposed to unknown concentrations are the same as those that are exposed above the action level. Once the concentrations are determined by the exposure assessment, those that are not exposed above 30 ug/m^3 do not have to have further medical monitoring, use of respiratory protection or training.
6. Those exposed above 30 ug/m^3 get continued medical surveillance. Those exposed above the PEL of 50 ug/m^3 continue medical surveillance and includes respiratory protection program. Both are required to have annual refresher training.

7. Employees that are exposed above the Permissible Exposure Level (PEL) of 50 ug/m^3 must also be provided with respiratory and personal protective equipment, medical monitoring, etc.

D. Other applicable OSHA standards include:
1. 29 CFR 1910.133 – Eye and Face Protection
2. 29 CFR 1910.134 – Respiratory Protection
3. 29 CFR 1926.59 – Hazard Communication

1.2 SUBMITTALS

A. All submittals required under Section 02 83 13 must be submitted to the Contracting Officer for his review prior to the start of any work operations. All Health and Safety plans shall by sealed/signed by a Certified Industrial Hygienist. All plans and/or submittals must conform to these specifications. After the Contracting Officer has reviewed each submittal, the Contractor shall comply with the terms thereof. Note that the Contracting Officer will perform a cursory review of the submittal and make comment if warranted, this does not constitute an approval of the plan nor excuse the Contractor for his employer responsibilities required by any regulation.

B. Worker Protection Submittals. The Contractor shall submit the following plans, programs and information a minimum of five (5) calendar days prior to any anticipated work.
1. Lead (Heavy Metal) Health and Safety Compliance Program. A written Project-specific Compliance Program, prepared under the direction of and signed by a Certified Industrial Hygienist (CIH) in accordance with 29 CFR 1926.62, for the protection of workers from lead and other heavy metals in the paint being removed or disturbed. Include the name of the competent person who will be making routine inspections of paint removal activities to ensure compliance with the program in accordance with 29 CFR 1926.62. Verify that any Subcontractors working for the Contractor are included in the program or are in a separate program, which meets the requirements of this Section. If Subcontractors are operating under a separate program, include the program with the Submittals required there under. This Compliance Program shall contain, without limitation, the following information:
a. Regulated Areas. A plan for the establishment of regulated areas around equipment and operations that may generate emissions of dust, vapors or debris containing lead or other heavy metals. A typical work area sketch and the methods that will be used for monitoring and designating the regulated areas shall be included.
b. Personnel Qualifications. The name, experience, and qualifications of both the CIH who will be overseeing the development of the Compliance Program, and the competent person who will be assigned to the project.
c. Outside Laundry. The name, address, and qualifications of the laundry facility, if one will be used, for the cleaning of reusable clothing. A letter from the laundry facility indicating that is permitted to handle clothing contaminated with lead and/or the other heavy metals of concern shall be included.
d. Laboratory Qualifications. Prior to using any laboratory to perform laboratory services in connection with the worker and area monitoring required under

this Section, the Contractor shall submit certificates of accreditation for each such laboratory to the Contracting Officer for review and approval.

1) Any such analytical laboratory shall be accredited for metals analysis by the American Industrial Hygiene Association AIHA, and a successful participant in the AIHA program for at least one (1) year, and accredited for environmental lead samples under the National Lead Laboratory Accreditation Program (NLLAP) and a successful participant in the ELPAT program for at least one (1) year.

e. Cleaning Solutions. Identify methods to be used for cleaning of surfaces and equipment when wet wiping or washing is employed.

f. MSDS. Three copies of the manufacturer's Material Safety Data Sheets (MSDS) for all chemicals and other potential hazardous material brought on Site.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION 028313

SECTION 032000 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete reinforcement as shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Comply with ACI-301, Chapter 5, except where more exacting requirements are specified.

B. Comply with requirements in AWS-D12.1, except where more exacting requirements are specified in the Contract Documents.

1.3 SUBMITTALS

A. Shop Drawings: Submit Drawings showing bending and placing of reinforcing. Include diagrammatic elevations of walls at a scale sufficiently large to show clearly the position and erection marks of marginal bars and their dowels and splices and bar arrangement for more than one layer of reinforcing steel in concrete sections.

B. Certificates: Submit certified mill test reports for review prior to fabrication.

C. Product specific Environmental Product Declaration (EPD) for each steel and fiber reinforcement product proposed for the project.

1.4 DELIVERY, STORAGE AND HANDLING

A. Shipping: Deliver reinforcement to the Project site bundled, tagged and marked to facilitate sorting and placing. Tags shall indicate bar sizes, lengths, grade and other information corresponding to markings shown on placement diagrams.

B. Storage and Protection: Store reinforcement at the site off the ground and in a manner to prevent damage to the materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: New billet-steel, deformed bars conforming to ASTM A615, Grade 60, (ASTM A615M, Grade 400) with a minimum yield of 60,000 psi for all bars, unless noted otherwise on Drawings.

1. Environmental product Declaration: Provide Type III Product Specific Evironmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.

a. Concrete Reinforcement Global Warming Potential (GWP): The GWP of structural products over its "cradle-to-mill gate" life cycle must not exceed the limits indicated in the table below.

PRODUCT	MAX. ACCEPTABLE UNFABRICATED GWP (kg CO2/MT)	MAX. ACCEPTABLE FABRICATED GWP (kg CO2/MT)
Rebar	753	854

B. Welded Wire Fabric: ASTM A185 using bright steel wire meeting the requirements of ASTM A82. Gauges and dimensions as noted on the Drawings.

C. Chairs: Galvanized steel or plastic tipped.

D. Tie Wire: ASTM A82, 16 gauge or heavier, black annealed.

E. Welding Rods: E-70 Series for A615 Grade 40 (ASTM A615M, Grade 300) reinforcing, and E-90 Series for A706 reinforcing; low hydrogen conforming to AWS A-5.1.

2.2 FABRICATION

A. Shop fabricate bars as far as is practical. Bend bars cold. Make bends for stirrups and ties around pins having diameters at least 2 times the thickness of the bars; for other bars 1 inch diameter and smaller, 6 times the thickness; for larger bars 8 times the thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Determine weldability of reinforcing steel by laboratory chemical analysis of steel. Only steel conforming to chemical requirements specified in AWS D12.1 may be welded.

3.2 PLACING REINFORCEMENT

A. General:
1. Place in accordance with ACI 318 and as shown.
2. Accurately place reinforcement and securely tie at intersections with 16 gauge black annealed wire.
3. Maintain reinforcing in proper position by chairs, bar supports or other approved devices.
4. Bars in footings shall be supported on precast concrete blocks.
5. The bending or field cutting of bars around openings or sleeves will not be permitted.
6. Reinforcing steel in beams and slabs shall not be placed until after concrete in walls and columns has been poured.

B. Bars shall lap per the schedules on the structural drawings.

C. Concrete protection of reinforcing shall be not less than the following:
1. Concrete is poured against and permanently exposed to ground: 3 inches.
2. Concrete is poured against forms but may be in contact with ground:
   a. 5 and under: 1-1/2 inches.

b. 6 and larger: 2 inches.

3. Exterior face of exterior walls (exposed to weather but not in contact with ground: 1-1/2 inches minimum.
4. Interior walls and interior face of exterior walls: ¾ inch minimum.
5. Beams, girders and columns: 1-1/2 inches.
6. Interior Slabs: 1 inch, unless noted otherwise on the structural drawings.

D. Clear distance between bars shall be not less than 1-1/2 times the maximum size of coarse aggregate unless noted otherwise.

E. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If bars are moved more than one bar diameter or enough to exceed code tolerances, resulting arrangement of bars shall be subject to review of Architect.

F. Bars with kinks or bends not indicated shall not be used. Reinforcement shall not be bent or be straightened in a manner that will weaken the material, or be bent after being partially embedded in hardened concrete.

G. Wire mesh in slabs:
1. Lap welded wire fabric at least 1-1/2 meshes plus end extension of wires but not less than 12 inches in structural slabs.
2. Lap fabric at least 1/2 mesh plus end extension of wires but not less than 6 inches in slabs on ground.
3. Extend mesh across supporting beams and walls.

3.3 CLEANING

A. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of off premises. Leave Work in clean condition.

END OF SECTION

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUSTAININABILITY REQUIREMENTS

A. The basis for designing concrete mixtures and demonstrating compliance with carbon budget targets shall be in accordance with:
   1. National Ready Mixed Concrete Association (NRMCA) Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete Manufactured by NRMCA Members – Version 3 (or later).
   2. National Ready Mixed Concrete Association, NRMCA Member Industry Average EPD for Ready Mixed Concrete – Version 3 (or later).

B. Sustainability Goals

   1. The target maximum Global Warming Potential (GWP) and target for maximum portland cement content is provided in Section 2 CONCRETE MIXTURES. The target carbon footprint reduction for concrete is an weighted average by volume. It shall be permitted to propose the use of innovative products and manufacturing processes for approval by the Engineer of Record. Proposed alternatives shall meet all performance criteria for strength, durability, and constructability, and achieve the required reduction in carbon footprint.
   2. CO2 mineralized concrete is permitted where available, pending concrete performance criteria is met.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Concrete toppings.
   5. Building frame members.
   6. Building walls.

B. Related Sections include the following:
   1. Division 4 Section "Concrete Unit Masonry”.
   2. Division 5 Section “Structural Steel Framing”.

1.4 DEFINITIONS

A. Carbon Dioxide Mineralization: Active carbonation treatment of concrete during mixing such that the carbon dioxide (CO2) that is injected during mixing is mineralized (I.E. chemically converted into a mineral) within the concrete. The concrete may undergo mix optimization whereby the strength enhancement property of the mineralized CO2 is utilized to adjust cementitious content, pending that the optimized concrete mix meets concrete performance requirements as outlined.

B. Carbonization Treatment: Active introduction of CO2 into the concrete pore fluid which reacts with calcium from calcium hydroxide and calcium silicate hydrate to form calcite (CaCO3).

C. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

D. Environmental Product Declaration: An Environmental Product Declaration (EPD) quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. EPDs are conducted in accordance with a Product Category Rule for the specific product being evaluated. (International Organization for Standardization 14025 as a Type III declaration).

E. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

F. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

G. Global Warming Potential: Global warming potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere, as a multiple of the heat that would be absorbed by the same mass of carbon dioxide. GWP is 1 for CO2. For other gases it depends on the gas and the time frame. GWP for concrete is expressed in kg of CO2e per unit of concrete (cubic yard or cubic meter).

H. Life Cycle Assessment: Life cycle assessment (LCA) is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

I. Product Category Rule: Product Category Rules (PCR) are a set of rules, requirements, and guidelines for developing Environmental Product Declarations (EPD) for one or more product categories. The PCR for concrete is published by NSF International.

J. Water to Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Under the active leadership of the Contractor
   2. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials.
   3. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

B. Review the following:

1. Special inspection and testing and inspecting agency procedures for field quality control.
2. Concrete finishes and finishing.
3. Cold- and hot-weather concreting procedures.
4. Curing procedures.
5. Global warming potential (GWP) limits.
6. Construction joints, movement joints, contraction/control joints, and isolation joints and joint-filler strips.
7. Semirigid joint fillers.
8. Forms and form removal limitations.
9. Shoring and reshoring procedures.
10. Anchor rod and anchorage device installation tolerances.
11. Steel reinforcement installation.
12. Concrete repair procedures.
13. Concrete protection.
14. Vapor-retarder installation.
15. Initial curing and field curing of field test cylinders (ASTM C31/C31M).
16. Protection of field cured test cylinders.
17. Schedule slab preinstallation conference.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals
1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data and Laboratory Test Reports: For liquid floor treatments, curing and sealing compounds, indicating compliance with requirements for low-emitting materials and printed statement of VOC content.
3. Product Certificates: For regional materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
4. For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.
5. Health Product Declaration (HPD): Provide documentation confirming product compliance with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard.
6. Plant specific Environmental Product Declaration (EPD) for each product and concrete mixture proposed for the project accompanying each concrete mixture submittal.
    a. It shall be permitted to substitute plant-specific EPDs with those listed in NRMCA Member Industry Average EPD for Ready Mixed Concrete if the proposed mixtures are similar to those listed and the concrete producer participated in providing data for the NRMCA Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete.

7. Plant specific Environmental Product Declaration (EPD) for each steel and fiber reinforcement product proposed for the project.

C. Design Mixtures: For each concrete mixture including the following:
1. Mixture identification.
2. Material data and mixture proportions.
3. Minimum compressive strength at specified time frame.
4. Durability exposure class.
5. Maximum w/cm ratio.
6. Mixture proportions.
7. Calculated equilibrium unit weight.
8. Slump limit.
9. Air content.
10. Nominal maximum aggregate size.
11. Steel fiber reinforcement content.
12. Synthetic fiber content.
13. Material data.
14. Supporting test data or preconstruction test results.
15. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.

D. Steel Reinforcement Shop Drawings: Comply with ACI SP-066.
1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, locations of splices, lengths of lap splices, details of mechanical couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Welding: Submit description of reinforcing bar weld locations and welding procedure specifications.

F. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
1. Indicate form liner layout and form line termination details.
2. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.
3. Indicate layout of insulating concrete forms, dimensions, course heights, form types, and details.
4. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

G. Construction, Contraction, and Control Joint Layout: Indicate dimensions and locations of joint in accordance with drawings and as indicated and as required to construct the structure in accordance with ACI 301 (ACI 301M).
1. Location of joints are subject to approval of the Architect.
2. For exposed vertical concrete walls, indicate dimensions and locations of joints and form tie locations.
3. Indicate location of waterstops.

H. Repair Methods, Materials and Modifications to the Work: Provide description of proposed repair work to be performed to bring under-strength or nondurable concrete into compliance.

I. Samples: For waterstops and vapor retarder.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, steel reinforcing supplier, concrete supplier, manufacturer, and installer.
   1. Including applicable ACI certificates.

B. Qualification Data: For testing agency, include copies of applicable ACI certificates.

C. Welding certificates.
   1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

D. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Aggregates
   3. Admixtures.
   4. Form materials, form-release agents, and form liners.
   5. Steel reinforcement and accessories.
   6. Epoxy-coated reinforcement: CRSI's "Epoxy Coating Plant Certification."
   7. Fiber reinforcement.
   8. Waterstops.
   9. Curing compounds.
   10. Floor and slab treatments.
   11. Bonding agents.
   12. Adhesives.
   13. Vapor retarders.
   14. Semirigid joint filler.
   15. Joint-filler strips.
   16. Repair materials.
   17. Moisture vapor reduction admixture (MVRA).
   18. Embeds and anchors.

E. Material Test Reports: For the following, from a qualified testing agency:
   1. Portland cement.
   2. Fly ash.
   3. Slag cement.
   4. Blended hydraulic cement.
   5. Silica fume.
   6. Performance-based hydraulic cement.
   7. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
   8. Admixtures:
   9. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.
   10. Steel Reinforcement:
   11. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
   12. Mechanical splice couplers.

F. Concrete Moisture Action Plan: Submit plan for complying with concrete moisture limits.

G. Concrete Tolerances Action Plan: Submit plan for complying with concrete flatness and levelness tolerances. Action plan to include placement, quality control procedures, finishing, anticipated dead load of slab and construction live loads, shoring, and potential for topping or leveling materials required to achieve specfied flatness and levelness criteria of finished slabs.

H. Manufacturer's Data and Instructions:
1. For moisture limits and flatness/levelness tolerances of finish flooring materials and adhesives specified in other Sections.
2. For admixtures if used.
3. For curing compounds if used.
4. For concrete slab-applied vapor retarder if anticipated.

I. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

J. Research reports:
1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

K. Field quality-control test and inspections reports.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer with a minimum of 5 years of experience in projects of similar size, type, and complexity.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An experienced independent third-party testing agency, complying with requirements in Section 014000 "Quality Requirements", acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CPP 610.1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
3. For concrete to be tested for moisture vapor emission rates the testing agency shall be currently certified as ICRI Moisture Testing Technician Grade 1 level.

a. Personnel performing laboratory tests shall be certified in the conduct of ASTM D5084 under the supervision of a licensed geotechnical engineer. The determination as to whether the concrete slab is prepared to receive flooring, coatings, roofing, etc. rests with the MVRA manufacturer.

D. Documentation that the concrete supplier participated in supplying data to the NRMCA Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete.

E. Steel Reinforcement: CRSI Plant Certification.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 347, "Guide to Formwork for Concrete."
4. ACI 302.1, "Guide for Concrete Floor and Slab Construction."
5. ACI 302.2R-06, "Guide for Concrete Slabs that Receive Moisture Sensitive Flooring" for slabs to receive moisture sensitive coatings or material, unless modified by requirements in the Contract Documents.

H. Concrete Testing Service: The contractor shall engage and pay for a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

I. Minutes of preinstallation conference.

J. Mockups: Cast concrete slab on grade and formed surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with the requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

B. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
1. Store reinforcement to avoid contact with earth.
2. Do not allow epoxy-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
3. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
4. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

C. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

D. Form Liners: Store form liners under cover to protect from sunlight.

1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 (ACI 306.1M) and as follows.
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
5. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
6. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature at time of discharge to not exceed 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 MATERIALS

A. Regional Materials: Concrete shall be manufactured within 100 miles (160 km) of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.

2.3 PERFORMANCE REQUIREMENTS

A. Provide concrete with moisture vapor emission rate or internal relative humidity that is in accordance with finish flooring materials and adhesive manufacturers' written instructions, by the time the finishes will be applied, when tested according to the technical Specification Sections and the manufacturers' written requirements. General Contractor is responsible for choosing and implementing methods of limiting excessive moisture, and for assigning and contracting for these responsibilities to suppliers and installers, including but not limited to one or more of the following:
   1. Limit moisture during curing. Plastic moisture-retaining curing covers are preferred over other methods of curing. Avoiding use of continuous water-fog spray. If a curing compound is used, verify compatibility with finish flooring materials in accordance with curing compound and finish flooring manufacturers' written instructions, or remove curing compound using method recommended by manufacturer without damaging concrete surface. If curing compound will remain, submit certification from the manufacturer that curing compound will not interfere with bonding of floor coverings used on Project.
   2. Provide temporary covers or enclosed construction to protect concrete from weather.
   3. Schedule to allow for drying time in accordance with ACI 302.2R and considering local seasonal humidity and temperatures.
   4. Provide self-leveling fast-drying concrete topping throughout for all new concrete slabs to achieve flatness and levelness requirements. May be used in conjunction with an intermediate layer of epoxy surface-applied vapor retarder. Submit written recommendations of selected manufacturer.
   5. Other methods submitted by Contractor.
   6. If methods employed still result in moisture limit exceeding limits acceptable for finish flooring, provide one of the following, to be included within the original Contract Sum:
      a. Provide surface-applied vapor retarder as specified in 090561.13 "Moisture Vapor Emission Control."
      b. Provide industrial drying and dehumidification with temporary enclosure.

B. Follow applicable provisions of ACI 302.2R-06.

C. Do not allow total water-cement ratio to exceed indicated amount, regardless of whether water is held back for adding to the mix at the Project site. Comply with ACI 301 (ACI 301M): "Do not exceed the specified water-cementitious material ratio or slump. Do not add water to concrete delivered in equipment not acceptable for mixing. After plasticizing or high-range water-reducing admixtures are added to the concrete at the site to achieve flowable concrete, do not add water to the concrete. Measure slump and air content of air-entrained concrete after slump adjustment to verify compliance with specified requirements."
   1. If required to improve concrete workability, use water-reducing, super-plasticizing, or other admixtures in accordance with ACI 212.3R and ACI 301 (ACI 301M).

2.4 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. APA HDO (high-density overlay), Class 1 or better.
   b. APA MDO (medium-density overlay), Class 1 or better; mill-release agent treated and edge sealed.
   c. APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
   d. APA Plyform Class I, B-B or better; mill oiled and edge sealed.

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Form Liners:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Architectural Polymers, Inc.
      b. Fitzgerald Formliners.
      c. Sika Corporation.
      d. Spec Formliners, Inc.
   2. Face Pattern: per drawings

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.5 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 97 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Epoxy-Coated Reinforcing Bars:
   1. Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
   2. Epoxy Coating: ASTM A775/A775M or ASTM A934/A934M, epoxy coated, with less than 2 percent damaged coating in each 12 inch bar length.

E. Plain-Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

F. Deformed-Steel Welded Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

G. Galvanized-Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

2.6 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, ASTM 775/A775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place.
   1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
      a. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
      b. For concrete-on-grade, use supports with sand plates or horizontal runners if base material will not adequately support chair legs.
      c. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, stone, broken block, or pieces of concrete.
      d. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
      e. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.7 CONCRETE MATERIALS

A. Source Limitations:
1. Obtain all concrete mixtures for a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain admixtures from single source from manufacturer.

B. Cementitious Material:
1. Portland Cement: ASTM C 150, Type II.
   a. Fly Ash: ASTM C 618.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
2. Blended Hydraulic Cement: ASTM C595/C595M, Type IS Portland blast-furnace slag, Type IP Portland-pozzolan, Type IL Portland-limestone, or Type IT ternary blended cement, excluding:
   a. Type IS (>70) and Type IT (s>70).
3. Fly Ash: ASTM C618/C618M, Class C or Class F.
4. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
5. Silica Fume: ASTM C 1240, amorphous silica.
6. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   a. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
   b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
7. Water and Water Used to Make Ice: ASTM C 94/C 94M and potable.

2.8 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Master Builder Solutions; Rheocrete CNI.
b. Euclid Chemical Company (The), an RPM company.
c. GCP Applied Technologies, Inc.
d. Sika Corporation.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Aggregate Industries (US); Lafarge.
b. Barrier-Bac; Inteplast Group.
c. Cortec Corporation.
d. GCP Applied Technologies Inc.
e. Master Builders Solutions.
f. Sika Corporation.
g. Specialty Products Group.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable,free of carbon black, nonfading, and resistant to lime and other alkalis.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Alabama Pigments Company, LLC.
b. Bon Tool Co.
c. Brickform; a division of Solomon Colors.
d. Butterfield Color, Inc.
e. Dynamic Color Solutions, Inc.
f. Euclid Chemical Company (The); an RPM company.
g. Hoover Color Corporation.
h. Lambert Corporation.
i. LANXESS Corporation.
j. Master Builders Solutions.
k. Matcrete Inc.
l. NewLook International, Inc.
m. Proline Concrete Tools, Inc.
n. QC Construction Products.
o. Scofield, a Business Unit of Sika Corporation.
p. Solomon Colors, Inc.
q. Stampcrete International, Ltd.
r. SureCrete Design Products.
s. Venator Materials PLC.
2. Color: As selected by Architect from manufacturer's full range.

2.9 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers:
   a. Greenstreak.
   b. Progress Unlimited, Inc.
   c. Williams Products, Inc.
2. Profile: Flat, dumbbell with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick, 6 inches by 3/8 inch thick, 9 inches by 3/8 inch thick; nontapered.

B. Flexible PVC Waterstops: CE CRD-C 572, OR C 513 with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
1. Manufacturers:
   a. Bometals, Inc.
   b. Greenstreak.
   c. Meadows, W. R., Inc.
   d. Murphy, Paul Plastics Co.
   e. Progress Unlimited, Inc.
   f. Tamms Industries, Inc.
   g. Vinylex Corp.
2. Profile: Flat, dumbbell without center bulb
3. Dimensions: 4 inches by 3/16 inch thick

2.11 BELOW-SLAB VAPOR RETARDER

A. Sheet Vapor Retarder, Class A: Low Permeance Polyethylene Sheet, Minimum 15 Mil Thickness: ASTM E1745, Class A, except maximum 0.1 perms. Include manufacturer's recommended adhesive or pressure-sensitive tape.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Raven Industries, Inc.
   b. Stego Industries, LLC.
   c. W. R. Meadows, Inc.

B. Do not use a blotter layer between concrete slab on grade and vapor retarder, unless using enclosed construction and keeping blotter layer continually dry.

2.12 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inchNo. 4No. 8 sieve.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anti-Hydro International, Inc.
   b. Dayton Superior.
   c. Lambert Corporation.
   d. Laticrete International, Inc.
   e. Metalcrete Industries.

2.13 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bon Tool Co.
      b. Brickform; a division of Solomon Colors.
      c. ChemMasters, Inc.
      d. Dayton Superior.
      e. Euclid Chemical Company (The); an RPM company.
      f. Kaufman Products, Inc.
      g. Lambert Corporation.
      h. Laticrete International, Inc.
      i. Master Builders Solutions.
      j. Metalcrete Industries.
      k. Nox-Crete Products Group.
      l. Sika Corporation.
      m. SINAK Corporation.
      n. SpecChem, LLC.
      o. TK Products.
      p. Vexcon Chemicals Inc.
      q. W.R. Meadows, Inc.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
   1. Color:
      a. Ambient Temperature Below 50 deg F: Black.
      b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
      c. Ambient Temperature Above 85 deg F: White

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anti-Hydro International, Inc.
      b. ChemMasters, Inc.
      c. Dayton Superior.
      d. Euclid Chemical Company (The), an RPM Company.
      e. Kaufman Products, Inc.
      f. Lambert Corporation.
      g. Laticrete Corporation.
      h. Nox-Crete Products Group.
      i. SpecChem, LLC.
      j. TK Products.
      k. Vexcom Chemicals, Inc.

l. W.R. Meadows, Inc.

F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. VOC content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anti-Hydro International, Inc.
b. ChemMasters, Inc.
c. Dayton Superior.
d. Euclid Chemical Company (The), an RPM Company.
e. Kaufman Products, Inc.
f. Lambert Corporation.
g. Laticrete Corporation.
h. Master Builder Solutions.
i. Metalcrete Industries.
j. Nox-Crete Products Group.
k. SpecChem, LLC.
l. TK Products.
m. Vexcom Chemicals, Inc.
n. W.R. Meadows, Inc.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ChemMasters, Inc.
b. Dayton Superior.
c. Euclid Chemical Company (The), an RPM Company.
d. Kaufman Products, Inc.
e. Lambert Corporation.
f. Laticrete Corporation.
g. Master Builders Solutions
h. Metalcrete Industries.
i. Nox-Crete Products Group.
j. SpecChem, LLC.
k. Vexcom Chemicals, Inc.
l. V-Seal Concrete & Sealers Specialty Coatings.
m. W.R. Meadows, Inc.

H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ChemMasters; Spray-Cure & Seal Plus.
b. Concrete Sealers USA.

c. Dayton Superior.
d. Euclid Chemical Company (The), an RPM company.
e. Kaufman Products, Inc.
f. Lambert Corporation; UV Super Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal Plus.
h. Master Builder Solutions.
i. Metalcrete Industries.
j. Nox-Crete Products Group.
k. Right Pointe.
l. TK Products.
m. Vexcon Chemicals, Inc.
n. W. R. Meadows, Inc.

2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.
3. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ChemMasters, Inc.
b. Concrete Sealers USA
c. Dayton Superior.
d. Euclid Chemical Company (The), an RPM Company.
e. Kaufman Products, Inc.
f. Lambert Corporation.
g. Laticrete Corporation.
h. Metalcrete Industries.
i. Nox-Crete Products Group.
j. Right Pointe
k. SINAK Corporation.
l. SpecChem, LLC.
m. TK Products.
n. Vexcon Chemicals, Inc.
o. W. R. Meadows, Inc.
2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.
3. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Curing compound must be compatible with specified waterproof membrane and other specified finish materials.

2.14 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.15 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psiat 28 days when tested according to ASTM C 109/C 109M.

2.16 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used.
   1. Limit supplementary cementitious materials for concrete assigned to Exposure Class F3 as follows:
      a. Fly ash or natural pozzolans: 25 percent.
      b. Slag cement: 50 percent.
      c. Silica fume: 10 percent.
      d. Total fly ash or natural pozzolans and silica fume: 35 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.17 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Requirements for different classes of concrete mixtures for different location or structural members as indicated on drawings.

B. Limit water-soluble, chloride-ion content in hardened concrete to percent by weight of cement as follows:
   1. Exposure Class C0 = 1.00 percent
   2. Exposure Class C1 = 0.30 percent
   3. Exposure Class C2 = 0.15 percent

C. Global Warming Potential (GWP) or portland cement content shall be lower than targets indicated on the drawings.

2.18 PLANT, EQUIPMENT, MACHINES, AND TOOLS

A. General: Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

B. Soft-Cut Saw: Designed and shown to be able to cut concrete shortly after final set without causing raveling or other untoward effect upon the concrete finish. Provide diamond blade with thickness no greater than 1/8 inch to soft-cut joint of size indicated.

2.19 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.20 CONCRETE MIXING

C. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
   1. Daily access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
   4. Security and protection for test samples and for testing and inspection equipment at Project site.

B. Protection of In-Place Conditions:
   1. Do not cut or puncture vapor retarder.
   2. Repair damage and reseal vapor retarder before placing concrete.

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.3 INSTALLATION OF FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch, Class C, 1/2 inch, Class D, 1 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.
   1. Minimize joints.
   2. Exposed Concrete: Symmetrically align joints in forms.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
   1. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and the like, for easy removal.

F. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
   1. Provide and secure units to support screed strips
   2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
   1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
   2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
   1. Determine sizes and locations from trades providing such items.
   2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

K. Construction and Movement Joints:
   1. Construct joints true to line with faces perpendicular to surface plane of concrete.
   2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   3. Place joints perpendicular to main reinforcement.
   4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
   5. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   6. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

L. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
   1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
   2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   4. Install dovetail anchor slots in concrete structures as indicated.
   5. Clean embedded items immediately prior to concrete placement.

3.5 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 48 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 80 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
   3. Slab shall be constantly supported by shores for 21 day minimum.

B. Clean and repair surfaces of forms to be reused in the Work.
   1. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces.
   2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.6 INSTALLATION OF SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.7 INSTALLATION OF BELOW-SLAB VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder accordance with ASTM E1643 and manufacturer's written instructions.
   1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
   2. Face laps away from exposed direction of concrete pour.
   3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
   4. Lap joints 6 inches and seal with manufacturer's recommended tape.
   5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
   6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
   7. Protect vapor retarder during placement of reinforcement and concrete.
      a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.8 INSTALLATION OF STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement.
   1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
   2. Do not tack weld crossing reinforcing bars.
   3. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

E. Provide concrete coverage in accordance with ACI 318.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Splices: Lap splices as indicated on Drawings.
   1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
   2. Stagger splices in accordance with ACI 318.
   3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
   4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

H. Install welded wire reinforcement in longest practicable lengths.
   1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice." And to minimize sagging.
      a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches (305 mm).
      b. Lap edges and ends of adjoining sheets at least one wire spacing.
      c. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
      d. Lace overlaps with wire.

I. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

J. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.9 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.10 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.11 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.12 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces per architectural drawings.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.13 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Refer to architectural drawings for required floor finishes for all slabs; confirm with architect where finish is not indicated.

B. Scratch Finish:
1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
3. Apply scratch finish to surfaces indicated per architectural drawings.

C. Float Finish:
1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats.
2. Restraighten, cut down high spots, and fill low spots.
3. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI 117M) tolerances for conventional concrete.
4. Apply float finish to surfaces per architectural drawings.

D. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, according to ASTM E1155:
   a. Slabs on Ground: Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17.
   b. Suspended Slabs: Specified overall values of flatness, FF 35; and of levelness, FL 20; with minimum local values of flatness, FF 24; and of levelness, FL 15.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Coordinate required final finish with Architect before application.
   2. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
   2. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps.
   1. Apply according to manufacturer's written instructions and as follows:
      a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in 1 or 2 applications unless greater amount is recommended by manufacturer.
      b. Tamp aggregate flush with surface, but do not force below surface.
      c. After broadcasting and tamping, apply float finish.
      d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

H. Where indicated on drawings, concrete stair treads, platforms and ramp shall have factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch (9.5-mm), No.4 (4.75-mm), No.8 (2.36-mm) sieve.

3.14 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
   1. Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place.
   2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
   3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Provide machine and equipment bases and foundations as shown on Drawings.
   2. Coordinate sizes and locations of concrete bases with actual equipment provided.
   3. Construct concrete bases a minimum of 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
   a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Cast anchor-bolt insert into bases.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs:
1. Provide concrete fill for steel pan stair treads, landings, and associated items.
2. Cast-in inserts and accessories as shown on Drawings.
3. Screed, tamp, and trowel-finish concrete surfaces.

3.15 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 306.1 for cold-weather protection during curing.
2. Comply with ACI 301 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1 (ACI 305.1M), before and during finishing operations.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for the remainder of the curing period, as follows:
   a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
   b. Continuous Sprinkling: Maintain concrete surface continuously wet.
   c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
   d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
   e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      1) Recoat areas subject to heavy rainfall within three hours after initial application.
      2) Maintain continuity of coating and repair damage during curing period.

D. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
   1. Begin curing immediately after finishing concrete.
   2. Interior Concrete Floors:
      a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
      b. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
      b. Curing compound to be compatible with specified waterproof membrane.
   4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.16 TOLERANCES

A. Conform to ACI 117.

3.17 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 28 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.18 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint and trim joint filler flush with top of joint after hardening.

3.19 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.20 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Testing and inspecting agency to perform tests and inspections and to submit reports.
   1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.

2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301 (ACI 301M), including the following as applicable to each test and inspection:
        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 7-, 28-, and 56-days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at 7-, 28-, and 56-days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure four (4) sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M.
   a. Test one set of two laboratory-cured specimens at seven days, one set of two specimens at 28 days.
   b. Test one set of three field-cured specimens at seven days, one set of three specimens at 28 days, and one set of three specimens at 56 days.
   c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7, 28, and 56-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests:

a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.18 WATER LEAKAGE TESTS

A. Purpose: Determine integrity of finished concrete and to show exposed wall surfaces are visually acceptable. Exposed shall mean all wall surfaces prior to backfilling, or application of any exterior coating system, and other permanently or temporarily exposed areas for all water holding structures.

B. All Water-Holding Structures:
1. Perform water leakage tests according to ACI 350.1 and as specified hereinafter.
2. Perform leakage tests after concrete has cured a minimum of 7 to 14 days and obtained its design strength, and before backfill, application of any exterior coating system, or other work which will cover concrete wall surfaces is begun.
3. Make other equipment, i.e., stop gates, sluice gates, valves, etc., or temporary bulkheads water-tight prior to test.
4. As an alternative to having watertight bulkheads, gates, or valves, accurately measure the leakage through gates, valves, and bulkheads with methods acceptable to Engineer. An assumed leakage through gates and valves based on manufacturer's recommendations is not acceptable.
5. Fill with water to maximum liquid level prior to leak testing, and maintain level for 48 hours for moisture absorption by concrete.
6. Close all valves and gates to the structure and measure the change in water surface for a 24-hour period.
7. During test period, examine exposed portions of structure for dampness or leaks and mark visible leaks or damp spots.

C. Test Evaluation Criteria:
1. For water-holding structures comprised entirely of new construction, an acceptable test shall have a drop in water surface in 24-hour period with basin full less than 1/10 of 1 percent of normal volume of liquid contained in water-holding structure, after accounting for evaporation and precipitation in open basins; and damp spots or seepage are not present on walls or other areas exposed to view prior to any backfilling.
2. Determine evaporation by floating an evaporation pan in structure during test period.

D. Excessive Leakage and Leakage Test Failure: If drop in water surface exceeds test

evaluation criteria or if damp spots or seepage is visible in exposed surfaces prior to any backfilling, the leak test shall be considered as failing.

E. Repairs:
   1. If leakage is excessive, or if damp spots or observed seepage is present on exposed surfaces, drain water-holding structure, repair all leaks and damp spots previously marked, and make necessary repairs, and retest basin.
   2. Repair in accordance with these Specifications and as approved by Engineer.

F. Retest:
   1. Refill water-holding structure and test for leakage until structure meets test criteria.
   2. Successful Test: If liquid level criteria is met and damp spots and seepage problems are corrected, the retest will be considered acceptable.

G. Cost of all leakage tests, repairs, and retests shall be borne by the Contractor, at no extra cost to the Owner.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE - WWTP

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section shall include constructing the cast-in-place concrete structures consisting of Portland cement, fine and coarse aggregate, water and selected admixtures, combined, mixed, transported, placed, finished, and cured, complete, as herein specified.

B. This section also includes grout for miscellaneous uses, surface hardeners, bonding agents, and other related concrete accessories and construction requirements.

C. Contractor is responsible to repair all cracks in water-holding structures as specified herein. The work shall be done by an experienced and certified applicator as specified herein.

1.2 RELATED WORK

A. Section 013300, SUBMITTAL PROCEDURES

B. Section014000, QUALITY CONTROL

1.3 QUALITY ASSURANCE

A. The Contractor shall have available on-site a copy of ACI SP-15 "Specifications for Structural Concrete for Buildings with Selected ACI and ASTM References."

B. The Contractor shall comply with all requirements of the following codes and standards, except as modified herein:
1. ACI 301 “Recommended Practice for Concrete Inspection.”
2. ACI 318 "Building Code Requirements for Reinforced Concrete."
3. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."
4. ACI 305 "Recommended Practice for Hot Weather Concreting."
5. ACI 306 "Recommended Practice for Cold Weather Concreting."
6. ACI 308 "Recommended Practice for Curing Concrete."
7. ACI 350, “Code Requirements for Environmental Engineering Concrete Structures.”

C. Other references:
1. ASTM C31: Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33: Specification for Concrete Aggregates.
3. ASTM C39: Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C94: Specification for Ready-Mixed Concrete.
5. ASTM C143: Standard Test Method for Slump of Portland Cement Concrete.
6. ASTM C150: Specification for Portland Cement.
7. ASTM C260: Specification for Air-Entraining Admixtures for Concrete.
8. ASTM C309: Specification for Liquid Membrane-Forming Compounds for Curing.
9. ASTM C311: Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete.
10. ASTM C494: Chemical Admixtures for Concrete.
11. ASTM C1260: Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).

12. ASTM C1567: Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
13. ACI 302: Concrete Floor and Slab Construction.
14. ACI 614: Specification for Concrete Placement.
15. ACI SP 66: Detailing Manual.
16. U.S. Army Corps of Engineers Concrete Research Division (CRD) C662: Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method).

D. Coordinate testing and Special Inspections as specified in Part 4, TESTING AND SPECIAL INSPECTIONS of this Section and as noted on the Drawings.

1.4 SUBMITTALS

A. Refer to Section 013300, SUBMITTAL PROCEDURES.

B. The Contractor shall submit copies of the manufacturer's data with the application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, bonding and patching compounds, joint systems, curing compounds, floor hardeners, grout, and others as requested by the Engineer.

C. A placement schedule shall be prepared by the Contractor and submitted to the Engineer for review prior to the start of concrete placement operations. Include information on time between adjacent pours and identification of the location of each type of construction joint to be used.
1. Cold Weather Concreting Plan: Submit a plan describing cold weather placement of concrete, including concrete mix design, freeze protection, placement, and curing methods as specified in this Section. Submit plan at least 14 days prior to placing concrete.

D. The Contractor shall furnish copies of the delivery tickets for each load of concrete delivered to the site and other information as specified under ASTM C94, Certification. A specific batched quantity for each load shall be included.

E. Concrete Mix Design Proposals
1. Concrete Mix: Submit each mix design to the Engineer for review at least 14 days before first use is planned. Include substantiating test data and mix design details, including aggregate gradation and source, test results on fine and coarse aggregate Alkali-Silica Reactivity (ASR), water/cement ratio, mix proportions, air content, slump, and strength tests. Substantiating data must include tests by an independent testing laboratory within the past 3 years verifying the requirements specified under "Part 2 Article PROPORTIONING AND DESIGN OF MIXES" and "PART 4 TESTING AND SPECIAL INSPECTIONS". Submit complete information for each mix design which has different strength, different aggregate size or gradation, different proportions or is to be transported differently. For previously used mix submit copies of at least 10 tests meeting these specifications. Do not place any concrete until the mix design and substantiating data for that concrete has been reviewed.
2. Pumped Concrete: At least 14 days before starting work, submit details of proposed pumping operation, equipment to be used, and any required adjustments to mix designs. Do not pump concrete if Engineer feels an

unsatisfactory concrete may result from the overall planned process and equipment.

F. To demonstrate their capabilities and experience, provide qualification data for Contractor's proposed independent testing agency that will provide the concrete mix design, trial mix batch mixtures, and initial mix design testing services.

G. Water-Holding Basin Repair Methods: As necessary if water holding basins fail tests or if damp spots or observed seepage is present as specified. Cracks shall be repaired by the epoxy or hydrophobic grout injection process. Submit crack injection data and procedures to Engineer for review. Crack repair personnel shall have a minimum of 5 years licensed and documented experience. Submit documentation of certification and past project experience including project name, location, type and amount of repair work completed, and contact name.

H. Crack Repair Report: Epoxy or hydrophobic grout injection materials manufacturer certification that crack repair was performed by a licensed and certified applicator per the manufacturer's recommendations.

I. Submit all reports resulting from testing and special inspections as specified herein and on the Drawings.

PART 2 - PRODUCTS

2.1 PROPORTIONING AND DESIGN OF MIXES

A. The following mix properties are required for all concrete placement within forms:

1. Proportion and design of concrete mix shall meet the following requirements:

Strength at 7 days	2400 psi minimum
Strength at 28 days	Per Drawings
Maximum water/cement ratio	Per Drawings
Slump at point of placement	
Without superplasticizer	3-5 inches
With superplasticizer	5-10 inches
Minimum Cement Content	6 sacks per cubic yard or 564 pounds per cubic yard
Entrained Air	Per Drawings 2-3% interior slabs trowel finished
Maximum Aggregate Size	¾-inch, as defined below, unless shown otherwise on the Drawings.

2. Design shall be by an approved independent concrete mix and testing laboratory and a trial mix batch shall be made and tested by that laboratory. Average strength of cylinders in trial batch must exceed specified strength by 15 percent.
3. A previously used mix design may be used provided aggregate source is the same, the mixing equipment is the same, and provided at least 10 tests were made by an independent laboratory with results meeting these specifications.
4. If any of the first three 7-day cylinder tests fail to meet the specified 7-day strength, the mix shall be modified for more strength. Submit modified mix for review before use.
5. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the Owner. Test data for

revised mix designs and strength results must be submitted and accepted before using the mix adjustments.

6. Entrained Air: Air-entraining admixture shall be used unless otherwise shown or specified. Air-entraining admixture shall be added at the manufacturer's prescribed rate to result in concrete at the point of placement with an air content as specified herein (volume basis).
7. Concrete shall be mixed in conformance with ASTM C94.

B. Entrained air admixtures shall be used according to the manufacturer's prescribed rate. Test in accordance with ASTM C231.

C. The use of an accelerating agent is not permitted unless specifically authorized by the Engineer.

D. Combined Aggregate Grading Limits:
1. Aggregate size shall be 3/4-inch maximum for slabs, beams, columns, walls and footings.
2. Aggregate size shall be 3/4-inch maximum for structures with textured surfaces.
3. Grading limits for coarse aggregate shall be as follows:

Sieve Size	Percentage Passing	
	1-inch Max.	¾-inch Max.
2-inch	--	--
1-1/2-inch	-100	--
1-inch	95-100	-100
¾-inch	--	90-100
½-inch	25-60	--
3/8-inch	--	40-90
No. 4	0-10	5-20
No. 8	0-5	0-5

4. Grading limits for fine aggregate shall be as follows:

Sieve Size	Percentage Passing
3/8-inch	-100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10
No. 200	0-4

5. The combined mixture of fine and coarse aggregate shall be such that not more than 1.5 percent passes the No. 200 sieve.

2.2 PORTLAND CEMENT

A. Meet ASTM C150, Type I or Type II, or Type I-II (sulfate resistant) cement.

B. Non-Hydraulic Above-grade Structures: Use either Type I or Type II cement.

C. Hydraulic and Below-grade Structures: Use Type I-II (sulfate resistant) or cement.

2.3 AGGREGATES

A. Fine: Clean, sharp, natural sand, ASTM C33. Fineness modulus shall not be less than 2.5 nor more than 3.0. Materials passing 200 sieve shall be 4 percent maximum.

B. Coarse: Crushed stone or gravel, ASTM C33. Maximum size of coarse aggregate shall be ¾-inch as defined hereinbefore, unless otherwise indicated on the Drawings. Materials passing 200 sieve shall be 0.5 percent maximum.

C. Aggregates shall be natural, free from deleterious coatings, meeting ASTM C33, nonreactive. Thoroughly and uniformly wash before use. Reactivity must be determined by testing in accordance with ASTM C1293 and categorized in accordance with ASTM C1778. Tests done within the previous 12 months are acceptable. In accordance with ASTM C33, Appendix XI, paragraph X1.1, evidence of reactive problems on existing structures may be used to prove sources of aggregates are reactive and are unsuitable for use in the work. Import nonreactive aggregates if local aggregates are reactive.

D. Aggregate soundness testing for fine and coarse aggregates shall be in accordance with ASTM C88 using a sodium sulfate solution.

E. Local aggregates not in compliance with the soundness and durability requirements of this standard shall not be used except with prior written approval of the Engineer and provided it can be shown by special testing or a record of past performance that these aggregates produce concrete of adequate strength and durability.

2.4 WATER

A. All water for concrete mixtures shall be clean, potable, and free from injurious substances and conforming to ASTM C94 and ASTM C1602. Water containing 2 percent or more common salt shall not be used and chloride levels shall be less than 500 parts per million.

2.5 AIR ENTRAINING ADMIXTURES

A. Air entraining admixtures shall be used in all concrete exposed to the weather and as specified for quality of concrete used, ASTM C260, except that admixture shall be non-toxic after 30 days and contain no chlorides or other chemicals causing corrosion. Do not use air entraining admixtures on interior slabs on grade to receive smooth trowel finish and/or surface hardener.
   1. MasterAir AE 200 by BASF/Master Builders Solutions.
   2. Sika AIR-260 by Sika Corporation.
   3. EUCON Air Mix 200 by Euclid Chemical Company..
   4. Or equal.

B. Must be compatible with water-reducing admixture. Concrete with air-entrainment admixture added shall maintain air percentage as batched, within 2 percent for minimum time required for placement into the structure.

2.6 WATER-REDUCING ADMIXTURES

A. Water-reducing admixtures shall conform to ASTM C494, Type A or Type D.

B. Complex, multi-component, non-chloride, non-corrosive admixture providing unique performance qualities unobtainable from conventional water-reducing admixtures.

C. Manufacturer and Product:
1. BASF/Master Builders Solutions Master Pozzolith 200, 210, or 322.
2. W.R. Grace and Company Daracem 19.
3. Euclid Chemical Company EUCON NW.
4. Or equal.

D. Must be compatible with air entraining admixture.

2.7 SUPERPLASTICIZERS

A. Meet ASTM C494 and use only Type F or G, of second or third generation type, or ASTM C1017, Type I.

B. Hold slump of 5 inches or greater for the time required for placement into the structure, or 2 hours minimum.

C. Type F Superplasticizer: Batch plant added to extend plasticity time, control temperature of fresh concrete, reduce water 20 to 30 percent, and give higher strengths at all ages.

D. Type G Superplasticizer: Batch plant added to extend plasticity time, maintain setting characteristics similar to normal concrete throughout its recommended dosage range and at varying concrete temperatures, reduce water 30 to 40 percent, and give high-early and ultimate strengths.

E. Superplasticizers for Hot Weather Placements:
1. A synthesized sulfonated complex polymer type superplasticizer containing no chlorides, other corrosive chemicals, or alkalines.
2. Add to concrete mix at manufacturer’s recommended dosage to allow placement with concrete temperatures up to 90 degrees F.

F. Manufacturer and Product:
1. BASF/Master Builders Solutions Master Rheobuild 1000.
2. W.R. Grace and Company Daracem 19.
3. Euclid Chemical Company EUCON SP or 537.
4. Or equal.

2.8 FREEZE PROTECTION ADMIXTURE

A. ASTM C494 Type E admixture, non-chloride, specially formulated to provide protection from freezing down to 20 degrees F (-7 degrees C) until initial set has been reached and surface has been sealed.

B. Manufacturer and Product:
1. BASF/Master Builders Solutions MasterSet FP 20.
2. Euclid Chemical Company ACCELGUARD AcN 200.
3. Or equal.

C. Use is Contractor's option. If used, full responsibility for providing concrete meeting this Specification rests with the Contractor, including replacement of defective concrete and delayed costs.

2.9 CALCIUM CHLORIDE

A. Calcium chloride and products containing more than 0.1 percent chloride ions are not permitted. Provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.

2.10 CONCRETE CURING MATERIALS

A. Do not use curing compound where additional finishes such as hardeners, paintings, and other special coatings are required. Use water curing as specified instead. Water shall be potable and not detrimental to concrete.

B. Absorptive cover shall be provided by burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard and complying with AASHTO M182, Class 2 or ASTM C171, Type C.

C. A moisture retaining cover shall comply with one of the following:
   1. Waterproof paper, ASTM C171, Type D.
   2. Polyethylene film, ASTM C171, Type E.
   3. Curing Compound: Resin based compound conforming to ASTM C309, with additional requirement that the moisture loss shall not exceed 0.030 gm/square cm/72 hours. Use Type 1 (clear without dye) for concrete not exposed to sunlight, Type 1D (clear with fugitive dye) for concrete exposed to sunlight, and Type 2 (white pigmented) for hot weather concreting. Curing compound shall be VOC compliant with a maximum VOC content of 2.90 pounds per gallon (350 grams per liter), or less where the project location regulations are more stringent.

D. Manufacturer's certification shall state that curing compound can be applied in one coat and shall show the quantity or coverage required to meet or exceed that above moisture retention.

E. Provide manufacturer's certification that curing compound is acceptable to the appropriate state agency or health department.

2.11 CRACK REPAIR MATERIALS

A. Two-component epoxy resin injection; conforming to ASTM C881, Types I, II, and IV, Grade 1 or 3, and Class B or C; and AASHTO M235. Epoxy crack repair material shall be Sikadur 35, Hi-Mod LV, by Sika Corporation; BASF/Master Builders Solutions MasterInject 1380; or equal.

B. In special applications, an expanding polyurethane chemical hydrophobic grout such as Sika Fix HH by Sika Corporation, or approved equivalent may also be considered.

2.12 NON-SHRINK GROUT

A. Non-shrink Grout Category I:
   1. Non-shrink, non-metallic, non-gas liberating grout for use in filling tie holes in concrete, blockouts for gate guides, joints of precast components or members, and grouting baseplates of columns that do not exceed one story in height shall be one of the following:
      a. L&M Crystex by Laticrete International.
      b. NS Grout or Dry Pack Grout by Euclid Chemical Company.

c. MasterFlow 110AN by BASF/Master Builders Solutions.
d. Sika Grout 328 by Sika Corporation.
e. Or equal.

2. All grout shall be a fluid consistency in use except that for formwork tie holes the grout shall be dry pack consistency and shall fill the conical section with dense grout hammered in with steel tool and steel hammer. Grout shall meet all requirements of ASTM C1107 and Corps of Engineers CRD-C261 and have a fluid grout minimum compressive strength of 5,000 psi at 7 days and 6,800 psi at 28 days.
3. Use Category II grouts for patching defects in walls and slabs after form removal.
4. No material other than water shall be added to the premixed grout at the jobsite. Follow manufacturer's instructions relative to mixing, placing, and curing.

B. Non-shrink Grout Category II:
1. Non-shrink grout with natural aggregate for use in high strength, precision support of machine bases of 25 horsepower or less; bases for precast wall sections, columns, and precast members more than one story in height; and patching defects in walls and slabs after form removal shall conform to the Corps of Engineers' Specification for Non-Shrink Grout, CRD-C621, ASTM C1107, and to these specifications. Fluid grout as determined by the flow cone, CRD-C611, shall have a minimum strength of 5,000 psi at 7 days and 7,000 psi at 28 days. The following listed grouts are acceptable for use as Category II grout (field test requirement shall be met):
a. HI-FLOW Grout by Euclid Chemical Company.
b. MasterFlow 713, by BASF/Master Builders Solutions.
c. SIKA Grout 328 by Sika Corporation.
d. Or equal.
2. No material other than water shall be added to the premixed grout at the jobsite. Follow manufacturer's instructions relative to mixing, placing, and curing.

C. Non-shrink Grout Category III:
1. Non-shrink grout for use in high strength, precision support of machine bases for machinery of 30 horsepower or greater and soleplates where very large loads and stresses from vibration and other dynamic loads are involved and when the equipment will be subject to thermal movements. Grout shall conform to the Corps of Engineers' Specification for Non-Shrink Grout, CRD-C621, ASTM C1107, and to these specifications. The following grouts are acceptable for use as Category III grout (field test requirements shall be met):
a. MasterFlow 885 by BASF/ Master Builders Solutions.
b. HI-FLOW METALLIC grout by Euclid Chemical Company.
c. SIKA Grout 428-FS by Sika Corporation.
d. Or equal.
2. The location for use, other than that specified above, shall be as shown on the Drawings and/or as specified hereinafter.
3. The grout shall be free of gas-producing or gas-releasing agents, free of oxidizing catalysts, free of inorganic accelerators, and free of chlorides. Provide performance characteristics when mixed to fluid consistency, 22 to 25 seconds (flow cone method, CRD-C611) as follows:
a. When mixed and maintained at 45 degrees F (7 degrees C) or higher, no visible bleeding and/or settlement up to 2 hours on 1/2 gallon grout poured

into gallon can, covered with glass plate to prevent evaporation.

b. Grout shall be cured in accordance with grout manufacturer's instructions.

c. Provide (2-inch by 2-inch cube) strengths as specified. Prepare specimens and test in accordance with ASTM C109 except as follows: Mix grout in accordance with manufacturer's instructions. Fill molds in two layers, puddling each layer gently with gloved finger five times; strike off excess grout; wipe edges of mold clean with rag and cover with steel plate clamped to mold until time to test. Seal cover 24 hours after placement.

4. The grout shall obtain a minimum compressive cube strength of 5,000 psi at 3 days and 9,000 psi at 28 days.

5. No material other than water shall be added to the premixed grout at the jobsite. Follow manufacturer's instructions relative to mixing, placing, and curing.

2.13 SURFACE (FLOOR) HARDENERS AND SEALERS

A. Surface hardeners shall consist of a colorless (natural) aqueous solution of sodium silicate and magnesium and zinc flurosilicates suitable for application to cured or partially cured concrete surfaces and capable of reacting with the soluble calcium compounds present in the concrete to form a thin surface of increased hardness with reduced potential for dusting.

B. Approved proprietary hardeners include:
1. MasterKure HD 300WB by BASF/Master Builders Solutions.
2. Hornolith by Tamms Industries.
3. MED-CURE by W.R. Meadows Incorporated.
4. Or equal.

C. The solution shall be delivered ready for use at the job site.

D. Sealers shall be a water based concrete penetrating type with a low (less than 100 grams per liter, less water and less exempt compounds) VOC content. Acceptable products include INTRAGUARD by W.R. Meadows Incorporated; MasterProtect H400 by BASF/Master Builders Solutions; or equal. Submit manufacturer’s instructions for placement of sealers.

2.14 EPOXY BONDING AGENT

A. Two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class", to suit project requirements. Meet the requirements of ASTM C881, Type I, II, IV, or V.

B. Products: Subject to compliance with specific project requirements, provide one of the following:
1. Sikadur-32 Hi-Mod by Sika Corporation.
2. Dural 452 MV or Euco 452 by Euclid Chemical Company.
3. CRACKBOND 2100 MV and MV-LPL by Adhesives Technology Corporation.
4. Or equal.

PART 3 - EXECUTION

3.1 CONCRETE MIXING

A. The materials for concrete shall be mixed at an acceptable and established concrete batch plant. Meet ACI 304 current edition, ASTM C94, ACI 301, ACI 302, and other requirements as specified for mix design, testing, and quality control. Each concrete

truck delivering concrete to the site shall deliver a copy of the batch ticket to the Contractor and the Engineer. The delivery ticket shall be noted with amount of additional water that can be added to the full load while still maintaining the mix design maximum water/cement ratio and submitted to the Engineer. Prorated amounts of water shall not be added to the remaining load after discharge has begun.

B. Ready-mix or portable temporary batch plant concrete shall comply with the requirements of ASTM C94, ACI 301, ACI 302.1R, ACI 304R, and as herein specified:
   1. Use of a portable temporary batch plant shall be only as approved by Engineer. Submit data on portable temporary batch unit to demonstrate conformance with referenced standards and these specifications.
   2. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures.
   3. The addition of water to the mix at project site must be approved by the Engineer and the maximum water-cement ratio shall not be exceeded.
   4. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates.
   5. Concrete shall be discharged at the job within 1-1/2 hours after water has been added to the cement and aggregates or cement batched with the aggregates, unless a longer time is specifically authorized by the Engineer.
   6. During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required:
      a. When the air temperature is between 85 degrees Fahrenheit and 90 degrees Fahrenheit, the mixing and delivery time shall be reduced from a maximum of 1-1/2 hours to 75 minutes and when the air temperature is above 90 degrees Fahrenheit, the mixing and delivery time shall be reduced to no more than 60 minutes.
   7. Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of off-site as directed.

C. Truck Mixers:
   1. Equip with electrically actuated counters to readily verify the number of revolutions of the drum or blades.
   2. Counter:
      a. Resettable, recording type, mounted in driver's cab.
      b. Actuated at time of starting mixers at mixing speeds.
   3. Performance Requirements:
      a. Truck mixer operation shall provide a concrete batch as discharged within acceptable limits of uniformity with respect to consistency, mix and grading.
      b. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when specified slump is 3 inches or less, or differing by more than 2 inches when specified slump is more than 3 inches, discontinue use of truck mixer unless causing condition is corrected and satisfactory performance is verified by additional slump tests.
      c. Check mechanical details of mixer, such as water measuring, and discharge apparatus, condition of blades, speed of rotation, general

mechanical condition of unit, and clearance of drum before attempting to reuse unit.

4. Do not use non-agitating or combination truck and trailer equipment for transporting ready-mixed concrete.

D. Mixing Process:
   1. Concrete Volume in Truck:
      a. Limit to 63 percent of total volume capacity per ASTM C94 when truck mixed.
      b. Limit to 80 percent of total volume capacity when central mixed.
   2. Mix each batch of concrete in truck mixer for minimum 70 revolutions of drum or blades at rate of rotation designated by equipment manufacturer as mixing speed.
   3. Perform additional mixing, if required, at speed designated by equipment manufacturer as agitating speed.
   4. Place materials, including mixing water, in mixer drum before actuating the revolution counter for determining the number of mixing revolutions.

E. Superplasticizers and Air Admixtures: Add at concrete plant only through equipment furnished and/or approved by admixture manufacturer. Equipment shall provide for easy and quick visual verification of admixture amount used for each dose. Discharge amount to be added to each load of concrete into separate dispensing container, measured verified as to amount, then add to concrete. Re-dosing of concrete in the field.is not permitted, unless specifically approved by the Engineer.

3.2 PREPARATION

A. Pre-Placement Inspection:
   1. Before placing concrete, the Contractor will inspect and complete the formwork installation, placement of reinforcing steel, and items to be embedded or cast-in. Reinforcing shall not be stabbed into freshly placed concrete.
   2. The wood forms shall be wetted immediately before placing the concrete when form coatings are not used. Dampen subgrade before placing concrete for slabs on grade unless a vapor barrier is used.
   3. The installation of joint materials shall be coordinated with the placement of forms and reinforcing steel.
   4. Secure reinforcement in position and allow Engineer to review acceptability before placing concrete.

B. Sleeves, Anchors and Inserts: All sleeves, anchors, and inserts required shall be properly placed, as detailed in the Drawings, in the concrete formwork and securely anchored to prevent displacement during the placing of the concrete.

C. Contractor shall protect formwork overnight, and at other times as required, when adverse weather is forecasted to prevent snow or water from building up in forms or frost from depositing on forms or reinforcing steel.

3.3 CONCRETE PLACEMENT

A. Concrete shall be placed in compliance with the practices and recommendations of ACI Standards 301, 304, 318, and 614, and as herein specified:
   1. Concrete shall be placed continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. The placement of

concrete shall be done at such a rate that concrete is still workable. Concrete shall be placed as near as practicable to its final location to prevent segregation due to re-handling or flowing. Do not subject concrete to any procedure which will cause segregation.

2. For flat work and slabs, concrete shall not be allowed to fall freely more than five feet. In no case shall concrete be allowed to freely drop more than eight feet, or as specified hereinafter for super plasticized concrete.
3. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.
4. Concrete which has become non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign material shall not be used. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of it at an approved location.
5. Concrete discharge time shall be less than 90 minutes after adding cement to water and aggregate.

B. Placing Concrete into Forms:
1. Concrete shall be placed in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined or unplanned cold construction joints. Where placement consists of several layers, place each layer while the preceding layer is still workable to avoid cold joints.
2. Temporary spreaders in forms shall be removed when concrete placement has reached the elevation of such spreaders.
3. Concrete placed in forms shall be consolidated by mechanical vibrating equipment, capable of reaching all extents of the formwork, supplemented by hand-spading, rodding, and tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.
4. Vibrators shall not be used to transport concrete inside of the forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of the vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix. Generally, this will be from 5 to 15 seconds in accordance with ACI 301.
5. Allowable Vertical Free Fall Drop to Final Placement:
   a. 5-feet in forms 8-inch or less wide and 8 feet in forms wider than 8 inches, except as hereinafter specified.
   b. Super-plasticized Mixes: Up to 15 feet of slump is over 6 inches.
6. Do not use aluminum pipe or other aluminum conveying devices.
7. Provide sufficient illumination for interior of forms so concrete at places of deposit is visible to permit confirmation of consolidation quality.

C. Conveyor Belts and Chutes:
1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system such that concrete passing from them will not become segregated.

2. Do not use chutes longer than 50 feet.
3. Minimum Slopes of Chutes: Angled to allow concrete of specified consistency to readily flow without segregation.
4. Conveyor Belts:
    a. Approved by Engineer.
    b. Wipe clean with a device which does not allow mortar adhering to the belt to be wasted.
    c. Cover conveyor belts and chutes.

D. Re-tempering: For concrete or mortar in which cement has partially hydrated, re-tempering is not permitted.

E. Pumping of Concrete:
1. General:
    a. Pumping is the preferred method of placing concrete.
    b. If pumped concrete does not produce satisfactory end results, discontinue pumping operation until the problem is corrected.
    c. At Contractor's option, other approved methods of placement may be used.
2. Equipment:
    a. Provide standby pump, conveyor system, crane and concrete bucket, or other system acceptable to Engineer, on site during pumping, for adequate redundancy to assure completion of concrete placement without cold joints in case of a primary placing equipment breakdown.
    b. Minimum Pump Hose (Conduit) Diameter: 4 inches.
    c. Replace pumping equipment and hoses (conduits) that are not functioning properly.
    d. Do not use aluminum conduits for conveying concrete.
3. Field Control (For Pumped Concrete): Concrete samples will be taken for slump (ASTM C143) and test cylinders (ASTM C31 and C39) including air content and shrinkage specimens (ASTM C157) at placement (discharge) end of line, unless approved otherwise by the Engineer.

F. Maximum Size of Concrete Placements:
1. Limit size of each pour regardless whether slabs or walls, to allow for strength gain and some volume change due to shrinkage to take place. Size shall be as specified hereinafter.
2. Expansion and Construction Joints:
    a. Unless otherwise shown, where expansion or construction joints are shown at approximately 60 to 70 feet spacing, intermediate construction joints are not required.
    b. Where expansion or construction joints are not shown or where expansion or construction joints are spaced at larger distances than 70 feet, provide intermediate construction joints at maximum 40 feet unless approved otherwise in writing.
    c. Locate joints, where not otherwise shown, as detailed on approved shop drawings.
    d. Alternate pours at each side of expansion or construction joints with 10 days minimum curing time between pours.

G. Removal of Water: Remove all water from space to be occupied by concrete.

H. Consolidation and Visual Observation:
   1. Consolidate concrete with internal vibrators with minimum frequency of 8,000 vpm and amplitude required to consolidate concrete in section being placed.
   2. Provide at least one standby vibrator in operable condition at placement site prior to placing concrete.
   3. Consolidation equipment and methods shall meet ACI 309.
   4. Provide sufficient windows in the forms or limit form height to allow visual observation of concrete.
   5. Vibrator operator shall be required to see concrete being consolidated to ensure good quality workmanship, or an individual shall actually observe the vibration of concrete at all times and advise vibrator operator of any changes needed to ensure complete consolidation.
   6. Consolidation and placement locations shall be planned and accomplished so that vibrators shall be inserted in the concrete as it is placed and in locations not to exceed a distance of 5 feet from point of placement.

I. Placing Concrete Slabs on Grade:
   1. Prior to concrete placing, any area of subgrade on which concrete is to be placed shall be properly wetted. Concrete slabs shall be placed in a continuous operation, within the limits of construction joints, until the placement of a panel or section is completed. When in-place concrete has sufficiently set up (at least 24 to 36 hours), an alternate section shall be placed. All joints between sections shall be properly keyed. The edges of all sections shall be tooled with a minimum radius or chamfer edging tool.
   2. Concrete shall be consolidated during placement operations using vibrating equipment, so that the concrete is thoroughly worked around reinforcement and other embedded items and into the corners.
   3. Slab surfaces shall be brought up to the correct level with a straightedge and struck off. Bull floats or darbies may be used to smooth the surface, leaving it free from humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
   4. Control Joints for Non-Water Holding Slabs on Grade:
      a. Locate as shown on the Drawings. Where not indicated, locate at 15 foot maximum intervals in both directions.
      b. Construct with a manufactured, embedded, preformed control joint form or stop pour at each control joint using keyway forms. Install form with no offsets and in straight lines as specified elsewhere.
   5. Reinforcing steel shall be continuously maintained in the proper position during concrete placement operations.
   6. All exterior concrete slabs shall be sloped in a manner to prevent the collection of water.

J. Bonding:
   1. Surfaces of set concrete at all joints shall be roughened, except where bonding is obtained by use of an approved concrete bonding agent, and the surfaces shall be cleaned of laitance coating, loose particles, and foreign matter. Surfaces shall be roughened in a manner to expose bonded aggregate uniformly and laitance, loose particles of aggregates, or damaged concrete at the surface shall be removed.

2. Bonding of fresh concrete to new concrete that has set, but is less than 60 days old or is not fully cured shall be done as follows:
    a. At joints between a footing and walls or columns, and between walls or columns and beams or slabs that they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing the fresh concrete.
    b. At horizontal joints in exposed work, and at joints designed to contain liquids, dampen, but do not saturate, the roughened and cleaned surface of set concrete and apply a minimum 2-inch layer of neat cement grout.
    c. Neat cement grout as specified hereinbefore shall be applied to a minimum thickness of 2 inches and a maximum of 3 inches. Fresh concrete shall be placed before the cement grout has attained its initial set. Limit concrete lift placed immediately on top of grout to 12 inches.
    d. In all cases, neat cement grout shall be used for all construction and expansion joints of water holding structures.
    e. An approved commercial bonding agent may be used in lieu of neat cement grout for non-water holding structures. The agent shall be applied to cleaned concrete surfaces in accordance with the printed instruction of the bonding agent manufacturer.
3. Epoxy bonding agent shall be applied in accordance with the manufacturer's recommendations for bonding to old concrete (more than 60 days old). Coat contact surfaces with bonding agent after mechanically roughening surface to a clean, rough surface.

K. Cold Weather Placing:
1. All concrete work, including concrete finishes, shall be protected from physical damage or reduced strength which could be caused by freezing or low temperatures, in compliance with the requirements of ACI 306 and ACI 318 and as herein specified.
2. Contractor shall protect formwork overnight, and at other times as required, when adverse weather is forecasted to prevent snow from building up in forms or frost from depositing on forms or reinforcing steel.
3. When the temperature of the surrounding air is expected to be below 40 degrees Fahrenheit during concrete placement or within 3 days (72 hours) thereafter, the temperature of the placed concrete shall be maintained at temperatures no lower than 60 degrees Fahrenheit for sections less than 12 inches in any dimension or 55 degrees for any other section. Heated water and/or aggregate shall be used in accordance with ACI 306.
    a. The placed concrete temperature shall be maintained at or above the specified temperatures for curing for at least 7 days.
4. Frozen concrete materials containing ice or snow shall not be used. Concrete shall not be placed on frozen subgrade or on subgrade containing frozen materials. The Contractor shall determine that the forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow, and ice before placing any concrete.
5. The use of calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators shall not be allowed, unless authorized in writing by the Engineer.

6. Strength requirements may require additional protection and curing during cold weather due to delayed field strength gain.
7. Determine strength, attainment, and the requirement for continue protection, from field test cylinders, cured alongside the cast concrete structure.
8. Surface Temperature:
    a. The actual temperature of concrete surface determines effectiveness of protection, regardless of air temperatures or whether the objective is durability or strength.
    b. Contractor shall provide a sufficient number of thermometers placed on concrete surfaces spaced throughout the work to allow inspection and monitoring of concrete surface temperatures representative of all the work.
9. External Heating Units:
    a. Vent heating units and do not locally heat or dry concrete.
    b. Do not exhaust flue gases directly into an enclosed area.
    c. Ensure fire safety and fire prevention measures are enforced during use of heating units.
10. Maintain curing conditions which will foster normal strength development without excessive heat, and without critical saturation of concrete at the close of the protection period.
11. Limit rapid temperature changes, particularly before strength has developed sufficiently to withstand temperature stresses.
12. At end of the required period, discontinue protection in such a manner that the drop in temperature of any portion of concrete will be gradual and will not exceed, in 24 hours, 50 degrees F.

L. Hot Weather Placing:
1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
2. The ingredients shall be cooled before mixing to maintain the concrete temperatures at the time of placement below 80 degrees Fahrenheit. Mixing water may be chilled or chopped ice may be used.
3. The use of retarding admixtures will not be allowed, unless otherwise accepted in mix designs by the Engineer.
4. The forms shall be thoroughly wetted before placement of concrete. Make provisions for windbreaks, shading, fog sprays, sprinkling, or wet cover, when necessary.
5. Reflective Cracking:
    a. Prevent reflective cracking due to differential temperatures between concrete and reinforcing steel.
    b. If reinforcement is in direct sunlight or is more than 20 degrees F higher in temperature than concrete temperature before placement, wet reinforcement to cool it with water fog spray 10 minutes before placing concrete. Alternatively, reinforcing steel may be covered with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
    c. Verify temperature of reinforcing is not more than 20 degrees F higher than fresh concrete.

3.4 JOINTS

A. Construction Joints: Construction joints shall be located and installed as shown on the Drawings in a manner that will not impair the strength and appearance of the structure. Construction joints, if not shown, shall be located only with approval of the Engineer to meet the requirements on Part 3 Article, Maximum Size of Concrete Placements, and as follows:
   1. The Contractor shall provide key-ways at least 1 ½-inch deep in all construction joints in walls, slabs, and between walls and footings of non-water holding structures. Joints for water holding structures shall be provided with a waterstop as shown on the Drawings.
   2. Construction joints shall be placed perpendicular to the main reinforcement and all reinforcement shall continue across construction joints.
   3. Construction joints shall be prepared as specified in ACI Standard 318, and as shown on the Drawings.

B. Expansion Joints: Expansion joints shall be located and installed as shown on the Drawings. Expansion joints shall be held down to receive the joint sealant. The horizontal and vertical waterstop shall be welded together to provide a continuous watertight seal.

C. For bonding to new concrete horizontal construction joints, roughen the surface of the hardened concrete. Thoroughly clean and saturate with water, cover the horizontal surfaces only with two to three inches of neat cement grout, as hereinbefore specified, and immediately place concrete. New concrete is defined as less than 60 days old. Limit the concrete lift placed immediately on top of the grout to 12-inches thick and thoroughly vibrate to mix and consolidate the grout and concrete together.

3.5 FINISH OF FORMED SURFACES

A. Rough Form Finish:
   1. This finish shall include formed concrete surfaces buried from view by backfill in the finish work or covered by other construction, unless otherwise shown or specified. Any surface which will be exposed to the air or water in the completed structure shall be a smooth form finish.
   2. The standard rough form finish shall leave the concrete surface with the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding ¼-inch in height rubbed down or chipped off.
   3. Fill snap-tie holes with non-shrink, non-metallic grout as specified herein. Patch honeycomb areas and rock pockets with grout as specified herein. Small air holes do not require patching.

B. Smooth Form Finish (Trowel Finish):
   1. This finish includes formed concrete surfaces which will be exposed to the air or water in the completed structure or to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete, such as water proofing, damp-proofing, painting, or other similar system.
   2. A smooth form finish shall be provided by selecting form materials that will impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. All defective areas shall be patched and repaired with all fins or other projections completely removed and smoothed.

3. For smooth form finish walls:
   a. Fill snap-tie holes with approved non-shrink, non-metallic color matched grout as specified herein.
   b. Grind off projections, fins, and rough spots.
   c. Repair other defects such as honeycomb areas, rock pockets, and rough spots resulting from form release agent failure or other reason with color matched non-shrink grout as specified herein.
4. For smooth form trowel finish slabs:
   a. Concrete floor finishing shall comply with ACI 301 and ACI 302.
   b. Finish by screeding and floating with straight-edges to bring surface to required finish elevation shown.
   c. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
   d. Use sufficient pressure on wood floats to bring moisture to surface.
   e. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
   f. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
   g. Do not use dry cement or additional water during troweling. No excessive troweling will be permitted.
   h. Power Finishing:
      1. An approved power machine may be used in lieu of hand finishing for finishing concrete floors and slabs in accordance with directions of machine manufacturer.
      2. Do not use power machine when concrete has not attained the necessary set to allow finishing without introducing high and low spots in slab.
      3. Do steel troweling for slab by hand first.

C. Grout Cleaned Finish (Sacked Rubbed Finish):
   1. A grout cleaned finish will be applied to all concrete surfaces as specified hereinafter, or which have received smooth form finish treatment, and are exposed to view. Surfaces exposed to water or on the inside of structures below the typical water surface level require a smooth form finish, but do not require a grout cleaned finish.
   2. The grout cleaned finish will use one part portland cement to 1-1/2 parts fine sand by volume, and shall be mixed with water to a consistency of thick paint. Proprietary additives may be used at the Contractor's option. Standard Portland cement and white Portland cement amounts shall be blended as determined by trial patches, so that final color of dry grout will match adjacent surfaces.
   3. The concrete surfaces shall be thoroughly wetted before the application of grout to the surfaces and to fill small holes. Excess grout will be removed by scraping and rubbing with clean burlap.

D. Broomed Finish:
   1. Finish as specified for smooth form trowel floor finish, except omit final troweling and finish surface by drawing a fine-hair broom lightly across the surface.

2. Brooming: In same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

E. Sidewalk Finish:
1. Slope walks down ¼-inch per foot away from structures, unless otherwise shown.
2. Strike off surface by means of strike board and float with wood or cork float to a true plane, then flat steel trowel before brooming.
3. Broom surface at right angles to direction of traffic.
4. Lay out sidewalk surfaces in sections with an approved grooving tool as shown on the Drawings, at the same interval as the walk width, or as directed by Engineer.

F. A 3/4-inch chamfer shall be provided at the top of all exposed walls, except where support angles are installed, and at exposed vertical corners.

G. In addition to the description of various finishes above, concrete surfaces shall be finished in accordance with ACI Standards 301 and 302 as scheduled below:

Surface	**Finish**
Interior Slabs	Smooth Trowel Finish
Exterior Slabs	Broom Finish
Exterior Concrete Above Final Grade	Grout Cleaned Sacked Rubbed Finish
Interior Walls of Water Basins Below Low Water Level; Exposed Interior Walls, Columns, Beams and Ceilings	Smooth Finish
Exterior Concrete Below Final Grade	Rough Finish, Correct Defective Areas including Stone Pocket and Fill Tie Holes
Sidewalks	Sidewalk Finish

3.6 CONCRETE CURING AND PROTECTION

A. General:
1. Freshly placed concrete shall be protected from premature drying and excessive cold or hot temperature, and maintained without drying at a relatively constant temperature for the 7 day period of time necessary for the proper hydration of the cement. Concrete damaged by improper curing or placement methods shall be replaced by the Contractor at no additional expense to the Owner.

2. Curing procedures shall begin immediately after placement of the concrete and continue for at least seven days or until concrete has attained 75 percent of its compressive strength in accordance with ACI 308.

B. Curing Method:
   1. Liquid membrane curing shall be provided as follows:
      a. The Contractor shall use a commercially produced liquid membrane forming curing compound for curing concrete which meets the requirements of ASTM C309. Use proper Type for conditions in the field.
      b. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a 2-coat continuous operation by power spray equipment in accordance with the manufacturer's directions, and with second coat applied at right angles to the first. Recoat all areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair any damage to the coat during the entire 7 day curing period.
      c. Membrane compounds shall not be used on surfaces which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, water-proofing, damp-proofing, flooring, paintings, and other coatings and finish materials.
   2. Use approved water curing method where membrane compounds are not allowed.
   3. For walls, use one of the following curing methods:
      a. Method 1: Leave concrete forms in place and keep entire exposed surfaces wet at all times.
      b. Method 2: Apply specified curing compound as specified, where allowed, immediately after removal of forms. Apply curing compound in two coats. Each coat shall be applied at the manufacturers recommended rate for one coat application.
      c. Method 3: Continuously sprinkle 100 percent of all exposed surfaces.
   4. For slabs, curbs, and sidewalks use one of the following curing methods:
      a. Method 1: Protect surface by ponding.
      b. Method 2: Cover with burlap or cotton mats and keep continuously wet.
      c. Method 3: Continuously sprinkle exposed surface.
      d. Other agreed upon method that will provide moisture to be present and uniform at all times on all surface of slabs.

C. Unformed surfaces shall be cured after finishing operations have been completed and as soon as marring of the concrete will not occur. The curing procedures shall continue for 7 days or until the concrete has attained 70 percent of its compressive strength in accordance with ACI 308.

D. Temperature of Concrete During Curing:
   1. When the atmospheric temperature is 40 degrees Fahrenheit and below, the concrete temperature shall be maintained between 50 and 70 degrees Fahrenheit continuously throughout the 7 day curing period. When necessary, the Contractor shall make arrangements before the placement of concrete for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously throughout the concrete curing period. Cold weather protections shall comply with the requirements of ACI 306.

a. Where water curing as specified herein for slabs is not possible, use an approved curing compound as herein specified at twice the manufacturer's recommended coverage per gallon.
b. Where specified curing compound cannot be used, special methods using moisture shall be agreed upon prior to pouring the concrete slabs.
c. Protect slabs during cold weather with polyethylene sheeting or other material inside required heated enclosure if foot traffic is permitted on slabs.

2. When the atmospheric temperature is 80 degrees Fahrenheit and above, or during other climatic conditions which will cause a rapid drying of the concrete, the Contractor shall make arrangements before the start of concrete placement for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or a moisture-retaining covering. The concrete shall be protected continuously for the 7 day concrete curing period. Hot weather concrete protection shall comply with the requirements of ACI 305.
3. The concrete temperature shall be maintained as uniformly as possible, and protected from rapid atmospheric temperature changes. Temperature changes in concrete which exceed 5 degrees Fahrenheit in any one hour and 50 degrees Fahrenheit in any 24-hour period shall be avoided and protected against.

E. During the curing period the concrete shall be protected from damaging mechanical disturbances including load stresses, excessive vibration and from damage caused by rain or flowing water. All finished concrete surfaces shall be protected from damage by subsequent construction operations. Any damage incurred shall be repaired by the Contractor at no additional expense to the Owner.

3.7 CONCRETE REPAIRS

A. Cracks in water-holding structures that are determined to have caused excessive leakage or damp spots, or if seepage is present on exposed surfaces:
1. Inject all cracks with crack repair materials as specified hereinbefore. Crack repairs shall be performed by a licensed applicator as specified hereinbefore and in accordance with the crack repair material manufacturer’s recommendations, unless approved otherwise. Drain structure and inject cracks from the inside of the structure. Repair of all cracks shall be by the Contractor at no extra cost to the Owner.

B. Defective surface areas shall be repaired and patched with grout as specified hereinbefore immediately after removal of forms and as directed by the Engineer. All repairs shall be made by the Contractor at no extra cost to the Owner.

C. Repair of Formed Surfaces:
1. Formed surfaces which will be exposed-to-view or air in the completed structure and contain defects which adversely affect the appearance of the finish shall be repaired. The concrete with the defective surfaces shall be removed and replaced at no additional expense to the Owner if the defects cannot be repaired to the satisfaction of the Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, and holes left by rods and bolts, fins, and other discolorations that cannot be removed by cleaning.
2. Concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete shall be repaired. If defects cannot be repaired, the

defective concrete shall be removed and replaced at no additional expense to the Owner.

D. Repair of Unformed Surfaces:
   1. Unformed surfaces such as monolithic slabs may be tested by the Engineer for smoothness and to verify that the surface planeness meets the tolerances specified for each surface and finish. Any low and high areas shall be repaired by the Contractor at no additional expense to the Owner as specified herein.
   2. Unformed surfaces that contain defects which adversely affect the durability of the concrete shall be repaired. Surface defects include crazing, cracks in excess of 0.01-inch in width or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
   3. High areas in unformed surfaces shall be repaired by grinding after the concrete has cured sufficiently so that repairs can be made without any damage to adjacent areas.
   4. Low areas in unformed surfaces shall be repaired during, or immediately after, completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. The repaired areas shall be finished to blend into adjacent concrete. Proprietary patching compounds may be used when approved by the Engineer.
   5. Defective areas, except random cracks and single holes not exceeding 1-inch diameter shall be repaired, by cutting the area out and placing fresh concrete. Defective areas shall be removed to sound concrete with clean, square cuts, and shall expose reinforcing steel with at least 3/4-inch clearance all around. Concrete surfaces in contact with patching concrete shall be dampened and brushed with a neat cement grout coating or approved epoxy adhesive, or a concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with the adjacent finished concrete. The repaired area shall be cured in the same manner as adjacent concrete.
   6. Isolated random cracks in non-water holding structures and single holes not over 1-inch in diameter shall be repaired by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete. Clean off all dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and apply by brush a neat grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact the dry-pack mixture in place and finish to match the adjacent concrete. Keep the patched areas continuously moist for not less than 72 hours.
   7. Repair methods not specified above may only be used if approved by the Engineer.

3.8 SURFACE HARDENERS AND SEALERS

A. Interior floor slabs of all new buildings shall receive an application of surface hardener as recommended by the manufacturer of the surface hardener.

B. Floors to receive hardener shall be thoroughly cured for at least 28 days, clean, unpainted, free from membrane curing compounds, and perfectly dry with all work above them completed. Apply liquid hardener evenly, using three coats, allowing 24 hours between coats, or as recommended by manufacturer.

C. Apply approved proprietary hardeners in conformance with the manufacturer's instructions. After the final coat is completed and dry, remove surplus hardener from the surface by scrubbing and mopping with water.

D. Where shown on the Drawings for new exterior or interior floors, apply concrete sealer as recommended by the sealer manufacturer.

3.9 CLEANING OF STRUCTURES

A. Clean thoroughly all interior concrete surfaces using water under pressure. The cleaning method adopted should accomplish the following: (1) remove all deposits of foreign nature; (2) remove all growths; (3) clean the slopes, walls, top, and bottom; (4) avoid damage to the structure; and (5) avoid pollution or oil deposits by workers and equipment. All water used in cleaning the concrete structures should be disposed of before allowing water or sludge to the structure.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

B. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated. Block out the original concrete or finish off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown on the Drawings. After the machinery has been set in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery base and the original pour of concrete shall be filled with a pourable non-shrinking type grout as hereinbefore specified.

3.11 REJECTIONS

A. Concrete Strength: Concrete strength shall be considered satisfactory if the average test of the two 28-day specimens exceeds the specified strength and neither specimen test falls below 95 percent of the specified strength. If the average strength of the two test specimens is less than specified and/or either specimen test is less than 95 percent of the specified strength, the concrete represented by the tests is rejected and must be removed and replaced at the Contractor's expense.

B. Alignment: Where concrete slabs or walls do not meet the alignment requirements, the Contractor must grind off irregularities until they comply. However, if such removal leaves less concrete section than indicated, the Engineer may reject concrete if they feel the remaining section would not be adequate.

C. Flatwork: Finished flatwork exceeding the tolerances of these specifications shall be repaired or replaced so that strength or appearance is not adversely affected. Follow Part 3 Article CONCRETE REPAIRS for repair work or as directed by Engineer.

D. Appearance: Concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired, if possible in accordance with Part 3 Article CONCRETE REPAIRS. If, in the opinion of the Engineer, the defects cannot be repaired to equal the specified finish, the concrete shall be rejected.

E. Misplaced Members: Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected or misplaced items interfere with other construction.

F. Rejected Concrete: Rejected concrete shall be removed and replaced. Limits of removal shall be as directed by the Engineer to accomplish a structure equal in strength, serviceability, and appearance, to that which would have been achieved by acceptable concrete.

G. Leakage Repairs: Water holding structures with any visible seepage or leakage at joints or due to cracks or other imperfections, or for any other reason does not pass leakage test defined hereinafter shall be replaced or repaired by Contractor.

H. Expense of Repairs: The cost of all repairs, removal, replacement, etc., required by the provisions of this Article shall be borne by the Contractor.

PART 4 - TESTING AND SPECIAL INSPECTIONS

4.1 GENERAL

A. Reference Structural General Notes on the Drawings with respect to testing and Special Inspections.

4.2 TESTING AGENCY/FIRMS AND COST

A. The Contractor shall provide the services of an independent Special Inspector certified by the appropriate jurisdiction to perform the types of inspections specified. Costs of Special Inspection shall be borne by the Contractor.

B. All quality assurance tests shall be made by an independent testing laboratory engaged by the Contractor. Engineer shall direct when and where all tests are made and Contractor shall coordinate all pour scheduling with independent testing firm. All inspection and test results shall be distributed to the Engineer and Contractor concurrently.

C. The Contractor shall bear all costs of initial quality control testing. Where retesting is required by this section including tests of hardened concrete where cylinder strengths indicate high or low strength concrete, the Contractor shall bear all retesting costs.

4.3 TEST RESULTS

A. One copy of all tests shall be submitted to the Engineer within 48 hours of testing.

4.4 TESTS OF AGGREGATE

A. Contractor shall provide tests of aggregate before concrete work per ASTM C33 and ASTM C1293. Tests may be waived by Engineer if aggregates to be used have shown actual use within the previous 18 months to produce concrete or required strength, durability, water-tightness, fire resistance, and wearing qualities.

4.5 STRENGTH TEST OF CYLINDERS DURING WORK

A. Independent testing firm shall provide for test purposes, sets of four or five cylinders each, taken for each 50 cubic yards or portions placed each day. For 6-inch by 12-inch cylinders, provide four cylinders and test one cylinder per set at 7 days, two at 28 days, and retain one for backup. For 4-inch by 8-inch cylinders, provide five cylinders and test one cylinder per set at 7 days, three at 28 days, and retain one for backup.

B. Evaluation will be in accordance with ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318 latest edition), and these Specifications. Where the term "building official" is used in ACI 318, term shall be redefined to "the Owner's representative".

C. Specimens will be made, cured, and tested by the independent testing firm in accordance with ASTM C31 and ASTM C39. The Engineer shall determine which concrete trucks are to be tested in any pour and shall direct the independent testing firm. Only the Engineer or the testing firm may transport specimens or cylinders from the site to the laboratory.
   1. Provide a cure box with internal temperature monitoring device at the project site for initial cure of test cylinders. Construct and equip box to provide initial cure in accordance with ASTM C31.

D. Frequency of testing may be increased at discretion of Engineer.

E. Cold Weather Placement Tests:
   1. During cold weather concreting, the independent testing firm will cast cylinders for field curing as follows. Use method which will produce greater number of specimens:
      a. Six extra test cylinders from the last 100 cubic yards of concrete.
      b. Minimum three specimens for each 2 hours of placing time or for each 100 yards.
   2. These specimens shall be in addition to those cast by the independent testing firm for lab testing.
   3. Test cylinders will be protected from the weather until they can be placed under same protection provided for the parts of the structure which they represent.
   4. Keep field test cylinders in same protective environment as the parts of the structure they represent, to determine if specified strength has been obtained and no further protection is needed.
   5. Test cylinders in accordance with applicable sections of ASTM C31 and C39.
   6. Evaluation and Acceptance: As specified herein.

F. Contractor Requested Expedited Testing: If Contractor desires additional cylinders to be tested at different times than specified hereinbefore to accelerate the schedule, this may be requested in writing to the Engineer who will coordinate this with the Independent Testing Firm. The cost of extra test cylinders and strength tests will be paid by the Contractor.

4.6 SLUMP TESTS

A. Slump tests will be taken with each strength test and as directed by the Engineer in accordance with ASTM C143.

4.7 AIR CONTENT

A. ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each strength test set.

4.8 CONCRETE TEMPERATURE

A. ASTM C1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each set of compressive strength specimens.

4.9 TEST OF HARDENED CONCRETE

A. Acceptance shall be based on concrete cylinder tests in accordance with Part 3 Article, REJECTIONS. Contractor will pay for additional test by coring per ASTM C42 or load tests for that portion of job where questionable concrete has been placed. Such additional testing will be accepted in lieu of cylinder tests. Results of rebound hammer tests will not be accepted except in defining problem areas.

4.10 WATER LEAKAGE TESTS

A. Purpose: Determine integrity of finished concrete and to show exposed wall surfaces are visually acceptable. Exposed shall mean all wall surfaces prior to backfilling, or application of any exterior coating system, and other permanently or temporarily exposed areas for all water holding structures.

B. All Water-Holding Structures:
   1. Perform water leakage tests according to ACI 350.1 and as specified hereinafter.
   2. Perform leakage tests after concrete has cured a minimum 14 days and obtained its 28-day design strength, and before backfill, application of any exterior coating system, or other work which will cover concrete wall surfaces is begun.
   3. Make other equipment, i.e., stop gates, sluice gates, valves, etc., or temporary bulkheads water-tight prior to test.
   4. As an alternative to having watertight bulkheads, gates, or valves, accurately measure the leakage through gates, valves, and bulkheads with methods acceptable to Engineer. An assumed leakage through gates and valves based on manufacturer's recommendations is not acceptable.
   5. Fill with water to maximum liquid level prior to leak testing, and maintain level for 48 hours for moisture absorption by concrete.
   6. Close all valves and gates to the structure and measure the change in water surface for a 24-hour period.
   7. During test period, examine exposed portions of structure for dampness or leaks and mark visible leaks or damp spots.

C. Test Evaluation Criteria:
   1. For water-holding structures comprised entirely of new construction, an acceptable test shall have a drop in water surface in 24-hour period with basin full less than 1/10 of 1 percent of normal volume of liquid contained in water-holding structure, after accounting for evaporation and precipitation in open basins; and damp spots or seepage are not present on walls or other areas exposed to view prior to any backfilling.
   2. Determine evaporation by floating an evaporation pan in structure during test period.

D. Excessive Leakage and Leakage Test Failure: If drop in water surface exceeds test evaluation criteria or if damp spots or seepage is visible in exposed surfaces prior to any backfilling, the leak test shall be considered as failing.

E. Repairs:
   1. If leakage is excessive, or if damp spots or observed seepage is present on exposed surfaces, drain water-holding structure, repair all leaks and damp spots previously marked, and make necessary repairs, and retest basin.
   2. Repair in accordance with these Specifications and as approved by Engineer.

F. Retest:
   1. Refill water-holding structure and test for leakage until structure meets test criteria.
   2. Successful Test: If liquid level criteria is met and damp spots and seepage problems are corrected, the retest will be considered acceptable.

G. Cost of all leakage tests, repairs, and retests shall be borne by the Contractor, at no extra cost to the Owner.

END OF SECTION

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polished concrete finishing.

1.2 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Cast-in-place concrete subcontractor.
      e. Polished concrete finishing Subcontractor.
   2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Laboratory Test Reports: For liquid floor treatments, indicating compliance with requirements for low-emitting materials.
   2. Product Data: VOC Content

C. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

D. Samples for Initial Selection: For each type of product requiring color selection.

E. Samples for Verification: For each type of exposed color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Repair materials.
   2. Liquid floor treatments.

1.6 QUALITY ASSURANCE

A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
   1. Locate panels as indicated or, if not indicated, as directed by Architect.
   2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
   3. Demolish and remove field sample panels when directed.

B. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Demonstrate curing, finishing, and protecting of polished concrete.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
   1. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 percent (1000 ppm).
   2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   3. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
   4. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, and sealants.

PART 3 - EXECUTION

3.1 POLISHING

A. Polish: Match design reference sample.

B. Surface Friction: Not less than 0.6 according to ASTM D 2047.
   1. No high gloss finish.

C. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
   1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
   2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
   3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
   4. Control and dispose of waste products produced by grinding and polishing operations.
   5. Neutralize and clean polished floor surfaces.

END OF SECTION

SECTION 035400 - CAST UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this section includes underlayment for interior finish flooring and is not limited to the following:
   1. Sound attenuating floor underlayment.

B. Related Requirements:
   1. Section 033000 "Cast-Place Concrete".
   2. Section 090561.13 "Moisture Vapor Emission Control."

1.2 REFERENCES

A. Underwriters Laboratory Fire Resistance Volume 1

B. ASTM E1007 Impact Sound Rating Insulation (ISR)

C. ASTM E492 Impact Insulation Class (IIC)

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 SYSTEM REQUIREMENTS

A. Performance Requirements:
   1. Sound Control: Minimum Impact Insulation Class, 55 IIC (50 if field tested)
      a. ASTM E492 and E1007

1.5 QUALITY ASSURANCE

A. Performance Standards:
   1. All materials, unless otherwise indicated, shall be manufactured by Maxxon Corporation and shall be installed in accordance with its current printed directions and by a Maxxon Corporation Authorized Applicator.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in their original unopened packages and protected from damage and exposure from the elements. Damaged or deteriorated materials shall be removed from the premises.

1.7 PROJECT CONDITIONS

A. Before, during and after installation of product, building interior shall be enclosed, with adequate ventilation and heat maintained at a temperature above 50 °F (10 °C) to allow for drying of product.

PART 2 - GENERAL

2.1 PRODUCTS AND MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Maxxon Corporation, Hamel, MN. Telephone: (800) 356-7887

2.2 MATERIALS

A. Sound control mat produts, including the following:
   1. Maxxon Acousti-Mat® 3/4 Sound Mat.

B. Maxxon Acousti-Mat Perimeter Isolation Strips as manufactured by Maxxon Corporation, Hamel, MN

C. Maxxon Acousti-Mat Tape as manufactured by Maxxon Corporation, Hamel, MN

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
   1. Installation shall not begin until the building is enclosed, including roof, windows, doors, and any other apertures, unless additional provisions and communications are made and agreed upon.
   2. Concrete substrate shall be structurally sound, properly fastened and dry. Contractor shall clean subfloor to remove mud, oil, grease, and construction debris before arrival of the authorized applicator.

3.2 PREPARATION

A. Moisture Testing of Concrete Subfloor: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   1. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   2. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

B. If water moisture tests exceed stated limits, apply vapor retarder for moisture vapor emission control as specified in Section 090561.13.

3.3 REQUIREMENTS

A. Application:
   1. Install in accordance with reference standards and manufacturer's instructions.

3.4 GENERAL INSTALLATION REQUIREMENTS

A. General: Install in accordance with reference standards and manufacturer's written instructions.

B. Installation
   1. Loose-lay Maxxon Acouti-Mat 3/4 over the entire concrete subfloor, do not allow wrinkles.
   2. The use of adhesives and fasteners of any kind are prohibited.
   3. Fit to adjoining work snugly, including at penetrations.

4. Install and tape Maxxon Acousti-Mat Perimeter Isolation Strips around the entire perimeter of the Acousti-Mat installation and at all penetrations in order to eliminate flanking paths.
5. Pour top course of concrete in accordance with Section 033000 "Cast-in-Place Concrete".

3.5 PROTECTION

A. Protection from Heavy Loads: During construction, avoid heavy wheeled ofr concentrated loads directly on the sound mat.

END OF SECTION

SECTION 042000 – UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMUs).
   2. Mortar and grout.
   3. Reinforcing steel.
   4. Masonry joint reinforcement.
   5. Ties and anchors.
   6. Miscellaneous masonry accessories.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for sealing control and expansion joints in unit masonry and for sealing mortar joints in cast stone copings.

C. Products installed, but not furnished, under this Section include the following:
   1. The following steel components for unit masonry are furnished under Division 5 Sections “Structural Steel” and "Metal Fabrications:"
      a. Steel bearing plates.
      b. Lateral support, partition top, angles for heads of masonry walls.

1.2 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths (f'm) at 28 days.

B. Determine net-area compressive strength (f'm) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Table 2 of ACI 530.1.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Samples for Verification: For each type and color of the following:
   1. Exposed concrete masonry units.
   2. Accessories embedded in masonry.

D. List of Materials Used in Constructing Sample Panels: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

E. Qualification Data: For testing agency.

F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.
   a. Include material test reports substantiating compliance with requirements.
   b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Table 2 of ACI 530.1.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Preconstruction Testing Service: Contractor will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Contractor. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
2. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
3. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
4. Prism Test: For each type of construction required, per ASTM C 1314.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.8 SEQUENCING

A. Contractor shall furnish products indicated. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning them over to Owner at Project closeout.

1.9 WORK RESTRICTIONS

A. Coordination: Locate dowels and anchor bolts in footing to coordinate with reinforcing in concrete masonry unit cores.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for exposed outside corners, including corners receiving corner guards specified in Division 5 Section “Metal Fabrications.”

B. Concrete Masonry Units: ASTM C 90, Grade N, Type I (moisture-controlled units).
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1,500 psi.
   2. Weight Classification: Medium weight.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions indicated on Drawings.
   4. Exposed Faces: Provide uniform color and texture for units exposed to view and not receiving opaque coatings.

C. Refer to Section 042613 - Masonry Veneer for “Trenwyth” products to be provided and installed where indicated in the Drawings.

2.4 MASONRY LINTELS

A. Provide prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color cement.
   1. Total amount of sodium of potassium oxide in cement shall not exceed 0.6 percent when the mortar and grout aggregates contain opalescent silica or are reactive to alkalis.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar
   1. Application: For use with decorative concrete masonry units.
   2. Available Products:
      a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
      b. Davis Colors; True Tone Mortar Colors.
      c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors

E. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve

F. Aggregate for Grout: ASTM C 404, except that not more than 5 percent shall pass No. 8 sieve and 100 percent shall pass 3/8 inch sieve.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Available Products:
      a. Addiment Incorporated; Mortar Kick.
      b. Euclid Chemical Company (The); Accelguard 80.
      c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
      d. Sonneborn, Div. of ChemRex; Trimix-NCA.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
   1. Application: Provide mortar made integral water repellent for masonry set below grade.
   2. Available Products:
      a. Addiment Incorporated; Mortar Tite.
      b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
      c. Master Builders, Inc.; Rheomix Rheopel.

I. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.
   1. Interior Walls: Mill-galvanized, carbon steel, except provide hot-dip galvanized, carbon steel at interior walls of Bus Wash M101.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
   4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
   5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods, except provide uncoated steel reinforcing bars of size indicated on Drawings.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
   1. Carbon-Steel Wire:
      a. Mill-Galvanized: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
         1) Application: Interior walls except for walls in Bus Wash M101
      b. Hot-Dip Galvanized: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
         1) Application: Exterior, foundation and walls in Bus Wash M101.
   2. Steel Sheet:
      a. Galvanized: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
         1) Application: Interior walls except for walls in Bus Wash M101
      b. Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
         1) Application: Exterior, foundation and walls in Bus Wash M101.
   3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
   1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
   2. Wire: Fabricate from 3/16 inch diameter, hot-dip galvanized steel wire.

C. Partition Top Angles: Install lateral support angles as indicated on Drawings.

D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.
   1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

C. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
   1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

2.9 EMBEDDED FLASHING MATERIALS

A. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
   1. Product: Subject to compliance with requirements, provide "Blok-Flash" by Advanced Building Products Inc.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
   1. Available Products:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Limit cementitious materials in mortar to portland cement and lime.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
   4. Machine mix mortar and grout for no less than 3 minutes.
   5. Measure mortar and grout ingredients using procedures and equipment that are precise and quantitative in accordance with the amount specified.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with, Property Specification. Provide Type S mortar.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Mix to match Architect's sample.

E. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use coarse type grout complying with Table 21-C in the Uniform Building Code for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

2.12 SOURCE QUALITY CONTROL

A. Contractor will engage a qualified independent testing agency to perform source quality-control testing indicated below:
   1. Payment for these services will be made by Contractor.
   2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Verify that foundations are within tolerances specified.
   2. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

D. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
   7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

E. Mortar: Any mortar not used within 30 minutes of being mixed shall not be used in the Work and shall be disposed of as masonry waste.

F. Grout: Any grout not used within 30 minutes of being mixed shall not be used in the Work and shall be disposed of as masonry waste.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated on Drawings, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top angles to structure above with legs firmly and squarely contacting face of masonry units. Space anchors 48 inches o.c., unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
   1. For cast stone copings rake mortar joints, including bed joint, out to depth of 5/8 inches to receive sealant and backer rod specified in Division 7 Section “Joint Sealants.”
   2. For walls indicated to receive field applied coating specified in Division 9 Section “High-Performance Interior Coatings” tool joint surface to compact mortar as hard as possible to resist the pull-out forces exerted by high-performance coating.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods, or steel reinforcing bars where indicated, in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units or as indicated on Structural Drawings.

D. Provide continuity at corners by using prefabricated L-shaped units or as indicated on Structural Drawings.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, pipe enclosures, and other special conditions.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.7 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 FLASHING

A. General: Install embedded flashing with weep spouts in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in Section 2104.5 in the Uniform Building Code.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in Section 2104.6 in the Uniform Building Code for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches.

3.10 FIELD QUALITY CONTROL

A. Inspectors: Contractor will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
   1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
   1. Payment for these services will be made by Contractor.
   2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

E. Mortar Test (Property Specification): For each mix provided, per ASTM C 780.

F. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

G. Prism Test: For each type of construction provided, per ASTM C 1314 at 7 days and at 28 days.

3.11 REPAIRING, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
   6. Clean stone trim to comply with stone supplier's written instructions.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 042500 - TERRA COTTA RAINSCREEN SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this section includes, but shall not be limited to, unitized (panelized) or stick built terra cotta panel rain screen system, a component of the exterior cladding system, consisting of the following:
   1. Aluminum vertical or horizontal track and clip (secondary support) system.
   2. Extruded hollow terra cotta panels.
   3. Silicone gaskets and isolators.
   4. Anchors, fasteners, flashings, weatherseals, cover plates and formed metal trim through and at the perimeter of the terra cotta panel rain screen system and other accessories required for a complete installation.

1.2 SYSTEM DESCRIPTION

A. Hollow core terra cotta panels hung on a pre-engineered aluminum track system with aluminum clip supports, gaskets and trim.
   1. The system shall consist of terra cotta panels supported by extruded aluminum clips attached to aluminum vertical or horizontal track.
   2. Silicone gaskets inserted into vertical track and silicone isolators wrapped around clips; provide custom color as selected by Architect at vertical joint and compression bubbles in every track to maintain panel position across the façade and prevent wind induced rattle.
   3. Track shall be attached to specified portion of wall assembly structurally sufficient to carry the terra cotta panel rain screen system and associated loads.

B. System shall be designed as a "drained and back ventilated rain screen system" to allow for the following:
   1. Pressure equalization in the air space behind the terra cotta panel and allow for subsequent drying within the cavity via ventilation.
   2. Movements within the structure, as specified.
   3. Performance Requirements of this Section, and to fit within the space allotted without projections into adjacent finished space.

C. Flatness: System shall be flat with no noticeable warp, buckling, deflections or other surface irregularities within manufacturers specified tolerances.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by preconstruction testing of rainscreen system representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Rainscreen system shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Panel breakage.
      c. Noise or vibration created by wind and thermal and structural movements.

d. Loosening or weakening of fasteners, attachments, and other components.

B. Delegated Design: Design rainscreen system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
1. Wind Design Criteria: As indicated on Drawings.
2. Periodic Maintenance-Equipment Loads: Minimum 250 pounds point load any place on framing.
3. Structural-Test Performance: Test according to ASTM E 330 as follows:
   a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity, but not less than 10 seconds.
4. Deflection of Framing Members: At design wind pressure, as follows:
   a. Deflections within the system are to be limited to L/360 of their clear span or 1/8 inch, whichever is less when tested in accordance with ASTM E 330.
5. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Project Wind Zone.
6. Seismic Performance: Rainscreen system shall withstand the effects of earthquake motions determined according to the governing building code, but not less than as according to SEI/ASCE 7.
   a. Component Importance Factor is 1.5.
7. Story Drift: Accommodate design displacement of adjacent stories indicated.
   a. Design Displacement: As indicated on Drawings.
   b. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

D. Infiltration/Penetration: The work of this Section shall be constructed to prevent air and water infiltration as outlined below:
1. Air Infiltration: ASTM E 283. Allowable air infiltration will be 0.06 cfm or less per square foot when tested under a constant pressure of 6.24 psf.
2. Water Penetration (Static): ASTM E 331. No uncontrolled water penetration shall occur when tested in static mode, under a constant pressure of 12 psf with 5 gallons of water per hour applied per square foot for a period of 15 minutes.
3. Water Penetration (Dynamic): AAMA 501.1. No uncontrolled water penetration shall occur when tested in dynamic mode, under a constant wind stream pressure of 12 psf with 5 gallons of water per hour applied per square foot for a period of 15 minutes.
4. The complete system is to be designed to evacuate any moisture which penetrates beyond the outside surface materials and to weather proof with membrane flashing around all perimeters and openings through the system.

E. Exterior Ventilation: The work of this section shall be constructed to incorporate exterior ventilation within the cladding system design.
   1. The system shall have a V3 or V4/W1 classification in accordance with AAMA 509-09; classification method for drained and back ventilated rain screen wall cladding systems.
   2. Water that penetrates the cavity behind the rain screen cladding element of the wall system and is on the exterior side of the air/water barrier shall be directed to the exterior by use of flashing, and weeps.

F. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Interior Ambient-Air Temperature: 72 deg F.
   3. Test Performance: No buckling; stress on panels; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

G. Color/Finish: Terra Cotta Panels shall be fired clay materials that achieve their final through-body or glaze color and texture through a kiln firing process forming permanent bonds.

H. Testing:
   1. Absorption (ASTM C67): 4.0% to 7.0%.
   2. Modulus of Rupture (ASTM C99): 2,231 to 3,717 psi.
   3. Flexural Strength (ASTM C880): 2,280 to 3,457 psi.
   4. Weight (ASTM C67): 130 to 135 lbs/cu.ft.
   5. Weight per Unit Area (standard panel): 13 to 16 lbs/sq.ft.
   6. Linear Coefficient of Thermal Expansion: 3.5×10^{-6}.
   7. Freeze and Thaw (ASTM C67): 300 cycles.
   8. Hardness (Various Standard Colors): 7 to 9 Mohs scale.
   9. Efflorescence (ASTM C67): Not effloresced.
   10. Chemical Resistance (ASTM C126): No change in color or texture.

I. Fabrication tolerances:
   1. Dimensional Tolerance: 0.039 inch for any cut length up to 60 inches.
   2. Height: Plus or minus 1/16 inch up to 10 inches; plus or minus 3/32 inch up to 15 inches; plus or minus 1/8 inch up to 20 inches, plus or minus 5/32 inch up to 24 inch.
   3. Thickness, Cross Section of Panel: Plus or minus 1/16 inch.
   4. Straightness ("sweep"): Plus or minus 0.25 % of length.
   5. Diagonal Flatness: Plus or minus 0.25 % of diagonal.
   6. Vertical Flatness: Plus or minus 1.0 % of height.
   7. Torsion: Plus or minus 0.25 % of diagonal.

1.4 SUBMITTALS

A. Sustainable Design Submittals
   1. Product Data: Product Data: Environmental Product Declaration (EPD).

B. Shop Drawings shall be submitted for approval prior to fabrication including:
   1. Elevations for each condition indicating terra cotta panel type and location.

2. Section details, to convey proper fabrication/installation for terra cotta panel types.
3. Shop drawings for wall assembly to receive terra cotta panel rain screen system to be coordinated with terra cotta panel rain screen system shop drawings.

C. Samples: 3 sets of the following samples in the selected finish and color.
1. Initial color, if custom, will be submitted on a 6h x 6w tile. Standard colors may be selected from manufacturers color box.
2. Two 12-inch long by full size profile of each type of panel. Samples shall represent the full range of color and texture proposed for the Work.
3. One 12-inch long by full profile sample of each type sheet metal trim and closure piece.

D. Product Data: Manufacturer's latest published literature describing each product selection.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Provide rainscreen system that complies with test-performance requirements indicated, as evidenced by reports based on Project-specific preconstruction testing by a qualified testing agency.
1. Owner will engage through the Contractor a qualified testing agency to perform preconstruction testing on laboratory mockups.
2. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
3. Preconstruction Testing Program: Perform tests specified in "Performance Requirements" Article on mockups in the following order:
    a. Structural-performance preloading at 50 percent of the specified wind-load design pressure when tested according to ASTM E 330.
    b. Air infiltration when tested according to ASTM E 283.
    c. Water penetration under static pressure when tested according to ASTM E 331.
    d. Water penetration under dynamic pressure when tested according to AAMA 501.1.
    e. Structural performance at design load when tested according to ASTM E 330.
    f. Repeat air filtration when tested according to ASTM E 283.
    g. Repeat water penetration under static pressure when tested according to ASTM E 331.
    h. Structural performance at maximum 150 percent of positive and negative wind-load design pressures when tested according to ASTM E 330.
    i. Periodic maintenance-equipment load at 2.0 times design load.
    j. Structure movement (vertical differential movement and lateral displacement) and thermal movement displacement, three cycles. Test procedure will be developed in conjunction with test laboratory.
    k. Thermal cycling with thermal performance test conditions maintained for 2 hours after equilibrium is achieved. Perform 6 cycles with a cycle consisting of one cold and one hot condition.
    l. Thermal performance with test conditions maintained for 2 hours after equilibrium is achieved.
    m. Repeat air filtration when tested according to ASTM E 283.

n. Repeat water penetration under static pressure when tested according to ASTM E 331.
o. Repeat water penetration under dynamic pressure when tested according to ASTM 501.1.
p. Structural performance at maximum 150 percent of positive and negative wind-load design pressures when tested according to ASTM E 330.
q. Repeat periodic maintenance equipment load to 2.0 times design load.

4. In the event of failure to meet the performance requirements, retest mockup with previously agreed upon modifications or changes. The Architect in consultation with the resting service will determine at which step in the testing procedure retesting shall resume.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:
1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
3. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
4. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
5. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
6. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
7. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
8. Environmental Product Declaration: For each product.
9. Health Product Declaration: For each product.
10. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
11. Environmental Product Declaration: For each product.
12. Third-Party Certifications: For each product.
13. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings: For rainscreen system. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of rainscreen system, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Panels.
e. Flashing and drainage.

3. Samples for Initial Selection: For each type of exposed finish.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes. Include 2 or more samples in each set, indicating limits of variation.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inchlengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Panels.
5. Flashing and drainage.
6. Cross-sectional sample of curtain wall showing thermal break construction.

F. Delegated-Design Submittal: For rainscreen system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Preconstruction Mockup Submittals:
1. Preconstruction Testing Program: Developed specifically for Project.
2. Preconstruction Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
3. Photographs:
a. Take and submit photographs at locations and intervals as required to accurately document mockup construction and testing.
b. Submit digital color images on CD-R of mockup before, during, and after preconstruction testing.
4. Record Drawings: Submit record drawings of preconstruction mockups prepared by preconstruction testing agency.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For rainscreen system to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Preconstruction Testing Agency Qualifications: Qualified according to ISO/IEC 17025 and accredited by ICC-ES for preconstruction testing indicated.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

F. Provide the following upon request:
   1. Qualification Data: For qualified Installer.
   2. Seismic Qualification Certificates: For rainscreen system, accessories, and components, from manufacturer.
      a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   3. Welding certificates.
   4. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for rainscreen system, indicating compliance with performance requirements.
   5. Field quality-control reports.

G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Furnish all labor and materials to completely erect mockup units of sufficient size and configuration to demonstrate the performance capabilities of the vertical wall system. Schedule mockup erection and testing sufficiently in advance of wall system fabrication to cause no delay. Do not install mockup materials as part of the wall system.
   2. After completion of mockup construction and prior to start of testing sequence two panels are to be removed and replaced to successfully demonstrate project replacement procedures.
   3. Build mockup of typical wall area as shown on Drawings.
   4. Exact configuration will be determined during wall system shop drawing review.
   5. Mockup shall have all details complete and identical to those approved on the wall system shop drawings. Mockup shall demonstrate quality of materials, finish, and workmanship, as well as compliance with performance requirements.
   6. Provide schedule for mockup fabrication, erection, sealing and testing a minimum of 30 days in advance of fabrication to permit owner and Architect to coordinate monitoring and observation.
   7. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   8. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   9. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for rainscreen system by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 QUALITY ASSURANCE

A. Installer/Fabricator Qualifications: Engage an experienced Installer/Fabricator, who has specialized in the erection and installation of types of systems similar to that required for this Project, to erect the terra cotta panel rain screen system.
   1. Installer/Fabricator shall be trained by the manufacturer and has engaged in similar work for a period of no less than 5 years.

B. Manufacturer's qualifications: Engage a Manufacturer experienced in the manufacture of terra cotta panel rain screen system similar to those indicated for the Project, and with a record of successful in-service performance.

C. Single responsibility:
   1. The terra cotta panel rain screen system, including panels, vertical track or horizontal track, clips and gaskets/isolators, shall be provided by the same firm unless otherwise noted.
   2. The terra cotta panel rain screen system shall have been in use for at least 5 years.

D. Pre-Construction Compatibility and Adhesion Testing: Submit to joint sealant manufacturer samples of material that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:
   1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
      a. Perform tests under normal environmental conditions that will exist during actual installation.

E. Pre-Installation Inspection: Installer to contact manufacturer of the terra cotta panel rain screen system Owner and Architect, prior to installation of terra cotta panel rain screen system if site conditions adverse to proper installation of the system exist.

1.12 HANDLING

A. Protect components from adverse job conditions prior to installation.

B. Protect components from other trades after installation.

C. Storage:
   1. Store components on platforms or pallets, covered with tarpaulins or other suitable weather-tight ventilated covering. Store components so that water accumulations will drain freely.
   2. Do not store terra cotta panels in contact with other materials that might cause staining, surface damage, or other deleterious effect.
   3. Do not stack platforms or pallets one on top of another.

1.13 WARRANTY

A. Special Assembly Warranty: Standard form in which Installer agrees to repair or replace components of rainscreen system that does not comply with requirements or that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed panel and framing areas.
      e. Failure of operating components.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. Shildan, "Longoton".
   2. Environmental Product Declaration: Provide Type III Industry-Wide Environmental Product Declaration with external verification in the manufacture is recognized as a participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that has a cradle to gate scope.

2.2 MATERIALS

A. Hollow terra cotta panels complying with the following:
   1. Size: As indicated on the Drawings.
   2. Color: Match Architect's samples.

B. Fasteners, clips, and vertical or horizontal track: In accordance with manufacturer's recommendations to meet performance criteria specified.

C. Vertical track:
   1. Aluminum alloy 6105 T5, mill finished.

D. Horizontal track:
   1. Aluminum alloy 6063 T6, mill finish

E. Flashing, Trim and other Accessories: Shop-fabricated, corrosion-resistant type capable of complying with the performance criteria specified and designed to allow adjustments of system prior to being permanently fastened.

F. Supporting system fastening method: Pre-engineered aluminum track, and clip, complying with the following.
   1. Panels fastened at head grooves and base channels using aluminum clips inserted into the track.
   2. The aluminum track is fastened to the building wall system as shown on the Construction Documents or Installation Contractor's Shop Drawings.

3. The replacement of damaged panels, particularly in the field, must be possible using simple methods and shall not require special tools nor damage the surrounding panels.
4. Silicone gaskets shall be colored black, unless specified by the Architect to match the panel color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Terra cotta panel rain screen system installer to examine conditions affecting the work of this Section at site. If any conditions exist that would be detrimental to proper installation of terra cotta panel rain screen system, installer is to notify Architect and Contractor in writing.

B. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 INSTALLATION

A. Do not install broken, chipped or cracked panels.

B. Isolate aluminum surfaces from direct contact to steel, cementitious, and dissimilar materials with high-impact plastic shims, paint or membrane.

C. Install terra cotta panel rain screen system to wall assembly specified in accordance with the approved shop drawings and their manufacturer's instructions.

D. Conceal fasteners.

E. Place terra cotta panels in stack or running bond as indicated, to lines and levels, plumb, with uniform, parallel joints, in accordance with their manufacturer's instructions.
1. Use caution to prevent damage to terra cotta panels.
2. When field-cutting, use caution to ensure that cuttings do not remain on exposed surfaces. Cut edges shall be sharp, without spalling.
3. Cutting shall be performed with a diamond tipped wet saw.

F. Ensure that assembly is plumb, level and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.

G. Built-in work:
1. As work progresses, build in flashing and other items.
2. Where applicable, remove protective film from finished aluminum surfaces.

H. Tolerances: Accurately align and locate components to column lines and floor levels; adjust work to conform to the following tolerances.
1. Plumb: 1/8-inch in 10 feet; 1/4-inch in 40 feet; non-cumulative.
2. Level: 1/8-inch in 20 feet; 1/4-inch in 40 feet; non-cumulative.
3. Alignment: Limit offset to 1/16-inch where surfaces are flush or less than 1/2-inch out of flush, and separated by less than 2 inches (by reveal or protruding work); otherwise limit offsets to 1/8 inch.
4. Location: 3/8-inch maximum deviation from measured theoretical location (any member, and location).
5. Lipping between units: 1/16 inch maximum.
6. Finished work shall be viewed from a distance of 15 feet per ASTM C216-07a.

3.3 CLEANING

A. Clean soiled surfaces using materials which will not harm terra cotta panels or adjacent materials, as recommended by the terra cotta panel manufacturer (clean with mild detergent using a natural bristle brush, starting from top of building to the bottom). Use non-metallic tools in cleaning operations. Pressure washer not to exceed 1200 psi.

B. Upon completion of installation, remove protective coatings or coverings and clean aluminum surfaces, exercising care to avoid damage of finish.

C. Remove excess sealant compounds, dirt or other foreign substances.

D. Remove and replace terra cotta panels that are broken, chipped, cracked, abraded or damaged during construction period. Reinstall in accordance with their manufacturer's instructions.

END OF SECTION

SECTION 042505 - STABILIZED RAMMED EARTH

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes earth placed in formwork and pneumatically compacted and cast in place, sealers for rammed earth, and concrete bond beams and bases for rammed earth.

B. Related Requirements: Section 013573 - "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design assignment indicated in this Section.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast- furnace slag, and silica fume; subject to compliance with requirements.

B. Design Reference Sample: Sample designated by the Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place rammed earth.

C. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

D. Lift means a course of rammed earth, placed within the forms, and then compacted.

E. Optimum moisture means sufficient water (generally no more than ten (10) percent) mixed into the soil to attain sufficient compaction.

F. Qualified soil means any soil, or mixture of soils, in combination with water and cement that attains 7 MPa compression strength and attains 1 MPa Modulus of Rupture.

G. Rammed earth means a qualified soil cement mix that is mechanically consolidated to full compaction.

H. Stabilization, stabilized means qualified soils that pass the wet strength test under ASTM D1633-00 and contains a minimum of seven (7) percent Portland cement by weight. Stabilization is achieved through the use of amendments.

I. Wet strength compression test means an approved testing laboratory process in which a fully cured rammed earth cylinder is completely submerged in water a minimum of four hours according to ASTM D1633-00, then subjected to a compression test.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site
   1. Require representatives of each entity directly concerned with rammed earth to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency.
      c. Rammed earth subcontractor.

2. Review rammed earth finishes and finishing, cold- and hot-weather placement procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, repair procedures, and protection of cast-in-place rammed earth.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   a. Product Certificate: For materials extracted and manufactured within 100 miles of the project

C. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect rammed earth and concrete bond beams and bases .

D. Delegated-Design Submittal: Refer to Section 013573 - "Delegated Design Requirements and Procedures" for delegated design submittal procedures and requirements.
   1. Provide delegated-design submittal for Stabilized Rammed Earth in accordance with Maricopa Association of Governments Building Code Amendments and Standards Manual BCAS #3, Standards for Earthen Structures and Straw Bale Construction.

E. Placement Schedule: Submit rammed earth placement schedule before start of placement operations. Include locations of all joints including construction joints.

F. Samples: For each of the following materials:
   1. Soil for rammed earth.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each of the following:
   1. Cementitious materials.

C. Installer's Qualifications: A firm experienced in installation of rammed earth products that has completed no less than three such projects of similar scale to the current project.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

B. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design rammed earth mixtures.

C. Mockups: Before placing rammed earth, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups of typical interior wall of rammed earth as shown on Drawings.
   2. Demonstrate curing, cleaning, and protecting of rammed earth, finishes, and contraction joints, as applicable.
   3. Incorporate embeded items such as electrical boxes and steel-box display cases.
   4. Construct mockup with backing system per structural drawings.
   5. Construct mockup with the architectural concrete base and bond beam per drawings.
   6. Obtain the Architect's approval of mockups before placing rammed earth.
   7. Refer to drawings for mockup requirements.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a registered design professional, as defined in Section 013573 "Delegated Design Requirements and Procedures" to design the Stabilized Rammed Earth.
   1. Material properties indicated in this Section shall be considered as minimum properties.

B. Structural Performance: Provide Stabilized Rammed Earth capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated on Drawings and per Building Code.
   2. Deflection Limits: Design Stabilized Rammed Earth systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Walls: Horizontal deflection of 1/360 of the wall height.
   3. Design Stabilized Rammed Earth systems to provide for movement of framing members located outside the building envelope without damage or overstressing, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
   4. Design Stabilized Rammed Earth to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downard movement of 1/2 inch (13 mm).

C. Stabilized Rammed Earth Standards: Unless more stringent requirements are indicated, comply with Maricopa Association of Governments Building Code Amendments and Standards Manual BCAS #3.

2.3 STABILIZED RAMMED EARTH SOIL MIX

A. General: The soil shall not contain rock more than 13 mm in diameter. The soil shall be slightly silty sand, suitability of soil mixture to be determined by testing laboratory hired by Contractor. The soil shall be free of all organic matter. The soil shall not contain more than two percent soluble salts.

B. Soil compressive strength: Prior to the start of construction, fully-cured rammed earth soil samples shall be tested at an approved testing laboratory for compressive strength. Cylinders shall be cured in steel molds. The ultimate compressive strength of all rammed earth soil shall be a minimum 7 MPa at 56 days. Samples tested shall be representative of soil to be used on the project.

C. Soil mixture shall contain seven (7) percent Portland white cement by weight. Laboratory testing shall indicate rammed earth samples attained a minimum of 2 MPa. after seven (7) days. Soils to be mixed shall be sufficiently dry to blend completely to one uniform color and texture.

2.4 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
   2. Stainless-Steel Sheet: ASTM A 666, Type 304.
   3. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

B. Adjustable Anchors for Connecting to Lightgage Steel Framing and Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Tie Section: Triangular-shaped wire tie, sized to extend within 100 mm of rammed earth veneer face, made from 2.9-mm- diameter, stainless-steel wire. Anchors shall be installed with two 5.5 mm diameter screws per location.
   2. Anchor spacing shall not exceed 400 mm on center in any direction.

2.5 FORM-FACING MATERIALS

A. Form-Facing Panels for As-Cast Finishes for rammed earth and concrete bond beams and bases: Steel, glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that will provide continuous, true, and smooth surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS, that adheres to form joint substrates.

C. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect rammed earth surfaces and will not impair subsequent treatments of those surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.6 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type II white for use in rammed earth.
   2. For cement in bond beams, see Section 033000 Cast-in-Place Concrete.

B. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations. Cold water shall be used to slow hydration rate of cement.

2.7 EXPOSED AGGREGATE FOR ACCENT BANDING

A. Add aggregate to soil used for rammed earth to achieve the appearance of a roughly horizontal banding of contrasting texture and exposed stones, as indicated on drawings.

B. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone.

C. Size: ASTM D 448, Size 3, ranging in size from 25 to 50 mm.

D. Increase in cement content of mix may be required to achieve necessary strength of accent banding. Submit mix design to the Architect for review.

2.8 SEALANTS

A. Interior walls:
   1. Primer: Acrylic polymer emulsion, three coats of Ram Seal Cure and Prime, or approved equal.
   2. Sealant: Acrylic polymer emulsion, three coats of Ram Seal Original or approved equal.
   3. Sealants are to comply with VOC limits specified.

B. Exterior walls:
   1. Primer: Acrylic polymer emulsion, three coats of Ram Seal Cure and Prime, or approved equal.
   2. Sealant: Acrylic polymer emulsion, three coats of Ram Seal Original or approved equal.

PART 3 - EXECUTION

3.1 FORMWORK

A. General: Comply with Division 03 Section "Cast-in-Place Concrete" and requirements in this section for formwork, embedded items, and shoring and reshoring.

B. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.

C. In addition to ACI 303.1 limits on form-facing panel deflection, limit rammed earth surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class B, 6 mm.

D. Fabricate forms to result in rammed earth that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Fabricate forms for easy removal without hammering or prying against rammed earth surfaces. Provide crush or wrecking plates where stripping may damage surfaces. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
   1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent leakage.
   2. Do not use rust-stained steel form-facing material.

F. Chamfer vertical comers and horizontal edges of rammed earth.

G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items. Brace, shore, and otherwise secure all openings so that acceptable compaction of rammed earth material can be accomplished.

H. Clean forms and adjacent surfaces to receive rammed earth. Remove chips, wood, sawdust, dirt, and other debris just before placing rammed earth.

I. Retighten forms and bracing before placing rammed earth, as required, to prevent leaks and maintain proper alignment.

3.2 REMOVING AND REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place rammed earth surfaces.

3.3 RAMMED EARTH PLACEMENT

A. Before placing rammed earth, verify that installation of formwork, form-release agent, masonry ties, and embedded items are complete and that required inspections have been performed.

B. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect rammed earth work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 5 deg C for three successive days, maintain delivered rammed earth mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place rammed earth on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
   4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain rammed earth temperature below 32 deg C at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing rammed earth. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

D. Placement of material, compaction and curing.
   1. No amount of Portland cement stabilized rammed earth will be mixed that will not be placed in the wall system within sixty (60) minutes of its preparation.
   2. Lifts of prepared soil shall be placed in the forms in relatively even layers not to exceed 250 mm in depth prior to compaction and 150 mm after compaction. Each lift shall then be pneumatically rammed to full compaction.
   3. Optimum moisture content as determined to meet minimum compressive strength shall be maintained.
   4. Work will progress, lift-by-lift, until the work approaches bond beam height.
   5. Forms may be stripped immediately after ramming is completed for a section of wall, providing ramming of adjacent sections does not affect the structural integrity of completed walls.
   6. Rammed earth walls not in forms shall be lightly spray-cured with water at least five (5) spaced times during daylight hours. This procedure shall continue for at least three (3) days starting from the time that the wall is exposed to the elements. Exception: Rammed earth walls left in forms three (3) or more days shall not require water-spray cunng.

3.4 FINISHES, GENERAL

A. Rammed earth Finish: Match the Architect's design reference sample, identified and described as indicated, to satisfaction of the Architect.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
   1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

C. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

3.5 SEALANTS

A. Apply prime coats and sealants in accordance with manufacturer's instructions.

3.6 AS-CAST FORMED FINISHES

A. Smooth-Formed Finish: As-cast texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities.

3.7 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:
   1. Steel reinforcement placement and placement of veneer anchors.
   2. Placement of pins between concrete cap and rammed earth.
   3. Verification of use of required design mixture.
   4. Placement, including conveying and depositing.
   5. Curing procedures and maintenance of curing temperature.
   6. Continuously monitor field in place density of rammed earth mixture.

C. Rammed Earth Tests: Testing of composite samples of fresh rammed earth obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Compression Test Specimens Sample Frequency: Obtain at least one composite sample for each 10 cu. m or fraction thereof of each mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. In Place Density Testing: Perform one test for every 2 cu m of rammed earth placed, but not less than one per day. Compaction to be 95% of maximum when tested in accordance with ASTM D558.
   3. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens m steel molds for each composite sample.
      b. Cast and field cure two sets of two standard cylinder specimens in steel molds for each composite sample.
   4. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 56 days.
      a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 56 days.
      b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   5. When strength of field-cured cylinders is less than 85 percent of companion laboratory- cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   6. Strength of each rammed earth mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 4 MPa.
   7. Test results shall be reported in writing to the Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of testing and inspecting agency, location of batch in Work, design compressive strength at 56 days, mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 56-day tests.
   8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Architect but will not be used as sole basis for approval or rejection of rammed earth.
   9. Additional Tests: Testing and inspecting agency shall make additional tests of rammed earth when test results indicate that compressive strengths or other requirements have not been met, as directed by the Architect.
   10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

3.8 REPAIRS, PROTECTION, AND CLEANING

A. Repair and cure damaged finished surfaces of rammed earth when approved by the Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
   1. Remove and replace rammed earth that cannot be repaired and cured to the Architect's approval.

B. Protect comers, edges, and surfaces of rammed earth from damage; use guards and barricades.

C. Protect rammed earth from staining, laitance, and contamination during remainder of construction period.

D. Clean rammed earth surfaces after finish treatment to remove stains, markings, dust, and debris.

END OF SECTION

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Decorative concrete masonry units.
2. Mortar.
3. Ties and anchors.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under this Section:
1. Steel lintels in masonry veneer.
2. Steel shelf angles for supporting masonry veneer.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals
1. Product Data: For Lead-free content in flashing

C. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Initial Selection:
1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.
3. Weeps.

E. Samples for Verification: For each type and color of the following:
1. Decorative CMUs.
2. Pigmented colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weeps.
4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Provide the following upon request:
   1. Material Certificates: For each type and size of the following:
      a. Masonry units.
         1) Include material test reports substantiating compliance with requirements.
      b. Cementitious materials. Include name of manufacturer, brand name, and type.
      c. Mortar admixtures.
      d. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
      e. Anchors, ties, and metal accessories.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical wall area.
   2. Build mockups for each type of exposed unit masonry construction in sizes approximately 96 inches long by 72 inches high by full thickness, including face and backup wythes and accessories.
      a. Include a sealant-filled joint at least 16 inches long in each mockup.
      b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
      c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
      d. Include metal studs, sheathing, water-resistive barrier, sheathing joint-and-penetration treatment, veneer anchors, flashing, cavity drainage material, and weeps in exterior masonry-veneer wall mockup.
   3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
   4. Protect accepted mockups from the elements with weather-resistant membrane.

5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
    1. Extend cover a minimum of 24 inches down face of veneer, and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
    1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
    2. Protect sills, ledges, and projections from mortar droppings.
    3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
    4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.3 CONCRETE MASONRY UNITS

A. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1500 psi.
2. Density Classification: Medium weight, unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Provide special block sizes and shapes required as shown on Drawings.
5. Texture and color shall be consistent for all units provided for exposed walls.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2.4 MORTAR MATERIALS

A. Masonry Cement: ASTM C 91/C 91M.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Holcim; Mortamix Masonry Cement.
b. Lafarge North America Inc.; Lafarge Masonry Cement.
c. Lehigh Hanson, Inc.; Lehigh Masonry Cement.

B. Mortar Cement: ASTM C 1329/C 1329M.
1. Products: Subject to compliance with requirements, provide the following:
a. Lafarge North America Inc.; Lafarge Mortar Cement.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.

D. Colored Cement Products: Packaged blend made from masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Masonry Cement:
a. Products: Subject to compliance with requirements, provide one of the following:
1) Holcim; Rainbow Mortamix Custom Color Masonry Cement.
2) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
3) Lehigh Hanson, Inc.; Lehigh Custom Color Masonry Cement.
2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

E. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Water: Potable.

2.5 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
2. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming

or developing play in excess of 1/16 inch.

2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.109-inch-thick, stainless-steel sheet.
3. Fabricate wire ties from 0.25-inch- diameter, stainless-steel wire unless otherwise indicated.
4. Fabricate wire connector sections from 0.25-inch- diameter, stainless-steel wire.
5. Seismic Masonry-Veneer Anchors: Connector section and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having slotted holes for inserting vertical leg of connector section. Connector section consists of a rib-stiffened, sheet metal bent plate with down-turned leg designed to fit in anchor section slot and with integral tabs designed to engage continuous wire.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Hohmann & Barnard, Inc.; 200/DA 213S with DA-213S.
        2) Wire-Bond; RJ-721.
6. Seismic Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie. Wire tie has sheet metal clip welded to it with integral tabs designed to engage continuous wire.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Hohmann & Barnard, Inc.; 200/DA 213-300C.
        2) Wire-Bond; RJ-711 with Wire-Bond clip.
7. Stainless-Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank.

2.6 EMBEDDED FLASHING MATERIALS

A. Masonry flashing shall be metal, except as otherwise noted. Metal flashing shall be through-wall, where feasible, except where otherwise clearly shown or noted. Through-wall flashing shall be 2-piece, except where otherwise clearly shown or noted.

B. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch thick.
2. Provide manufacturer documentation or statement validating lead free flashing.
3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
    a. Products: Subject to compliance with requirements, provide the following:
        1) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.

5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
6. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
7. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
8. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
9. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
10. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
11. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
12. Solder metal items at corners.

C. Flexible Flashing: Use the following unless otherwise indicated:
1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
a. Products: Subject to compliance with requirements, provide one of the following:
1) Advanced Building Products Inc.; Copper Fabric Flashing.
2) Hohmann & Barnard, Inc.; H & B Copper-Fabric NA Copper Fabric Flashing.

D. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

E. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with phosphoric acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
3. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

G. Termination Bars for Flexible Flashing: steel bars 0.075 inch by 1 inch.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene PVC.

B. Weep Products: Use the following unless otherwise indicated:
   1. Mesh Weep: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Advanced Building Products Inc.; Mortar Break Weep Mesh.
         2) Mortar Net USA, Ltd.; Mortar Net Weep Vents.

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Advanced Building Products Inc.;
      b. Heckmann Building Products Inc.; Weep-Thru Mortar Deflector.
      c. Hohmann & Barnard, Inc.; Mortar Trap.
      d. Mortar Net USA, Ltd.; Mortar Net.
   2. Configuration: Provide one of the following:
      a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
      b. Sheets or strips, full depth of cavity and installed to full height of cavity.

2.8 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.9 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use masonry cement or mortar cement mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Use Type N unless another type is indicated.

D. Pigmented Mortar: Use colored cement product.
   1. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
   2. Mix to match Architect's sample.
   3. Application: Use pigmented mortar for exposed mortar joints.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Mix to match Architect's sample.
   2. Application: Use colored aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Lay CMUs with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
   1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with seismic masonry-veneer anchors to comply with the following requirements:
   1. Fasten seismic anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Embed tie sections, connector sections, and continuous wire in masonry joints.
   3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   4. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Provide airspace between back of masonry veneer and face of insulation as shown.
   1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 EXPANSION JOINTS

A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints as follows:
   1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
   2. Build flanges of factory-fabricated, expansion-joint units into masonry.
   3. Build in compressible joint fillers where indicated.
   4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified.

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified.
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING AND WEEPS

A. General: Install embedded flashing and weeps in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
   3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
   4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
   5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
   6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weeps in veneers in head joints of first course of masonry immediately above embedded flashing.
   1. Use specified weep products to form weeps.
   2. Space weeps 24 inches o.c. unless otherwise indicated.
   3. Cover cavity side of weeps with plastic insect screening at cavities insulated with loose-fill insulation.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage through the Contractor special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

C. Testing Prior to Construction: One set of tests.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

E. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weeps, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Grout.

B. Related Requirements:
   1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
   2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications not defined as structural steel.
   3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Retain four definitions below if required for "High-Seismic Applications" as defined in AISC 360.

C. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

D. Heavy Sections: Rolled and built-up sections as follows:
   1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
   2. Welded built-up members with plates thicker than 2 inches.
   3. Column base plates thicker than 2 inches.

E. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

F. AISC 341 requires that structural Drawings show locations of demand critical welds, which must comply with additional quality and toughness requirements.

G. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of post-consumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Environmental Product Declarations (EPD): Submit manufacturer's EPD per the following:

1. EPDs to be submitted for each of the following structural steel types:
   a. Hot-rolled structural sections (W, S, M).
   b. Hollow structural sections (HSS).
   c. Structural plate.

D. Shop Drawings: Show fabrication of structural-steel components.
1. Prepare erection drawings, complete with all necessary plans, elevation and sections, to indicate size and relative position of members. Do not reproduce design drawings for use as erection drawings. Include erection drawings with each submittal indicating marks of all members, assemblies and loose pieces included in the submittal.
2. Indicate on details of all pieces, principal column grid lines where members are located.
3. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
4. Include setting drawings and direction for installation of anchor rods and other anchorages embedded in concrete.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
7. Indicate surface preparation as per SSPC and prime painting for each member if specified.
8. Retain first three subparagraphs below for "High-Seismic Applications" as defined in AISC 360.
9. Identify members and connections of the seismic-load-resisting system.
10. Indicate locations and dimensions of protected zones.
11. Identify demand critical welds.
12. Retain subparagraph below if fabricator is responsible for selecting or completing details of structural-steel connections required to withstand specific design loads. Retain option for jurisdictions that require deferred connection design to be signed and sealed by a specialty structural engineer. Professional engineer qualifications are specified in Section 014000 "Quality Requirements."
13. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
14. Clearly indicate revisions made on erection drawings and pieces on any re-submittal.
15. Retain below if structural cables are in the project.

16. Submit complete shop drawings for fabrication of cables and fittings. Show exact locations, material, sizes and lengths of all cables and fittings. Indicate fabricating and preparation procedures for cables and fittings. Clearly indicate sequence, procedures and method of erection.

E. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint qualified by testing, including the following:
1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Product Test Reports: For the following:
1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Welding filler metals and fluxes.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

E. Fastener Certification.
1. Submit to the inspection and testing agency and the Architect certified copes of mill test reports for the bolts, nuts and washers from the manufacturer for each shipping lot, complying with the requirements of ASTM A 325/A 325M or ASTM A 490/A 490M, ASTM A 563/A 563M, ASTM F 436/F 436M and ASTM F 959/F 959M.
2. Submit to inspection and testing agency, a certified statement of compliance that high-strength bolts, nuts and washers furnished under this section meets the specified requirements.
3. Submit to inspection and testing agency, a certified statement of compliance that welding materials furnished under this section meets AWS requirement.

F. Forged Steel Structural Hardware.
1. Submit copies of test results of breaking strength for forged steel structural hardware.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ASCE.

D. Employ a steel erector who has had 5 years of successful experience in erection of structural steel and is able to furnish evidence of erector's ability, facilities, proficiency of erector's personnel and completed projects.

E. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

G. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
   a. Throughout AISC 303, replace "Structural Design Drawings" with "Design Drawings and other Contract Documents".
   b. Delete paragraph 3.3 – Discrepancies.
   c. Delete paragraph 4.4 – Approval, and replace with the following:
      Refer to the Condition of Contract and Section 01330, Submittal Procedures.
      1) Review of Shop Drawings by the Architect shall not relieve the Contractor of responsibility for accuracy of detail dimensions, fit of parts assembled in shop or field, ability to erect the material, or other Contract requirements.
      2) Notation by the Architect made on the Shop Drawings does not authorize changes to the Contract requirements including Contract sum or Contract time.
   d. Paragraph 4.6 – The RFI Process: Omit reference to "Revision to the Contract Document".
   e. Delete paragraph 9.3 – Revisions to Contract Documents.
   f. Paragraph 9.4 – Contract Price Adjustment, replace with the following:
      Revision to the Contract Documents and Contract Price Adjustment shall be as per the Condition of Contract.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. AWS D1.1 "Structural Welding Code", with the exception as listed in AISC 360-05 specification section J2, apply in lieu of AWS provisions and to the following:
   a. Delete section 5.3.3.4, "Recrushed Slag"
5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Contractor's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.
4. Do not store material on structure that might cause distortion, damage or overload to members or supporting structures. Repair or replace damaged materials or structures as directed by the Architect.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.9 PROJECT CONDITIONS

A. Measurements:
1. Make such field measurements as are necessary to lay out the Work properly.

B. Retain first paragraph below if attachment is being made to existing steel or if existing steel is being reinforced.

C. Alteration and Connections to existing steel:
1. Make all necessary field measurements for detailing, fabricating and installing reinforcing and new members to be connected to existing steel or reworking existing members. Identify conditions prohibiting installation as indicated.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
1. W-Shapes: 60 percent.
2. Channels, Angles, M, S-Shapes: 60 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 25 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

C. Structural Steel Global Warming Potential (GWP): The GWP of structural products must not exceed the limits indicated in the table below. The intent is that 85% of the product tonnage for the shapes indicated meet the requirements indicated. The controlling GWP value is to be taken as follows:
   1. If an unfabricated Product EPD is provided, the sum of GWP from product stages A1, A2 and A3 (cradle-to-mill gate) is to be taken as the controlling GWP value.
   2. If a fabricated product EPD is provided, the sum of the GWP from product stages A1, A2 and A3 (cradle-to-fabricator gate) is to be taken as the controlling GWP value.

PRODUCT	MAX. ACCEPTABLE UNFABRICATED GWP (kg CO2/MT)	MAX. ACCEPTABLE FABRICATED GWP (kg CO2/MT)
Hot-Rolled Structural Sections	901	1,080
Hollow Structural Section (HSS)	1,710	1,990
Plate	1,480	1,730

D. W-Shapes: ASTM A 992/A 992M, Grade 50 (345)
   1. For ASTM A6/A6M hot rolled shape with a flange thickness 50 mm (2 in.) , provide steel with minimum Charpy V-notch (CVN) toughness of 27 J (2- ft.-lb.) at 21º C (70ºF) tested in the alternate core location as per ASTM A6/A6M, Supplementary Requirements S5 and S30.
   2. For built-up heavy shapes, provide steel plates with CVN as per AISC 360 and AISC 341.

E. Channels, Angles-Shapes: ASTM A 36/A 36M.

F. Plate and Bar: ASTM A 36/A 36M.

G. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50.

H. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.

I. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.

J. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
   1. Weight Class: Double-extra strong.
   2. Finish: Black except where indicated to be galvanized.

K. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

L. Steel Forgings: ASTM A 668/A 668M.

M. Welding Filler Materials, Fluxes and Electrodes: Comply with AWS requirements. Provide filler metal for welds used in members and connections in seismic load resisting system with a minimum Charpy V-notch toughness of 27 J (20 ft-lb) at 0ºF (minus 18ºC) as determined by appropriate AWS classification.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Carbon Steel Bolts: ASTM A 307.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

C. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
   1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.

D. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dip or mechanically deposited zinc coating.
   2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.

E. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

F. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

G. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   1. Configuration: Straight.
   2. Nuts: ASTM A 563 hex carbon steel.
   3. Plate Washers: ASTM A 36/A 36M carbon steel.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain.

H. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
   1. Nuts: ASTM A 563 hex carbon steel.
   2. Plate Washers: ASTM A 36/A 36M carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Plain.

I. Threaded Rods: ASTM A 36/A 36M (345).
   1. Nuts: ASTM A 563 hex carbon steel.
   2. Washers: ASTM A 36/A 36M carbon steel.
   3. Finish: Plain.

J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

L. Elastomeric Bearings: Prefabricated unreinforced pads (consisting of elastomer only) or reinforced bearings with steel or fabric laminate materials to suit the design loads: Division II, Section 18.2 of AASHTO Standard Specification for Highway Bridges.

M. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
1. Manufacturers: Subject to compliance with requirements.
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Amscot Structural Products Corp.
   b. Fluorocarbon Company Limited.
   c. R.J. Watson Bridge & Structural Engineered Systems.
   d. Seismic Energy Products, L.P.
3. Mating Surfaces: PTFE and PTFE.
4. Coefficient of Friction: Not more than 0.03
5. Design Load: Not less than 5,000 psi.
6. Total movement capability includes movement in both directions and is typically twice the dimension of the expansion joint.
7. Total Movement Capability: 6 inches.

N. Pins and Rollers.
1. 100 mm (4 inch) diameter or less: ASTM A 108, Grade 1016 to 1030; minimum yield strength: 248 MPa (36 ksi).
2. 100 to 500 mm (4 to 20 inch) diameter: ASTM A 668/A 668M, Class D; minimum yield strength: 259 MPa (37.5 ksi).

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

C. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.

D. Primer: SSPC-Paint 25 BCS, Type II, zinc oxide, alkyd, linseed oil primer.

E. Primer: SSPC-Paint 23, latex primer.

F. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

G. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20, ASTM A 780.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. All provisions of AWS D1.1 apply to welds.
   4. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
   5. Mark and match-mark materials for field assembly.
   6. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Shop Welding: Perform welding in accordance with approved welding procedures and AWS D1.1, except as modified in Section J2 of AISC 360-05.
   1. Enforce and supervise approved procedure for welding during fabrication of structural steel by employing experienced supervisors knowledgeable of good welding practices.
   2. Assemble and weld built-up sections by method that will maintain true alignment of axes without exceeding tolerance of AISC 303-05.
   3. Remove backing bars or run off tabs, back gouge, and grind smooth as per AWS D1.1 requirements.

C. High Strength Steel Bolting.
   1. Joints installed in oversized holes.
   2. Joints that utilize slotted hole except those with applied load normal to long dimension of the slot.
   3. Joints in which slip at the faying surface would be detrimental to the performance of the structure.
   4. Joints in which fastener pretension is required in the governing code or specification.
   5. Joints subjected to load reversal.
   6. Joints subjected to fatigue load with no reversal of loading.
   7. Joints with ASTM A325 or F1852 bolts subjected to tensile fatigue. Joints with ASTM (5) A490 bolts that are subjected to tension, or combined shear and tension, with or without fatigue.
      a. ST joints are permitted for all other application and should be used whenever possible.
      b. Mixing of A325 and A490 bolts of same diameter should be avoided to assure that bolts are installed in proper locations.
      c. Do not use A490 bolts larger than one inch diameter in SC joint as torque required to install these is beyond the commonly available wrenches.
      d. Coordinate and indicate on drawing joint types.
   8. Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolts and type of joint as indicated.
      a. Snug tightened joints (ST): Bearing type connections based on allowable stresses with threads included in shear plane (Type N). Faying surfaces and surfaces adjacent to bolt heads and nuts shall be free of dirt and other foreign material.

b. Pretensioned joints (PT): Provide PT joints as indicated. Use turn-of Nut (nut rotation from snug-tight condition), calibrated wrench pretensioning, Tension-Control (twist-off) bolt assembly conforming to ASTM F1852, or Direct-Tension Indicator conforming to ASTM F959 as pretensioning method Faying surfaces adjacent to bolt heads and nuts shall be free of dirt and other foreign material.
c. Slip-Critical Joints (SC): Provide SC joints as indicated using direct tension indicator conforming to ASTM F959 or Tension-Control (twist-off) bolt assembly conforming to ASTM F1852 and installed according to Section 8 of RSSC. Faying surfaces shall be free of burr, blast cleaned to comply with RCSC Class B requirement.

D. Anchor Rods (Bolts).
1. Furnish anchor rods (bolts) as indicated to be embedded in concrete, including nuts and washers. Detail anchor rods (bolts) such that the minimum projection above the nut, after the column is in place, is 25 mm (one inch).

E. Columns and Base Plates.
1. Furnish anchor rods (bolts) as indicated to be embedded in concrete, including nuts and washers. Detail anchor rods (bolts) such that the minimum projection above the nut, after the column is in place, is 25 mm (one inch).

F. Beams.
1. Provide one-piece beams without splice(s), unless otherwise indicated. Where splices are permitted, splice connections shall develop the strength of the beam.

G. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

H. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

I. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

J. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

K. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

L. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

M. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.

N. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

O. Hollow Structural Steel and Other Closed End Members.
1. Provide hollow structural steel and other closed end members with cap plates with watertight welds at the ends and with weep holes where indicated.

P. Trusses and Sway Frames.
1. Fabricate trusses as all-welded construction with connections designed in accordance with loads and stresses indicated but in no case less than the requirements of AISC specifications and the following:
   a. Neutral axes of members: intersect at joints.
   b. Top and bottom chord of trusses: one piece and without splices unless otherwise indicated.
   c. Splice connections: meet the approval of the Architect. No holes drilled in a tension member of a truss.
   d. Camber: 3 mm per 3 meters (1/8 inch per 10 feet) of span, unless otherwise indicated.
2. Construct sway frames as outlined for trusses.
3. Bracing.
   a. Provide diagonal bracing, ties and struts as indicated. Design diagonal bracing in the plane of the truss top chord to be welded or clamped to the bottom flange of the purlins. Support bottom chord horizontal bracing members over 6 meters (20 feet) long at approximately mid span by means of 13-mm-diameter (1/2-inch-diameter) rod hangers to purlins above. Detail ties and bracings for draw.
4. Purlins.
   a. Provide purlins as indicated. Purlins resting on top of trusses or beams may be connected to trusses or beams by means of two 19-mm-diameter (3/4-inch-diameter) machine bolts. Use high strength bolts at all purlin connections which form a part of the bracing system. Provide two- or three-span continuous purlins, with splices staggered on alternate trusses. Provide splice plate at web of purlins with two 19-mm-diameter (3/4-inch-diameter) machine bolts in each purlin, unless otherwise indicated.

Q. Connections for Other Work.
1. Notify other trades so that holes in structural steel can be provided for attachments where required. Provide necessary holes if information is received prior to fabrication.
2. Make provisions in structural steel for the following:
   a. Future expansion where shown.
   b. Connections to existing building where required.
3. Unless otherwise indicated, holes for attachment of wood blocking: 13 mm (1/2 inch) diameter at 600-mm (24-inch) spacing.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Enforce and supervise approved procedure for welding during fabrication of structural steel by employing experienced supervisors knowledgeable of good welding practices.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
   3. Remove backing bars or run off tabs, back gouge and grind smooth as per AWS D1.1 requirements.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces on which metal floor deck shear studs are to be welded.
   5. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   6. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 6, "Commercial Blast Cleaning."

C. Primer:
   1. Fast-Dry Prime Coat:
      a. For shop coat and field touch-up:
         1) Tenemec 88HS 557, white.
         4) Carboline Carbocoat 115 SG 0700 gray.
         5) Sherwin Williams B 50 WV 8430, white.
   3. Paint for shop coat and field touch-up applied to steel which is to receive field-applied mastic fireproofing.

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize Items where noted on drawings.
   3. Safeguard against warpage and distortion during galvanizing in accordance with ASTM A384.
   4. Where welding is required after galvanizing, conform to AWS D19.0 Welding of Zinc Coated Steel. Perform welding in well-ventilated area.
   5. On bolts, nuts, and washers: ASTM B695, Class 50.
   6. Galvanizing Repair paint: ASTM A780.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
2. Detail the structural steel with a minimum of 1 inch (25 mm) of anchor rod (bolt) thread projecting above the nuts and the base plate hole 1-1/3 times the rod (bolt) diameter. Based on these procedures, the foundations shall be found acceptable if erection can be accomplished within AISC 303-05 tolerances for plumbness and elevation, and with minimum-maximum grout thickness of 1/2 to 2 inches (13 to 50 mm).

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

B. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

C. Design and provide temporary supports, such as guys, bracing, falsework, cribbing or other elements required for steel framework erection, including partly assembled steel framing in consideration of noted interaction items. Design temporary supports to withstand all loads to which the structure may be subjected during erection and subsequent construction, including erection equipment.

D. Furnish and place all temporary bracing necessary for erection before bolting or welding. Only light drifting will be permitted to draw parts together. Drifting to match unaligned holes will not be permitted. Perform enlargement of holes necessary to make connections resulting from misfit by drilling and reaming; then use the proper size bolt.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Comply with OSHA 29 CFR 1926, and all state, city and municipal laws for steel erection.

C. Foundation and anchor rods (bolts) are designed for the forces of completed structure. Forces due to erection are the responsibility of the Contractor.

D. Start steel erection only after concrete in the supporting structure such as footings, piers and walls or mortar in masonry piers and walls has attained minimum 75 percent of intended strength or sufficient strength to support the loads imposed during steel erection.

E. In planning the method of erection, make full allowance for obstructions encountered which may result from work performed by other trades as well as the operations of the Owner.

F. In planning the method of plumbing the structure, make allowance for temperature difference between time of erection and mean operating temperature of structure when completed. Take into account differential temperature effects on column lengths in plumbing when tall frames are subjected to strong sun exposure on one side.

G. Furnish and deliver to the job site anchor rods (bolts), and templates for setting the anchor rods (bolts).
   1. Lateral-load-resisting system and connecting diaphragm that provides lateral strength and stability in completed structure.
   2. Any special erection considerations that are required by design such as shores, jacks or load that must be adjusted during erection, etc.

H. All lateral load resistance and stability of the completed structure in each orthogonal direction is provided by moment frames and connection diaphragm elements of concrete.

I. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

J. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

K. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

L. Splice members only where indicated.

M. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

N. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

O. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

P. Elastomeric Bearings: Install elastomeric bearing per Division II, Section 18 of AASHTO Standard Specification for Highway Bridges and manufacturer's recommendations.

Q. Slide Bearings: Install slide bearing per Division II, Section 18 of AASHTO Standard Specification for Highway Bridges and manufacturer's recommendations.

R. Cables: Avoid damage to cables and their coating during erection. Do not drag over or around any objects that will scrub, abrade or distort the wires, thereby damaging protective coating or cable assemblies.

S. Pins and Rollers: Install pins and rollers per Section 11.4.9 of the AASHTO reference, Division II - Construction. Secure pins in position by hexagonal recessed nuts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.
   2. Provide a minimum of two (2) rows of bolts for beam connections. Begin connection near top of the web and extend them down to at least one half (1/2) of distance between web toes of fillet at top and bottom of web.
   3. Provide truss connections to column with symmetrical double angles and bolts designed for eccentricity and prying action. Provide minimum of six (6) high strength bolts for truss to truss or truss to column connection.
   4. ASTM A 307 bolts may be used for secondary members such as girts, door frames, parapet frames, small roof openings (less than 600 mm 24” square) and sag rods.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Field welding will be permitted only where indicated on approved Shop Drawings or where otherwise approved by the Architect. Perform field welding in accordance with the approved welding procedures and AWS D1.1 except as modified in Section J2 of AISC 360-05.
   3. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
   4. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
   5. Remove backing bars or runoff tabs, back gouge and grind smooth as per AWS D1.1 requirements.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting"Section 099123 "Interior Painting."

END OF SECTION

SECTION 051400 – STRUCTURAL ALUMINUM – WWTP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural aluminum, including the fabrication and erection of framing and bracing members and connections.

B. Related Sections include, but are not limited to the following:
   1. Division 00, PROCUREMENT AND CONTRACTING REQUIREMENTS
   2. Division 01, GENERAL REQUIREMENTS
   3. Section 099600, HIGH PERFORMANCE COATINGS-WWTP

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. Aluminum Association (AA):
      a. ADM 1, The Aluminum Design Manual
      b. 45, Designation System for Aluminum Finishes
   2. American Institute of Steel Construction (AISC):
      a. Manual of Steel Construction
   3. ASTM International (ASTM):
      a. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
      b. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
      c. B247, Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and rolled Ring Forgings
      d. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
      e. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
      f. F467, Standard Specification for Nonferrous Nuts for General Use
      g. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
      h. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
   4. American Welding Society (AWS):
      a. D1.2, Structural Welding Code – Aluminum

B. Qualifications:
   1. For welding aluminum: Qualify welding procedures and welding operators in accordance with AWS D1.2, welding operators to have been qualified during the 12-month period prior to commencement of welding.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 013300, SUBMITTAL PROCEDURES for requirements for the mechanics and administration of the submittal process.
   2. Fabrication and/or layout drawings:

a. Erection plans and details of each piece including connection details:
   1. Show all cuts, copes, and holes.
   2. Indicate all shop and field welds using AWS symbols.
   3. Indicate all shop and field bolts.
   4. Reviewed and sealed by Professional Engineer retained by Contractor to verify conformance with design criteria stipulated in the Contract Documents.
b. Complete shop drawings for all of the work showing clearly all pieces, details, connections, materials, and shop-applied coatings.
c. Prepare complete erection drawings showing the location and marks of all pieces.

3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
4. Certifications:
   a. Certificates of compliance with standards specified for all major components and fasteners incorporated into work.
   b. Copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.
5. Test reports:
   a. Certified copies of mill tests
   b. Manufacturer's load test and temperature sensitivity data for expansion anchor bolts and adhesive anchor bolts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER'S

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Expansion anchor bolts:
      a. Kwik Bolts by Hilti, Inc.
      b. Trubolt by ITW Ramset/Red Head
      c. Powerbolt by Powers Rawl
      d. Or equal.
   2. Adhesive anchor bolts:
      a. HVA Adhesive Anchor System by Hilti
      b. HIT HY 150 Adhesive Anchor by Hilti
      c. HSE 2411 Epoxy Adhesive Anchor by Hilti
      d. EPCON Ceramic 6 Epoxy by ITW Ramset/Red Head
      e. Power Fast by Powers Rawl
      f. Needle Capsule Anchor Systems by Powers Rawl
      g. Or equal

2.2 MATERIALS

A. Alloy 6061-T6, 32,000 psi tensile yield strength minimum:
   1. ASTM B209 for sheets and plates
   2. ASTM B210 for tubes

3. ASTM B221 and ASTM B308 for shapes: Beams, channels, angles, and tees
4. ASTM B247 for forgings

B. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum:
1. ASTM B221 and AASTM B429 for bars, rods, wires, and tubes.

C. Aluminum Bolts and Nuts: ASTM F467 and ASTM F468 of alloy 2024-T4 (62,000 psi tensile strength minimum).

D. Bolts and Nuts for fastening aluminum to structural steel: Stainless steel complying with ASTM F593, Type 303, 304, or 316 with a minimum yield strength of 30,000 psi and a minimum tensile strength of 75,000 psi.

E. Washers: Same material and alloy as found in bolts and nuts with which the washers are to be used.

F. Electrodes for Welding Aluminum: AWS D1.2 filler alloy 5356.

G. Expansion Anchor Bolts and Adhesive Anchor Bolts for Fastening to Concrete:
1. Where approved by Engineer.
2. Stainless steel, Type 304, 314, or 316.
3. Provide minimum edge distance cover and spacing as recommended by manufacturer or as indicated on Drawings:
   a. Minimum embedment as recommended by manufacturer or eight diameters of bolt whichever is larger.
   b. Notify Engineer if required depth of embedment cannot be achieved at a particular anchor bolt location.
   c. Follow manufacturer's recommendations for installation and torque.
   d. Submit manufacturer's load test data to verify at least the anchor bolt capacities at the following embedment depths:

ANCHOR BOLT DIAMETER (IN)	EMBEDMENT (IN)	MINIMUM ULTIMATE TENSION CAPACITY (KIP)*,**
3/8	3	4.8
1/2	4	8.1
5/8	5	11.4
3/4	6	15.4
7/8	7	20.0
1	8	24.7
1 1/4	10	34.3

   e. Data must be based on actual tests performed in unreinforced mass concrete of not more than 4000psi compressive strength.
   f. Capacity must be at a concrete temp. of at least 130 deg F.

2.3 DESIGN CRITERIA

A. Where final design of members and connection for any portion of structure is not indicated, perform final design of such members and connections.

B. Final designs of members and connections shall conform to AA ADM 1 and to details and requirements shown on Drawings:
1. Design loads for members and connections shall be as shown on Drawings.

2.4 FABRICATION

A. Fabrication of bolted and welded connections of aluminum work shall be in accordance with AA ADM 1.

B. Contractor to be solely responsible for correctness of all shop and field fabrication and fit, verify field conditions and dimensions prior to fabrication.

C. Fabricate aluminum work and assemble in shop to greatest extent possible, make splices only where indicated or approved.

D. Provide connections as indicated. Where not indicated, design and provide connections in accordance with requirements of this Section. One-sided or other types of eccentric connections are not acceptable unless indicated on Contract Drawings or approved on shop drawings.

E. Drill or punch holes at right angles to surface of metal. Do not make or enlarge holes by burning. Provide holes clean and free of torn or ragged edges. Use tools which will make 1/16 IN bevel to remove outside burrs resulting from drilling or punching operations.
   1. Punch or drill for field connections and for attachment of work by other trades.

F. Cope at 45 degrees corners of stiffener plates at junction of member flanges with webs.

G. Welding: Weld connections to members in shop and bolt connections in field. Perform welding using electrodes of filler alloy 5356, perform welding in accordance with AWS D1.2, use only welding procedures and welding operators qualified in accordance with requirements of paragraph 1.2 B “Qualifications”.

H. Form to shapes indicated with straight lines, true angles, and smooth curves. Grind smooth all rough welds and sharp edges:
   1. Round all corners to approximately 1/8 IN radius.

I. Finish: Anodized:
   1. Architectural Class 1 coater per AA 45:
      a. Clear anodized AA-M12C22A413.

PART 3 - EXECUTION

3.1 ERECTION

A. Contractor is solely responsible for safety. Construction means and methods and sequencing of work is the prerogative of the Contractor. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g. until decks and diagonal bracing or rigid connections are installed:
   1. Partially complete structural members shall not be loaded without an investigation by the Contractor.
   2. Until all elements of the permanent structure and lateral bracing system are complete, provide temporary bracing designed, finished, and installed by the Contractor.

B. Bolting:
   1. Protect bolt threads from damage.
   2. Rest bolt heads and nuts squarely against surfaces.

3. Where bolt heads or nuts rest on beveled surfaces having slope greater than 1 in 20 with planes normal to bolt axis, provide beveled washers to give full bearing to head and nut.
4. Correct poor matching of holes by drilling next larger size and using larger diameter bolt.
5. Connect aluminum members to:
   a. Aluminum members using ¾ IN DIA aluminum bolts of alloy 2024-T4.
   b. Structural steel using ¾ IN DIA stainless steel bolts.
   c. Concrete or masonry using stainless steel expansion anchor bolts or adhesive anchor bolts unless shown otherwise, provide dissimilar materials protection.

C. Welding: Field welding of aluminum is not allowed unless indicated on Drawings.

D. Correct fabrication errors and damaged members in shop, do not use cutting torch in shop or in field to cut any members, to correct fabrication errors, or to cut openings.

E. Provide templates for anchors, bolts, and other items to be installed in other work.

F. Field Assembly: Tolerances shall comply with the latest edition of AISC “Manual of Steel Construction”. Before members are assembled, thoroughly clean all bearing surfaces and surfaces that will be in permanent contact. After assembly, carefully align all members of each frame or assembly and accurately adjust until final, correct and true location is achieved. As work progresses, securely fasten in place:
   1. Provide full length members without splices.
   2. Securely tighten and leave in place all erection bolts used in welded construction, unless removal is required.

G. Set beam and column base plates accurately, as indicated on nonshrink grout, in accordance with Division 3:
   1. If not indicated, provide minimum of 1 IN grout thickness under base plates.
   2. Set and anchor each base plate to proper line and elevation:
      a. Use aluminum wedges, shims, or setting nuts for leveling and plumbing columns and beams, tighten anchor bolts.
      b. Fill space between bearing surface and bottom of base plate with nonshrink grout, fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
      c. Do not remove wedges or shims and where they protrude, cut off flush with edge of base plate.

H. Temporary Protection: Suitably protect aluminum surfaces against lime mortar stains, discoloration, surface abrasion and other construction abuses. Remove protection during predemonstration period.

I. Contact with Dissimilar Materials: Where aluminum surfaces will be embedded in concrete, built into masonry, or in contact with steel, concrete, or masonry, or other dissimilar materials, coat the aluminum surfaces as described in Section 099600, HIGH PERFORMANCE COATINGS.

END OF SECTION

SECTION 053100 – STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 ACTION SUBMITTALS

A. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Certificates for Credit MR 5.1 and Credit MR 5.2: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
   3. Laboratory Test Reports for Credit EQ 4: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Environmental Product Declarations (EPD): Submit steel floor and roof deck manufacturer’s EPD:

C. Shop Drawings:
   1. Include fabrication and erection drawings indicating layout and types of deck panels, bearing lengths, anchorage details, reinforcing of openings larger than 6 inches, reinforcing channels, pans, cut deck openings, special jointing, accessories, finishes, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Construction Loads: Submit plan for complying with both the maximum loads on deck before concrete hardens and with maximum live loads after concrete hardens. Plan shall confirm that all actual construction loads, including equipment, personnel, material stockpiles, etc. do not exceed the maximum allowable loads. If heavier construction loads will be used, deck shall be shored or deck gage increased.
   1. Should maximum loads on deck before concrete hardens exceed allowable, provide a shoring plan and supporting calculations prepared by a Professional Engineer licensed in the state of the project. Weight of wet concrete must distribute to the specified supporting beams to engage camber fall-out. Do not post shore down to lower levels. Shoring shall stay in place until slab reaches specified strength.

2. Should construction loads on hardened concrete exceed maximum live loads, provide a shoring and reshoring plan and supporting calculations prepared by a Professional Engineer licensed in the state of the project.

1.4 QUALITY ASSURANCE

A. Product Data: For each type of deck, accessory, and product indicated.

B. Testing Agency Qualifications and field quality control reports: Qualified according to ASTM E 329 for testing indicated.

C. Installer Qualification: Engage an experienced installer who has successfully installed steel deck similar in material, design and extent that is indicated for this project.

D. Product Tests, Evaluation Reports and Certificates: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Each type of steel deck.
   2. Power-actuated mechanical fasteners.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

F. Shop Painting: Paint top coats and other coatings to be applied over shop primers shall be compatible with shop primers.

G. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

H. Fire-resistance rating: For each type of steel deck assembly. Indicate steel deck assembly compliance with performance requirements for fire-resistance rating.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

C. Do not use decking for storage or as working platforms until it has been permanently secured in position.

D. Maximum load on deck before concrete hardens; wet weight of concrete plus 30 psf uniformly distributed, or concentrated load of 150 pounds on one square foot section of deck.

E. Maximum uniformly distributed load on roof deck: the design live load of the deck as indicated on the drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. The steel deck and concrete of specified type and thickness which is indicated to be fire-rated shall be as listed in the "UL Fire Resistance Directory" under the applicable Design No. or from the listings of another qualified testing agency for - hour rating. Indicate UL listing mark or appropriate design designations.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Environmental product Declaration: Provide Type III Product Specific Evironmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.
   1. The GWP of structural products must not exceed the limits indicated in the table below.

PRODUCT	MAX. ACCEPTABLE GWP (kg CO2/MT)
Floor and Roof Decking	2,330

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company.
   2. Canam United States; Canam Group Inc.
   3. Consolidated Systems, Inc.; Metal Dek Group.
   4. Cordeck.
   5. Epic Metals Corporation.
   6. New Millennium Building Systems, LLC.
   7. Nucor Corp.; Vulcraft Group.
   8. Valley Joist; Subsidiary of EBSCO Industries, Inc.
   9. Verco Manufacturing Co.
   10. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Steel Roof Deck: Factory Mutual Global Approved per Loss Prevention Data Sheet 1-28, Design Wind Loads and Loss Prevention Data Sheet 1-29, Roof Deck Securement and Above-deck Roof Components.
   2. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 50 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.

3. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50 minimum, G60 zinc coating.
4. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50, G60zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
5. Deck Profile: As indicated.
6. Profile Depth: As indicated.
7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated .
8. Span Condition: As indicated.
9. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company.
   2. Canam United States; Canam Group Inc.
   3. Consolidated Systems, Inc.; Metal Dek Group.
   4. Cordeck.
   5. Epic Metals Corporation.
   6. New Millennium Building Systems, LLC.
   7. Nucor Corp.; Vulcraft Group.
   8. Roof Deck, Inc.
   9. Verco Manufacturing Co.
   10. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 50 minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard gray baked-on, rust-inhibitive primer.
   2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50 G60 zinc coating.
   3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50 G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
   4. Profile Depth: As indicated
   5. Design Uncoated-Steel Thickness: As indicated.
   6. Span Condition: As indicated.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

1. Minimum 1/2 inch (12 mm) diamter steel washers, knurled shanks, ballistic points, and electroplated zinc conforming to ASTM B 633, SC 1, Type III.
2. Powder-actuated mechanical fasteners recognized by ICC-ES AC43, SDI listed and approved by Factory Mutual and Underwirter's Laboratories for wind uplift.
3. Powder-actuated mechanical fasteners listed by Underwriter's Laboratories for fire resistive steel roof deck assemblies in accordance with TLSX & TGKX designs.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equivalent that is recommended for application:
   a. Hilti X-ENP-19 L15 or X-HSN-24 types as recommended for application.

C. Side-Lap Fasteners: As indicated

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 50,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 50,000 psi, of same material and finish as deck, and of thickness and profile indicated and recommended by SDI Publication No. 31 for overhang and slab depth to support the wet weight of concrete plus 30 psf (958 Pa) construction load.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inchminimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A 780, SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Comply with OSHA, and all other state, city and municipal laws for steel deck erection.

C. Install temporary shoring before placing deck panels if required to meet deflection limitations.

D. Locate deck bundles to prevent overloading of supporting members.

E. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

F. Provide decking of length required to span a minimum of three spans, unless otherwise indicated.

G. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

H. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

I. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

J. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

K. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

L. Clean soiled deck prior to construction.

M. Do not use deck for storage or working platform until units have been secured in position. Distribute loads by appropriate means to avoid deck damage during construction. Repair or replace damaged deck, at no cost to the Owner, as deemed necessary by the structural engineer.

N. Adequately protect deck areas subjected to heavy or repeated traffic, concentrated loads, impact loads or wheel loads by planking or other means to avoid deck damage. Repair or replace damaged deck, at no cost to the Owner, as deemed necessary by the structural engineer.

O. Provide a continuous, smooth, straight line deck surface, free of obstructions, with adjacent flanges varying no more than 1/16 inch (1.6 mm) when a straight edge is laid across them.

P. Do not use steel deck for hanging supports for any type or kind of building component including, but not limited to, suspended ceilings, electrical light fixtures, electrical conduit, plumbing, and heating or air conditioning piping and ductwork.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: 5/8 inch, nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
   3. Weld Washers: Install weld washers at each weld location.

B. Fasten roof-deck panels to steel supporting members with mechanical fasteners in accordance with manufacturer's instructions including appearance and quality of fastening of the steel deck. Use only certified or licensed powder-actuated fastening system operators.
   1. Bring steel deck units into direct contact with structural steel supporting members or steel bar joists prior to and during powder-actuated mechanical fastening. Moisture may be present on deck surface during powder-actuated mechanical fastening.
   2. Fasten steel deck units to structural steel supports or steel bar joists as noted in the Drawings. Powder-actuated mechanical fasteners shall achieve adequate penetration of the steel deck and supporting member in accordance with manufacturer instructions. Powder-actuated mechanical fasteners shall be appropriately gauged to the base material thickness and hardness prior to final fastening. Mechanical shear connectors placed on mechanical fastener locations may be considered to replace those fasteners.
   3. Powder-actuated mechanical fasteners shall achieve adequate penetration of the steel deck and supporting member in accordance with manufacturer instructions. Powder-actuated mechanical fasteners shall be appropriately gauged to the base material thickness and hardness prior to final fastening.

C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 6 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
   2. Mechanically clinch or button punch.
   3. Fasten with a minimum of 1-1/2-inch- long welds.

D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

G. Cant strips: Install per manufacturer's recommendations.

H. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

I. Openings: Cut and neatly fit openings for vents, piping, ductwork and other mechanical equipment services to the size, dimensions and shapes necessary for proper functioning, as indicated. Make openings using saw; torching or burning is not permitted.

J. Openings: Reinforce holes and openings with sheet steel as indicated. Sheet steel to be a minimum of 12 inches (300 mm) wider and longer than opening and fastened to deck at corners and at a maximum spacing of 6 inches (300 mm) on each side.
   1. Holes and openings 8 inches (200 mm) across or smaller to be reinforced with 0.0474 (1.20 mm) inch sheet steel
   2. Holes and openings 8 inches (200 mm) to 13 inches (325 mm) across to be reinforced with 0.0598 inch (1.52 mm) sheet steel

3.4 FLOOR AND FORM DECK INSTALLATION

A. Clean soiled deck prior to installation.

B. Install decking independent of stud shear connectors. Do not use welding of shear connectors as a method of fastening the decking

C. Cut and neatly fit deck panels around openings and around other work projecting through or adjacent to decking.

D. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 5/8 inch3/4 inch, nominal.
   2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
   3. Weld Spacing: Space and locate welds as indicated.
   4. Weld Washers: Install weld washers at each weld location.

E. Fasten steel deck panels to steel supporting members with mechanical fasteners in accordance with manufacturer's instructions including appearance and quality of fastening of the steel deck. Use only certified or licensed powder-actuated fastening system operators.
   1. Bring steel deck units into direct contact with structural steel supporting members or steel bar joists prior to and during powder-actuated mechanical fastening. Moisture may be present on deck surface during powder-actuated mechanical fastening.
   2. Powder-actuated mechanical fasteners shall achieve adequate penetration of the steel deck and supporting member in accordance with manufacturer instructions. Powder-actuated mechanical fasteners shall be appropriately gauged to the base material thickness and hardness prior to final fastening. Mechanical shear connectors placed on mechanical fastener locations may be considered to replace those fasteners.

F. SG Note: Typically deck spans on SG projects exceed 60 inches.

G. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 18” inches, and as follows:
   1. Mechanically clinch or button punch.

H. Provide and weld cover plates as per SDI recommendations where deck changes direction.

I. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches (50 mm), with end joints as follows:
   1. End Joints: Lapped or butted at Contractor's option.

J. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

K. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
   2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 054000 - COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
3. Ceiling joist framing.
4. Soffit framing.

1.2 ACTION SUBMITTALS

A. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
2. Product Data: Environmental Product Declaration (EPD).
3. Product Data: Material Ingredient Documentation.
4. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers".
5. Product Data: For galvanizing repair paints indicating compliance with General Emissions Evaluation and VOC content requirements.
6. Product Data: Indicating Lead and Cadmium free paint

B. Product Data: For each type of product.

C. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

D. Delegated-Design Submittal: For cold-formed steel framing.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency or performed by a qualified testing agency.
1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips

7. Miscellaneous structural clips and accessories.

D. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

D. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

E. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Exterior Non-Load-Bearing Framing providing backup for masonry veneer or EIFS: Horizontal deflection of 1/600 of the wall height.
   b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/180 of the wall height under a horizontal load of 5 lbf/sq. ft.
   c. Ceiling Joist Framing: Vertical deflection of 1/180 of the span for live loads and 1/240 for total loads of the span.

3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 3/4 inch.
4. Design framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts as required to provide a complete and stable wall-framing system.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S240

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

F. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification where the manufacture is recognized as the participant by the program operator in accordance with ISO 14025, and EN 15804 or ISO 21930 and that has a cradle to gate scope.

G. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 (1000 ppm).

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with AISI S240 for conditions indicated.

B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: ST33H or ST50H As required by structural performance.
2. Coating: G60.

C. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 50, Class 1.
2. Coating: G60.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch or larger as required by engineering analysis.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: As required by design.
   2. Flange Width: 1 inch plus twice the design gap.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: As required by design.
      b. Flange Width: 1 inch plus twice the design gap.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: As required by design .
      b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by design.
   2. Flange Width: 1-5/8 inches minimum or as required by design.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs or as required by design.
   2. Flange Width: As required by design.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: As required by design.
   2. Flange Width: 1 inch plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: As required by design.
      b. Flange Width: 1 inch plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:
   a. Minimum Base-Metal Thickness: As required by design.
   b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

2.5 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by design.
   2. Flange Width: 1-5/8 inches minimum or as required by design, minimum.

2.6 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by design.
   2. Flange Width: 1-5/8 inches minimum unless otherwise required by design, minimum.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Foundation clips.
   5. Stud kickers and knee braces.
   6. Joist hangers and end closures.
   7. Hole-reinforcing plates.
   8. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M.

1. General Emissions Evaluation: Products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Evaluation must state the applicable exposure scenario, total VOC (TVOC) content range, as well as the amount applied in mass per surface area (for wet applied products.
2. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
3. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, and sealants.
4. Lead- and cadmium shall not be intentionally added in paints,

B. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, as required to provide a complete and stable framing system.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track and top track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inches or less as indicated on shop drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Connect vertical deflection clips to studs where required and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
   1. Install solid blocking at 96-inch centers.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inchesor less/more as indicated on shop drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support by one of the following systems.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
   1. Install solid blocking at 96-inchcenters.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inchesfrom abutting walls, and as follows:
   1. Joist Spacing: –16 inches.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
   1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
   2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 054300 – SLOTTED CHANNEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel framing and supports for the following:
      a. Medical equipment.
      b. Applications where framing and supports are not specified in other Sections.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Convene a preinstallation conference at project site before start of installation of support systems. Require attendance of parties directly affecting work of this section, including General Contractor or Owner representative, Mechanical, Plumbing and Electrical Contractor, Equipment representative and support system installer. Review the following:
   1. Shop Drawings.
   2. Sequencing.
   3. Existing Interferences.
   4. Mechanical, Plumbing, and Electrical installation coordination.
   5. Time restrictions.
   6. Access to areas.
   7. Finished Ceiling Elevations.
   8. Reflected Ceiling Plan light fixture locations.
   9. Final equipment center-point/iso-center locations.

1.3 ACTION SUBMITTALS

A. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

B. Shop Drawings: Drawings showing complete system including plans, section, and system details. Center point/Iso-centers of equipment shall be located off of finished wall lines. Show manufacturer's parts by catalog numbers, fabricated parts, and fasteners and hardware.

C. Delegated-Design Submittal: Refer to Section 013573 "Delegated Design Requirements and Procedures" for delegated design submittal procedures and requirements.
   1. Provide delegated-design submittals for the following:
      a. Slotted channel framing.
      b. Connection to building construction.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity approved by equipment support system supplier.

B. Material Quality Assurance: Submit certification that products comply with specified requirements and are suitable for intended application.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a registered design professional, as defined in Section 013573 "Delegated Design Requirements and Procedures" to design products and systems indicated.
   1. Material properties indicated in this Section shall be considered as minimum properties.

B. Design framing systems to provide for movement of framing members without damage or overstressing, connection failure, undue strain on fasteners and anchors, or other detrimental effects.

C. Ceiling Channel Grids shall be a universal grid or per manufacturer™™s drawing -type consisting of 12 Gage, 1-5/8 inch cold-formed channel rails flush with the finished ceiling and extending wall to wall unless otherwise noted on the reflected ceiling plans and shall be perpendicular to the path of travel of the equipment.

D. Ceiling Direct Mounting Channel Systems shall be single channels consisting of 12 Gage, 1-5/8 inch cold-formed channel rails flush with the finished ceiling and extending wall to wall unless otherwise noted on the reflected ceiling plans and shall be parallel to the path of travel of the equipment. Take-Up rails finish painted white with trolleys shall be provided and installed with these systems.

E. The building structural members, elevations, and room layout shall be fully coordinated for the design of all supports. Equipment loads must be adequately supported from the building structural members and distributed accordingly. Floor to floor distances, finished ceiling elevations, room locations, and building support structure elevations must all be coordinated for appropriate design of support systems for proper understanding of required hanger lengths, bracing requirements, attachment design, etc.

F. Loads to be used shall be per each equipment manufacturer™™s specification.

G. An overall system minimum factor of safety of two shall be used for strength design.

H. Minimum rotational requirements, unless otherwise stated in the equipment manufacture's specifications, shall be as follows:
   1. For all light and gas/service column/booms: Maximum rotation on the equipment mounting plate shall be no greater than 0.20 degrees per 12 inches.
   2. For all Ceiling Channel Grids and Ceiling Channel Systems: Maximum deflection on the system shall be no greater than 0.0625 inch for any one location of worst case loading on the system.

I. All systems shall be adequately braced in all four directions for lateral loading. If no lateral loading is specified by the equipment manufacturer™™s specifications, 1/10th of the static downward loading shall be applied in the horizontal axis. Movement shall not exceed the total for that allowed on the system at the worst case loading condition.

J. For ceiling channel, rails shall be designed for no more than 1/720th of the span maximum deflection in either plane when maximum loading conditions are applied due to equipment operation.

K. Ceiling channel shall be installed horizontal in plane and parallel to each other within 1/32nd of an inch.

L. Anchorage to the existing structure shall be as designed by the structural engineer of the system.
   1. Mechanical anchors into concrete shall be designed with a minimum factor of safety of 6 and shall be either expansion bolts, epoxy anchors, or through bolts with backing plate.
   2. Anchorages into existing concrete shall not penetrate existing reinforcing bars.
   3. Connections to structural steel shall be clamp-on fittings or field welding.
   4. Drilling through truss bottom chords shall not be allowed.

2.2 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. Unistrut Corporation (Basis of Design).

2.3 MATERIALS

A. Channel: All cold-formed channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A1011 SS GR 33 or A653 GR 33. Channel shall be 1-5/8 inch framing system 12 Gage. Minimum yield strength shall be 33 ksi.

B. Fittings: All cold-formed fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A575, A576, A36, or A653. Minimum fitting thickness shall be 1/4 inch with physical requirements per A1011. Minimum yield strength shall be 33 ksi.

C. Channel Nuts: All channel nuts shall be fabricated from steel conforming to ASTM specification A1011 SS GR 33.

D. Bolts and Fasteners: All bolts and fasteners used in connections shall be minimum SAE Grade 5, EG finish. Threaded Rod Grade B7.

E. Hot Rolled Structural Steel: ASTM A36 minimum.

F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

2.4 FINISHES

A. All cold-formed channel and/or fitting members shall be finished in accordance with one of the following standards:
   1. Electro-Galvanized (EG): Electrolytically zinc coated per ASTM B633 Type III SC 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which systems are to be installed. Notify Architect of areas or conditions not acceptable for support of system. Do not begin installation until unacceptable areas or conditions have been corrected.

B. Design all supports to work around mechanical ductwork, electrical lighting fixtures, and plumbing where possible. All efforts shall be fully coordinated prior to final design.

3.2 INSTALLATION

A. For ceiling channel, rails shall be on centers at 2'-2" center to center as required by equipment manufacturer and allow continuous attachment along any point on the rail. System shall be true, plumb, and level to the tolerances specified.

B. Framing shall be adjusted as required in the field to avoid interferences.

C. Hammer drilling times shall be coordinated in existing facilities with the Owner.

D. All bolted connections into cold-formed channel members with channel nuts shall be tightened to a minimum:
   1. 50 ft-lbs for 1/2 inch bolts.
   2. 100 ft-lbs for 5/8 inch bolts.
   3. 125 ft-lbs for 3/4 inch bolts.

E. All bolted connections for structural steel joints shall be per ASIC Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts.

F. Supply and install all required threaded rod, hex nuts, flat washers, lock washers for exam and surgical lights and gas/service column/booms unless indicated otherwise.

G. Install wall mold on Ceiling Channel Grids and Ceiling Direct Mounting Channel Systems in rooms to receive lay-in ceiling tile where applicable.

H. Shear off tek screws on the inside of the ceiling channel for equipment mounting block installation.

I. Do not bridge building expansion joints with slotted channel framing. Independently frame both sides of joints.

J. Make possible attachment of equipment support rails at any point along support system without drilling or welding into system.

K. Attach to overhead construction using embedded concrete inserts, through-bolts, or direct attachment to structural framing.

L. Rigidly fix and brace support structure against sway.

M. Integrate design and connections with adjacent construction.
   1. Accommodate allowable tolerances and deflections for structural members in installation.
   2. Coordinate with reflected ceiling plan and other items indicated to be placed in, or above ceiling to ensure equipment support system does not interfere with or dislocate other items.

N. Supply and install white snap-in closure strips into the open ceiling channel as required after the equipment has been installed unless installation labor is agreed to otherwise at the time of contract agreement.

3.3 CLEANUP

A. Upon completion of this section of work, remove all protective wraps and debris. Repair any damage due to installation of this section of work.

3.4 PROTECTION

A. Protect installed work from subsequent construction damage.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Miscellaneous framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Elevator pit sump covers.
5. Miscellaneous steel trim.
6. Metal bollards.
7. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Metal bollards.
6. Metal ladders.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Elevator machine beams, hoist beams, and divider beams.
3. Steel shapes for supporting elevator door sills and hoistway entrances.
4. Steel girders for supporting wood frame construction.
5. Steel pipe columns for supporting wood frame construction.
6. Prefabricated building columns.

7. Shelf angles.
8. Metal ladders.
9. Elevator pit sump covers.
10. Miscellaneous steel trim .
11. Metal bollards.
12. Loose steel lintels.

C. Delegated-Design Submittal: Refer to Section 013573 "Delegated Design Requirements and Procedures" for delegated design submittal procedures and requirements.
1. Provide delegated-design submittals for the following:
a. Slotted channel framing.
b. Ladders.

D. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For galvanizing repair paints indicating compliance with General Emissions Evaluation and VOC content requirements.
3. Product Data: Indicating Lead and Cadmium free paint.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

B. Provide the following upon request:
1. Certificates:
a. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
b. Welding certificates.
c. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
2. Research Reports: For post-installed anchors.
3. Delegated design engineer qualifications.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a registered design professional, as defined in Section 013573 "Delegated Design Requirements and Procedures" to design slotted channel framing and ladders.

1. Material properties indicated in this Section shall be considered as minimum properties.

B. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.3 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

D. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316L.

E. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A53/A53M, Standard Weight unless otherwise indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
1. Size of Channels: As indicated.
2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

I. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

J. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

K. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

L. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening aluminum and stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Chemical anchors.
   1. Material f: Alloy Group 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
   1. General Emissions Evaluation: Products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Evaluation must state the applicable exposure scenario, total VOC (TVOC) content range, as well as the amount applied in mass per surface area (for wet applied products.
   2. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
   3. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, and sealants.
   4. Lead and cadmium shall not be intentionally added in paints,

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports.

D. Prime miscellaneous framing and supports with .

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3.
   2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Aluminum Ladders:
   1. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
   2. Space siderails 18 inches apart unless otherwise indicated.
   3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
   4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
   5. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
   6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
   7. Provide minimum 72-inch- high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.10 PERSONAL FALL ARREST DEVICES

A. Personal Fall Arrest Devices; Manufactured system consisting of pipe, channels or stainless steel cables designed to be secured to ladder. Include mounting brackets, and traveling devices for complete installed system.
   1. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, include but are not limited to, the following:
      a. FIxFastUSA.
      b. Granger Inc.
      c. Industrial Safety Products.
   2. Pipe and channels shall be aluminum, galvanized steel or stainless steel

2.11 ELEVATOR PIT SUMP COVERS

A. Fabricate from 1/8-inch abrasive-surface floor plate with four 1-inch- diameter holes for water drainage and for lifting.

B. Provide steel angle supports unless otherwise indicated.

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime miscellaneous steel trim with zinc-rich primer.

2.13 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.14 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.15 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.16 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

B. Fabricate sleeves for bollard anchorage from steel or stainless steel pipe with 1/4-inch-thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

C. Prime steel bollards with zinc-rich primer.

2.17 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.18 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
   1. Hot-dip galvanize steel fabrications.
   2. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
   5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.19 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for ceiling anchored toilet partitions overhead doors securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction.

3.3 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.5 INSTALLATION OF ELEVATOR PIT SUMP COVERS

A. Install tops of elevator sump pit cover plates and frames flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.6 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.7 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
   1. Do not fill removable bollards with concrete.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.8 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.9 REPAIRS

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
      a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS - WWTP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Miscellaneous framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Elevator pit sump covers.
5. Miscellaneous steel trim.
6. Metal bollards.
7. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Metal bollards.
6. Metal ladders.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Elevator machine beams, hoist beams, and divider beams.
3. Steel shapes for supporting elevator door sills and hoistway entrances.
4. Steel girders for supporting wood frame construction.
5. Steel pipe columns for supporting wood frame construction.
6. Prefabricated building columns.
7. Shelf angles.

8. Metal ladders.
9. Elevator pit sump covers.
10. Miscellaneous steel trim .
11. Metal bollards.
12. Loose steel lintels.

C. Delegated-Design Submittal: Refer to Section 013573, DELEGATED DESIGN REQUIREMENTS AND PROCEDURES for delegated design submittal procedures and requirements.
1. Provide delegated-design submittals for the following:
a. Slotted channel framing.
b. Ladders.

D. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For galvanizing repair paints indicating compliance with General Emissions Evaluation and VOC content requirements.
3. Product Data: Indicating Lead and Cadmium free paint.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

B. Provide the following upon request:
1. Certificates:
a. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
b. Welding certificates.
c. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
2. Research Reports: For post-installed anchors.
3. Delegated design engineer qualifications.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a registered design professional, as defined in Section 013573, DELEGATED DESIGN REQUIREMENTS AND PROCEDURES to design slotted channel framing and ladders.
1. Material properties indicated in this Section shall be considered as minimum properties.

B. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.3 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

D. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316L.

E. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A53/A53M, Standard Weight unless otherwise indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: As indicated.
   2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

I. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

J. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

K. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

L. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum and stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Chemical anchors.
1. Material f: Alloy Group 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
1. General Emissions Evaluation: Products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Evaluation must state the applicable exposure scenario, total VOC (TVOC) content range, as well as the amount applied in mass per surface area (for wet applied products.
2. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
3. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, and sealants.
4. Lead and cadmium shall not be intentionally added in paints,

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000, CAST-IN-PLACE CONCRETE-WWTP for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports.

D. Prime miscellaneous framing and supports with .

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3.
   2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Aluminum Ladders:
   1. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
   2. Space siderails 18 inches apart unless otherwise indicated.
   3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
   4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
   5. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
   6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
   7. Provide minimum 72-inch- high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.10 PERSONAL FALL ARREST DEVICES

A. Personal Fall Arrest Devices; Manufactured system consisting of pipe, channels or stainless steel cables designed to be secured to ladder. Include mounting brackets, and traveling devices for complete installed system.
   1. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, include but are not limited to, the following:
      a. FIxFastUSA.
      b. Granger Inc.
      c. Industrial Safety Products.
   2. Pipe and channels shall be aluminum, galvanized steel or stainless steel

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime miscellaneous steel trim with zinc-rich primer.

2.12 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.13 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.14 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.15 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

B. Fabricate sleeves for bollard anchorage from steel or stainless steel pipe with 1/4-inch-thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

C. Prime steel bollards with zinc-rich primer.

2.16 ALUMINUM INTERIOR ACCESS COVERS

A. Interior type extruded aluminum single leaf or double leaf of size as shown; Halliday Series S; or equal.

B. Component Fabrication:
1. Access Door Leaf(s): 1/4-inch diamond pattern plate with reinforcing on underside to withstand a minimum live load of 150 pounds per square foot for interior hatches and 300 pounds per square foot for exterior hatches, with maximum deflection of 1/150th of the span.
2. Channel Frame: 1/4-inch with full anchor flange around perimeter and built-in neoprene cushion.
3. Equip door(s) with concealed cast galvanized or stainless steel hinges for interior hatches, stainless steel hinges for exterior hatches, and stainless steel pins for all hatches.
4. Hinges shall be bolted to underside and pivot on torsion bars that counter balance the door for easy operation.
5. Equip doors with fully enclosed and lubricated compression springs with lower enclosing telescopic tube locked into supporting "boot" firmly attached to frame to retard downward motion of door leaves.
6. Equip doors with hold-open arm with positive locking device with conveniently positioned release handle for easy and controlled closing.
7. Provide stainless steel snap lock mounted on bottom of leaf with removable topside handle and socket recessed in cover and provided with threaded plug for flush surface with handle removed.
8. Provide exterior covers with 1 ½-inch drainage coupling in the corner of channel frame. Route drain to sump, or as shown on the Drawings. Interior covers shall seal without drain.
9. Provide fall protection grating under the door leaf(s) rated for the same live load as the door leaf(s).
10. Hardware: Type 316 stainless steel.

C. Aluminum Finish: Mill finish with bituminous coating applied to surfaces in contact with concrete.

D. Furnish with ladder safety post as specified hereinafter where shown on the Drawings.

E. Furnish manufacturer guarantee against defects in materials and workmanship for a period of at least 5 years.

2.17 LADDER SAFETY POSTS

A. Where indicated on the Drawings, equip ladders or manhole steps installed beneath floor openings with telescoping tubular safety post, spring balanced and automatically locking in the raised position, with release lever for unlocking.
1. Aluminum post.
2. Spring Mechanism: Corrosion-resistant steel alloy.

3. Manufacturer:
    a. Halliday Products, Ladder Extension Model L1E.
    b. Or equal.

2.16 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.17 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
    1. Hot-dip galvanize steel fabrications.
    2. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
    1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
    1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
    2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
    3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
    4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
    5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
    1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.18 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for ceiling anchored toilet partitions overhead doors securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction.

3.3 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.5 INSTALLATION OF ELEVATOR PIT SUMP COVERS

A. Install tops of elevator sump pit cover plates and frames flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.6 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.7 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
   1. Do not fill removable bollards with concrete.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.8 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.9 REPAIRS

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
      a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Preassembled steel stairs with concrete-filled treads.
   2. Steel tube railings and guards attached to metal stairs.
   3. Steel tube handrails attached to walls adjacent to metal stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.
   1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete.
   2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
   1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:
   1. Prefilled metal-pan-stair treads.
   2. Nonslip-aggregate concrete finish.
   3. Handrail wall brackets.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

D. Samples for Verification: For each type and finish of nosing

E. Delegated-Design Submittal: Refer to Division 01 sections for delegated design submittal procedures and requirements. Design to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional responsible for their preparation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. Provide the following upon request:
1. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.
2. Welding certificates.
3. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.
1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a registered design professional, as defined in Section 014000 "Quality Requirements," to design stairs, railings and guards, including attachment to building construction.
1. Material properties indicated in this Section shall be considered as minimum properties.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
   b. Infill load and other loads need not be assumed to act concurrently.
3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.5.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25percent.

C. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

D. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed).
1. Provide galvanized finish for exterior installations and where indicated.

E. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight, unless another grade and weight are required by structural loads.

F. Galvanized-Steel Sheet: ASTM A653/A653M, G90 coating, either commercial steel, Type B, orstructural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

A. General: Provide Type 304 stainless steel fasteners.
1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts.

2.4 MISCELLANEOUS MATERIALS

A. Handrail Wall Brackets: Cast stainless steel, refer to Drawings for center of rail dimension from face of wall.

B. Welding Electrodes: Comply with AWS requirements.

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 ASTM A780/A780M and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Prefilled Concrete Treads:
1. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.
2. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
3. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, galvanized steel, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated on Drawings.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.
1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 1 - Fully dressed with no evidence of weld, spatter removed..

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:
1. Fabricate stringers steel channels or steel rectangular tubes.
   a. Stringer Size: As indicated on Drawings, but not less than as required to comply with performance requirements.
   b. Provide closures for exposed ends of channel and rectangular tube stringers.
   c. Finish: Galvanized.
2. Construct platforms of steel channel or rectangular tube headers and miscellaneous framing members as indicated on Drawings, but not less than as reqited to comply with performance requirements.
   a. Provide closures for exposed ends of channel and rectangular tube framing.
   b. Finish: Galvanized.
3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below.
   a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
2. Steel Sheet: Uncoated, hot-rolled steel sheet unless otherwise indicated.
3. Steel Sheet: Galvanized-steel sheet, .
4. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
5. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
6. Shape metal pans to include nosing integral with riser.
7. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
   1. Rails and Posts: As indicated on Drawings.
   2. Picket Infill: square pickets as indicated on Drawings spaced to prohibit the passage of a 4-inch diameter sphere.

C. Welded Connections: Fabricate railings and guards with welded connections.
   1. Fabricate connections that are exposed to weather in a manner that excludes water.
      a. Provide weep holes where water may accumulate internally.
   2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
   3. Weld all around at connections, including at fittings.
   4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   5. Obtain fusion without undercut or overlap.
   6. Remove flux immediately.
   7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint as shown in NAAMM AMP 521.

D. Form changes in direction of railings and guards as follows:
   1. By radius bends of radius indicated.

E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing and guard members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
   1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

H. Connect posts to stair framing by direct welding unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
   1. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
   2. For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
   3. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
   1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
   1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
   1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.
   1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
   2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
   3. Comply with requirements for welding in "Fabrication, General" Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

3.3 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
   1. Space posts at spacing indicated or, if not indicated, as required by design loads.

B. Attach handrails to wall with wall brackets.
   1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
   2. Secure wall brackets to building construction as required to comply with performance requirements.and as follows:
      a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
      b. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.4 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 055119 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior metal grating stairs.
   2. Steel railings and guards.

B. Related Requirements:
   1. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design assignment indicated in this Section.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.
   1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
   2. Deliver such items to Project site in time for installation.

C. Schedule installation of railings and guards so wall attachments are made only to completed walls.
   1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:
   1. Gratings.
   2. Shop primer products.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachment to other work.
   2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
   3. Include plan at each level.
   4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated-Design Submittal: Refer to Section 013573 "Delegated Design Requirements and Procedures" for delegated design submittal procedures and requirements.
   1. Provide delegated-design submittals for the following:
      a. Stairs.
      b. Railings and guards.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Provide the following upon request:
   1. Qualification Data: For design professional's experience with providing delegated design engineering services of the kind indicated, including documentation that design professional is licensed in the jurisdiction in which Project is located.
   2. Welding certificates.
   3. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.
   1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
   2. Protect steel members and packaged materials from corrosion and deterioration.
   3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
      a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a registered design professional, as defined in Section 013573 "Delegated Design Requirements and Procedures" to design stairs, railings, and guards, including attachment to building construction.
   1. Material properties indicated in this Section shall be considered as minimum properties.

B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform Load: 100 lbf/sq. ft..
   2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
   5. Limit deflection of treads, platforms, and framing members to L/360.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      b. Infill load and other loads need not be assumed to act concurrently.
   3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.

D. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.

E. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.

F. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight, unless another grade and weight are required by structural loads.

G. Provide galvanized finish for exterior installations and where indicated.

H. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
   1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs.

E. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with ASTM A780/A780M and compatible with paints specified to be used over it.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.
1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 3 - Partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:
1. Fabricate stringers of steel channels.

a. Stringer Size: As required to comply with "Performance Requirements" Article.
b. Provide closures for exposed ends of channel stringers.
c. Finish: Galvanized.

2. Construct platforms and tread supports of steel plate or channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
a. Provide closures for exposed ends of channel framing.
b. Finish: Galvanized.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

D. Risers: Open.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
1. Rails and Posts: 1-1/2-inch- diameter top and bottom rails and posts.
2. Intermediate Rails Infill: 1-1/2-inch- diameter intermediate rails spaced as indicated on Drawings.

B. Welded Connections: Fabricate railings and guards with welded connections.
1. Fabricate connections that are exposed to weather in a manner that excludes water.
a. Provide weep holes where water may accumulate internally.
2. Weld all around at connections, including at fittings.
3. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #3 - Partially dressed weld with spatter removed as shown in NAAMM AMP 521.

C. Form changes in direction of railings and guards as follows:
1. By bending.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.
1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing and guard members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
   1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
   2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
   3. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.8 FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
   1. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Preparation for Shop Priming: For components to be painted, prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components to be painted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
   1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
   1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.
   1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

3.3 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
   1. Space posts at spacing indicated or, if not indicated, as required by design loads.
   2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
   3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
   4. Secure posts, rail ends, and guard ends to building construction as follows:
      a. Anchor posts to steel by welding or bolting to steel supporting members.

3.4 REPAIR

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 055200 – HANDRAILS AND RAILINGS - WWTP

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section includes designing, furnishing, and installing all aluminum handrails, guardrails, railings, and supports, complete.

1.2 GENERAL

A. Like items of materials provided hereunder shall be the end products of one manufacturer to achieve standardization for appearance, maintenance, and replacement.

B. See CONDITIONS OF THE CONTRACT, and Division 01, GENERAL REQUIREMENTS, which contains information and requirements that apply to the work specified herein and are mandatory for this project.

1.3 DEFINITIONS AND AGENCY ABBREVIATIONS

A. Handrails: Synonymous with terms; i.e., guardrail, railing system, ramp-rail system, and stair-rail system. Handrails are comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.

B. Toeboards: Vertical barrier at floor level usually erected on handrails along exposed edges of floor or wall openings, platforms, ramps, or stairs to prevent miscellaneous items from falling through.

C. ICC: International Code Council.

D. ICBO: International Conference of Building Officials.

E. IBC: International Building Code, latest edition, published by ICC.

F. Special Inspection: As governed by the IBC.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Indicate handrail profiles, sizes, connections, anchorage, splices, dowel lengths, size and type of fasteners, and accessories. Provide project-specific scale plans and elevations of handrails.
   2. Manufacturer’s literature and catalog data of handrail and components.
   3. Design Data: Calculations or test data using design performance loads specified hereinafter and include the following:
      a. Bending stress in, and deflection of, posts in accordance with ASTM E985.
      b. Stress in post base connection.
      c. Calculation of anchorage forces and comparison of these forces to ICBO Uniform Building Code recommendations regarding safe allowable design loads of anchorages.
      d. For concrete anchor spacings less than 12-anchor diameters and edge distances less than 6-anchor diameters, make a reduction in allowable pullout and shear values. Use published ICBO Report values for anchors without Special Inspection; or provide independent laboratory inspection services for ICC Report values with Special Inspection.

B. Quality Control Submittals:
   1. Manufacturer's assembly and installation instructions.
   2. Manufacturer's Certificate of Proper Installation in accordance with Section 019113, GENERAL COMMISSIONING REQUIREMENTS.
   3. Manufacturer's written recommendations describing procedure for maintaining handrails including cleaning materials, application methods, and precautions to be taken in the use of cleaning materials.
   4. Test Reports: Test data may supplement load calculations providing data covers the complete handrail system, including anchorage:
      a. Test data for handrail and components showing load and deflection due to load, in enough detail to prove handrail is strong enough and satisfies national, state, local standards, regulations, code requirements, and OSHA 29 CFR Subpart D and specifically 29 CFR 1910.23 and 1910.29, using design loads specified. Include test data for the following:
         1. Railing and post connections.
         2. Post and base connections.
         3. Railing wall connections.
         4. Railing expansion joint connections.
      b. Deflection Criteria: In accordance with ASTM E985 and design loads specified.
      c. Aluminum Rail Piping: Test data showing yield strength of pipe as-delivered equals or exceeds 35,000 psi.
      d. Concrete Anchors: Calculations and test data for review prior to use, on anchors other than those specified.

1.5 QUALITY ASSURANCE

A. Qualifications: Calculations required for design data stamped by a registered engineer licensed in the United States

B. Handrails, railings, and associated fittings, hardware, and specialties shall meet minimum requirements of national, state, and local standards, regulations, and code requirements, including OSHA and the current edition of the IBC, as they specifically apply to this project.

C. Perform work of this section according to the Aluminum Association (AA) ADM 1, Aluminum Design Manual and ASTM E985.

PART 2 - PRODUCTS

2.1 DESIGN PERFORMANCE

A. Structural Performance of Handrails: Design, test, fabricate, and install handrails to withstand the following structural loads without exceeding the allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in each of the respective components comprising handrails.
   1. Top Rail of Handrails: Capable of withstanding the following load cases applied:
      a. Concentrated load of 200 pounds applied at any point and in any direction in accordance with ICC IBC.
      b. Uniform load of 50 pounds per linear foot applied horizontally in accordance with ICC IBC.

c. Concentrated load need not be assumed to act concurrently with uniform loads in accordance with ICC IBC.

2. In-Fill Area of Railing Systems:
   a. Capable of withstanding a horizontal concentrated load of 200 pounds applied to one square foot at any point in the system including panels, intermediate rails, balusters, or other elements composing the in-fill area.
   b. Horizontal concentrated load need not be assumed to act concurrently with loads on top rails of handrails.
3. Mid-rails with corner returns shall withstand a 300-pound concentrated vertical load applied at any point or direction without damage and loosening of pipe, fittings, or attachment hardware.
4. Concrete Anchors for Handrail Wall Brackets: Anchors with a strength required by calculations with concrete strength assumed at 4,000 psi and not exceeding ICC IBC allowable loads for actual spacing, edge distance, and embedment.
5. Concrete Anchors: In accordance with ICC IBC allowable load values for size, length, embedment, spacing, and edge distance to match required loads shown in calculations.

2.2 ALUMINUM HANDRAILS

A. General:
   1. Furnish pre-engineered and pre-fabricated three rail handrail system or components as shown on the Drawings and as specified herein. Meet load and deflection criteria specified hereinbefore.
   2. Handrail system shall provide for field cutting of all posts to fit, prior to installation or attachment to, base connections.
   3. Provide toeboards at all handrails except where concrete curbs or gates are furnished.
   4. Pop rivets and glued railing construction are not permitted.

B. Manufacturers (listed or alternate manufacturers must meet performance and material specifications herein):
   1. Thompson Fabricating LLC, Tarrant, AL.
   2. Superior Aluminum Products, Inc.
   3. Or approved equal.

C. Rails, Posts, and Formed Elbows: Extruded Alloy 6105-T5, 6061-T6, or 6063-T6, minimum tensile strength of 38,000 psi and minimum yield strength of 35,000 psi, with special close tolerances for tight fit and excellent appearance. Use the same alloy throughout the project for railings to provide a uniform appearance.
   1. Miscellaneous Aluminum Parts: Alloy 6063-T6 or 6061-T6 extruded aluminum of adequate strength for all loads.
   2. Post and Railing: Nominal 1-1/2-inch diameter post and rail system.
      a. Rails: 1.900-inch outside diameter by 0.145-inch wall thickness, Schedule 40.
      b. Posts: 1.900-inch outside diameter by 0.200-inch wall thickness, Schedule 80.
      c. Provide solid dowel interconnectors of 6105-T5, 6061-T6, or 6063-T6 aluminum to fit tight inside the posts where required.
      d. Post Spacing: Maximum 6.0-feet horizontal spacing.

D. Fittings:
1. Top Mount Post Base:
   a. Cast aluminum to allow for cutting posts to accurate length in the field and to allow for tight fit of post base to top of concrete.
   b. Four holes in base for concrete anchors. For narrow walls or curbs, furnish two holes in base for concrete anchors with required edge distance.
   c. Manufacturer and Products: Thompson Fabricating; Part No. TBF-3.4 and Part No. TBF-3.2 for narrow walls and curbs.
2. Handrail and Post Fittings: Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements. Fittings shall match color and finish of pipe in handrails. Sand cast parts are not permitted.
3. Side Mounted Handrail Bracket: Extruded aluminum, Alloy 6063-T6 with two separate pieces, each with two holes for bolts or concrete anchors.
   a. Manufacturer and Product: Thompson Fabricating; Part No. TSM-1.5.
4. Concrete Anchors for Securing Bases and Brackets to Concrete: Type 304 or Type 316 stainless steel 1/2-inch by 5-1/2-inch concrete wedge anchors as specified in Section 055000, METALS FABRICATION - WWTP
5. Handrail Connections for Metal Stairway Stringers:
   a. Extruded aluminum bracket, Alloy 6063-T6.
   b. Brackets Bolts: 1/2-inch diameter Type 304 or Type 316 stainless steel bolts.
   c. Offset adjustable stair fitting of cast Al-mag, Part No. ABF.
   d. Manufacturer and Products: Thompson Fabricating; Part Nos. SMB-2 or SMB-3, ABF.
6. Handrail Connections for Metal Beams:
   a. Extruded aluminum bracket, Alloy 6063-T6.
   b. Bracket Bolts: 1/2-inch diameter Type 304 stainless steel bolts.
   c. Manufacturer and Products: Thompson Fabricating; Part Nos. SMB-2 or SMB-3. Use Part No. TSM-1.5 (one piece with four holes for bolts) if bracket is attached to flat side of a channel.
7. Handrail Wall Brackets: Cast Al-mag aluminum bracket, adjustable wall fittings, with provision for three 3/8-inch Type 304 stainless steel bolts or concrete wedge anchors.
   a. Manufacturer and Product: Thompson Fabricating; Part No. AWF.
8. Miscellaneous Rail to Post Fittings:
   a. Cast Aluminum Tee Fittings: Part Nos. TF-1 and TX-1.
   b. Cast Aluminum Ell Fittings: Part Nos. TE-1, TE-2, and TE-3.
   c. Aluminum Splice Lock: Part No. SL-1.
   d. Aluminum Expansion Joint Splice: Part No. ES-1.
   e. Formed Aluminum Wall Flange: Part No. CF-2.
   f. Manufacturer: Thompson Fabricating.
9. Toeboards and Accessories:
   a. Material: Molded or extruded 6063 or 6061 aluminum, minimum size and mounting as shown on the Drawings.
   b. Manufacturer: Thompson Fabricating.
10. Handrail Gate and Hardware: Furnish 6063-T6, 6105-T5, or 6061-T6 extruded aluminum gate as shown on the Drawings. Hardware manufacturers and products include:

a. Thompson Fabricating Company, Factory Industrial Gate aluminum hinges and stainless steel latch.
b. Julius Blum and Company, Inc.; No. 782/783 gate hinges with springs, and No. 784 gate latch and stop.
c. Or approved equal.

11. Safety Chains: Provide safety chains of Type 316 stainless steel, coil proof straight link type, ¼-inch diameter, with snap hooks on one end. Provide Type 316 stainless eye bolts for attachment of chains to handrail post on one end and attachment to other post with snap hooks, as shown on the Drawings. Provide three chains, each 4 inches longer than the anchorage spacing, for each guarded area.
12. Castings for Handrails: Cast Al-mag with sufficient strength to meet load and test requirements. Anodizable grade finish with excellent resistance to corrosion when subject to exposure of sodium chloride solution intermittent spray and emersion.

E. Chain-Link Railing Infill: Where indicated on the Drawings, infill railings with 9-gauge aluminum chain link fabric with clear anodized finish

F. Concrete Embedded Metal Anchorages: In accordance with Section 055000, METALS FABRICATION-WWTP.

G. Finishes:
1. Handrail Pipe and Post: In accordance with American Architectural Manufacturer's Association (AAMA) 611 Class I, with Aluminum Association designation AA-M32-C22-A41.
2. Cast Fittings and Toeboards: In accordance American Architectural Manufacturer's Association (AAMA) 611 Class I, with Aluminum Association designation AA-M10-C22-A41.
3. Anodize exposed pre-fabricated components, except stainless steel fasteners, after fabrication.

2.3 ANCHOR BOLTS, FASTENERS, AND CONCRETE ANCHORS

A. Locknuts, Washers, and Screws:
1. Elastic Locknuts, Steel Flat Washers, RHMS Round Head Machine Screws: Type A 304 or A 316 stainless steel.
2. Flat Washers: Molded nylon.
3. Manufacturer: McMaster-Carr Supply Company, or equal.

B. Bolts and Nuts for Bolting Handrail to Metal Beams: ASTM A193 and ASTM A194, Type A 316 stainless steel with minimum yield strength for bolts of 95,000 psi, unless otherwise shown.

C. Concrete Anchors:
1. Anchor Bolts: Stainless steel Type 316, with minimum yield strength of 30,000 psi, 1/2-inch minimum diameter with hex nuts, or size as shown.
2. Wedge Anchors Type 316 stainless steel, minimum 1/2-inch diameter by 5-1/2-inches long, or size as shown.
3. Use ICC IBC approved service load allowable values for size, length, embedment, spacing, and edge distance to match required loads shown in calculations.

D. Epoxy Adhesive Anchors: Heavy-duty 1/2-inch diameter minimum, for exterior use only in accordance with Section 055000, METALS FABRICATION-WWTP, as an alternative to mechanical concrete anchors. Design and provide the number required. Do not use where fire or elevated temperatures above 110 degrees F may exist.

2.4 FABRICATION OF ALUMINUM HANDRAILS

A. Perform all work according to approved shop drawings by workmen experienced in the fabrication and erection of aluminum railing systems of type and quantity specified.

B. Shop Assembly: Fit and shop assemble components in largest practical sizes for delivery to site. Clearly mark components for reassembly in the field and coordinated installation.
   1. Post Spacing: Maximum 6 foot horizontal spacing.
   2. Railing Posts Bolted to Metal or Concrete:
      a. Furnish longer than needed posts and field cut to exact dimensions required to satisfy any vertical variations on actual structure. In lieu of field cutting, provide an approved fitting with sufficient post overlap, containing provisions for vertical adjustment.
      b. Field fit-up is required. Do not use shims or grout under baseplates. Misfits shall be rejected.
   3. Aluminum handrails shall be free of burrs, nicks, and sharp edges when fabrication is complete. Welding is not permitted.
   4. Form bends to maintain cylindrical cross section of pipe throughout entire bend without buckling, cracking, or otherwise deforming exposed surfaces of pipe.
   5. Exposed mechanical fastenings shall be flush countersunk screws or bolts, unobtrusively located, consistent with design of component, except where specifically noted otherwise.

C. Shop/Factory Finishing: Use same alloy for uniform appearance throughout fabrication for railings. Handrail and post fittings shall match the fittings with the color and finish of pipe in handrail. Sand cast parts are not permitted.

D. Tolerances:
   1. Shop assemble rails, posts, and formed elbows with a close tolerance for tight fit.
   2. Fit dowels tightly inside posts.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Handrails shall be adequately packaged and cushion wrapped to prevent scratching and denting during shipment, storage, and installation. Leave protective wrapping intact, insofar as possible, until railing is completely installed.

B. Aluminum Handrails:
   1. Shop assemble into practical modules of lengths not exceeding 24 feet for shipment. Deliver toeboards loose for field assembly.
   2. All clear anodized handrail pipe and posts shall be delivered with protective plastic wrap. Wrap shall only be removed after erection.

3.2 GENERAL EXECUTION PROVISIONS

A. Provide railing posts longer than needed and field cut to exact dimensions required to satisfy vertical variations on the actual structure. Install railing with a base that provides plus or minus 1/4-inch vertical adjustment inside the base fitting. If adjustment is required in the field and exceeds plus or minus 1/4-inch, reduce post length not to exceed beyond bottom of lowest setscrew or bolt in base fitting.

B. Field fabrication of aluminum railing systems is not permitted.

C. Modification to structure will not be permitted where handrail is attached.

D. Mount handrails only on completed walls or structures. Do not support handrails temporarily by means not satisfying structural performance requirements.

3.3 HANDRAIL INSTALLATION

A. Assembly and Installation: Perform in accordance with manufacturer's written recommendations for installation and as shown on the Drawings. Install components plumb and level, accurately fitted, and free from distortion or defects. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

B. Protection from Entrapped Water:
   1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.
   2. For posts mounted in concrete, and bends and elbows occurring at low points, drill weep holes of 1/4-inch diameter at lowest possible elevations, one hole per post or rail. Drill hole in the plane of the rail.

C. Expansion Joints:
   1. Provide at maximum intervals of 54 feet on center and at structural joints.
   2. Slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide 1/2-inch slip joint gap to allow for expansion.
   3. Fasten to one side using 3/8-inch diameter setscrew. Place setscrew at bottom of pipe.
   4. Locate joints within 12 inches of posts. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.

D. Setting Posts:
   1. Embedded:
      a. Clean dust and foreign matter from sleeves or blockouts.
      b. Moisten interior of hole and surrounding surface with clean water. Fill hole with non-shrink grout as specified in Section 033000, CAST-IN-PLACE CONCRETE-WWTP prior to installing post.
      c. Brace railing until grout sets.
      d. For posts installed outside and exposed to freezing temperatures, drill weep hole through post approximately 1/2-inch above the level of the grout inside the post and in plane of the rail to prevent entrapment and freezing of water inside post.
   2. Surface Mounted:
      a. Bolt post baseplate connectors firmly in place.
      b. Shims, wedges, grout, and similar devices for handrail post alignment will not be permitted.

c. Furnish in longer length than needed. Accurately field measure for correct length, cut and secure to the post baseplate connector.

E. Posts and Rails:
1. Set posts plumb and aligned to within 1/8-inch in 12 feet.
2. Set rails horizontal or parallel to slope of steps to within 1/8-inch in 12 feet.
3. Install posts and rails in the same plane. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
4. Support 1-½-inch rails directly above stairway stringers with offset fittings.

F. Handrail Wall Brackets:
1. Support wall rails on brackets spaced maximum 5 feet on centers for aluminum as measured on the horizontal projection.

G. Toeboard:
1. Provide at all handrails except where 4-inch or higher concrete curbs are installed, or at gates or safety chain areas.
2. Accurately measure in field for correct length, after handrail post installation, cut and secure to posts.
3. Dimension between bottom of toeboard and walking surface shall not to exceed 1/4-inch.
4. Aluminum Toeboards: Provide expansion and contraction connections between each post.

H. Railing Gates: Install in accordance with manufacturer's installation instructions.

I. Chain-Link Infill: Attach fabric on the interior side of the posts with aluminum hog rings as recommended by fabric manufacturer. Make sure all cut fabric wires are bent over and connected to adjacent wires.

J. Safety Chains: Install in accordance with details shown on the Drawings.

3.4 FIELD FINISHING

A. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces in accordance with System No. 27 in Section 099000, HIGH PERFORMANCE COATINGS - WWTP. Where aluminum is to be bolted with stainless or carbon steel bolts provide mylar, polyethylene or Engineer approved isolation sleeves and washers.

3.5 CLEANING

A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.

B. Do not use acid solution, steel wool, or other harsh abrasive.

C. If stain remains after washing, restore in accordance with manufacturer's recommendations, or replace stained handrails with new handrails meeting specified finish.

END OF SECTION

SECTION 055300 – FABRICATED GRATING - WWTP

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section includes furnishing and installing all fabricated metal grating and grating supports and stair treads, complete.

B. Related work specified in other sections includes:
   1. Section 055200, HANDRAILS AND RAILINGS.

1.2 GENERAL REQUIREMENTS

A. See CONDITIONS OF THE CONTRACT, and Division 01, GENERAL REQUIREMENTS, which contains information and requirements that apply to the work specified herein and are mandatory for this project.

B. Like items of materials provided hereunder shall be the end products of one manufacturer or supplier to achieve standardization for operation, maintenance, spare parts, appearance, and replacement.

1.3 QUALITY ASSURANCE

A. Quality Requirements: Fabrication, installation, standard clearances, banding and tolerances shall be in accordance with the National Association of Architectural Metal Manufacturers (NAAMM) Metal Bar Grating (MBG) standards; MBG 531 “Metal Bar Grating Manual”, MBG 532 “Heavy-Duty Metal Bar Grating Manual”, MBG 533 “Welding Standards for Fabrication of Steel, Stainless Steel, and Aluminum Bar Grating, and MBG 534 “Metal Bar Grating Engineering Design Manual”.

1.4 SUBMITTALS

A. Product Data:
   1. Catalog information and catalog cuts, along with span and deflection tables demonstrating compliance with these specifications.
   2. Manufacturer's specifications, including coatings.
   3. Special handling and storage requirements.
   4. Installation instructions.

B. Shop Drawings:
   1. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other work. Also show all required opening locations and sizes for piping or other penetrations in the grating.
   2. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.
   3. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure. Also indicate required bearing length and allowable clearing tolerances.

C. Quality Control Submittals:
   1. Factory test reports.
   2. Manufacturer's certification of compliance for specified products.
   3. Manufacturer's report that swaged cross bars, if used on grating, meet the requirements of these Specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall meet the following ASTM Specifications:
   1. Stainless Steel:
      a. Bolts: A193, Type 316.
      b. Nuts: A194, Type 316.
      c. Bars and Shapes: A276, Type 316.
      d. Plate, Sheet, Strip: A167, Type 316.
   2. Anchor Bolts and Nuts:
      a. Stainless: A193, Type 316.
   3. Flat Washers (Unhardened): F844, use A153 for zinc coating.

B. Design and Fabrication:
   1. Meet minimum dimensional requirements as shown on the Drawings, as specified herein, and/or as needed to meet specific loading design criteria.
   2. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimensions required for specified clearances.
   3. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
   4. Minimum Depth of Grating: As shown on the Drawings for foot traffic grating. As shown on the Drawings or as required to meet specific loading criteria for vehicular traffic grating.
   5. Minimum bearing of main bars on each support and end clearance of installed grating sections shall be as specified in the references included under Article QUALITY ASSURANCE hereinbefore.
   6. Metal Cross Bar Spacing: 2-inch maximum center to center, unless otherwise shown in Drawings or specified.
   7. Cross Bars:
      a. Flush with top of main bar and extend downward a minimum of 50 percent of the main bar depth for pressure locked or dove tail type design grating.
      b. Swaged or Squeezed Cross Bars:
         1. Within 1/4-inch of top of grating with 1/2-inch minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16-inch square.
         2. Cross Bar Dimension After Swaging: Minimum 1/8-inch wider than the opening at minimum of two corners at each side of each square opening in main bar.
         3. Tightly fit main bars and cross bars allowing no differential movement.
   8. Do not use weld type cross bars.
   9. Banding:
      a. Same material as grating.
      b. Band grating edges and openings in grating shall be as specified in the references listed under Article QUALITY ASSURANCE hereinbefore.
   10. Metals for Embedment, or Seat Angles for Partial Embedment in Concrete: Type 316 stainless steel, unless otherwise shown or specified.

C. Grating Accessories: Anchor bolts, bolts, inserts, threaded anchor studs, wedge anchors, expansion anchors, adhesive anchors and as necessary for anchorage of grating to supports, as specified in Section 055000, METAL FABRICATIONS-WWTP and below:
   1. Stainless steel Type 316.
   2. Fastener Capability: Firmly secure grating section to supports.
   3. Fastener Clips and Bolts: In accordance with grating manufacturer's recommendations, except minimum of four fasteners per grating section and removable from above grating walkway surface.
   4. Provide stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, as manufactured by:
      a. Stanley Engineering Fastening, Nelson Stud Welding and fastening.
      b. Atlantic Bolt Inc.
      c. Or equal.

D. Grating Supports:
   1. Seat angles and beams where shown.
   2. Stainless steel Type 316, except hot dip galvanized steel for vehicular traffic galvanized steel grating specified, unless otherwise specified or shown on the Drawings.
   3. Coordinate dimensions and fabrication with grating to be supported.

E. Slip-Resistant Surface for Foot Traffic Grating:
   1. Bar Grating Steel or Aluminum: Uniform disbursement of custom alloy slip resistant particles to substrate by a CNC laser welding deposition process as manufactured by:
      a. Borden Gratings ALGRIP surface.
      b. Grating Pacific AlGrip surface.
      c. Or equal.

2.2 FOOT TRAFFIC GRATING

A. Use aluminum grating at all locations, unless shown otherwise on the Drawings. Uniform service load for foot traffic grating shall be 100 pounds per square foot minimum with a concentrated load force of 300 pounds per foot width, unless otherwise shown.

B. Maximum Deflection: 1/4-inch, unless otherwise shown.

C. Banding: 3/16-inch minimum, in accordance with NAAMM 531.

D. Provide Algrip slip resistant surface on all metal foot traffic grating.

E. Aluminum Bar Type Grating:
   1. Pressure locked or dove tail, rectangular bar design, as manufactured by:
      a. Borden Gratings Type F (19-P-2).
      b. Grating Pacific Type 19-ADT-2.
      c. Or equal.
   2. Swage or squeeze locked grating, rectangular bar type, as manufactured by:
      a. Borden Gratings Type S/F.
      b. Grating Pacific Type 19-SG-2.
      c. Or equal.

F. Galvanized Steel Bar Type Grating: Where specifically called out for use on the Drawings, galvanized steel grating shall be pressure locked or dove tail, deep rectangular crossbar design, as manufactured by Bordon Gratings Type F (19-P-2); Grating Pacific Type 19-DT-2; or equal.

G. Stair Treads:
1. Material and Type: Same as grating material and grating type as provided for connecting walkway or work surface.
2. Provide nonslip abrasive nosing on each stair tread along one long edge.
3. Provide a carrier plate or angle at each stair tread end for connection to stair stringers.
4. Dimensions:
   a. Length: As shown.
   b. Width: As shown or manufacturer’s standard as close as possible to width as shown.
5. Manufacturers: Same as for grating.

2.3 LIGHT VEHICULAR TRAFFIC GRATING

A. Design aluminum grating for vehicles with a maximum load of 2,200 pounds per wheel, minimum wheel base and axle width of 4.0 feet, and as shown on the Drawings.

2.4 FABRICATION

A. General:
1. Exposed surfaces shall be smooth finish with sharp, well-defined lines.
2. Provide necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Weld connections are not permitted on grating except at banding bars.

B. Aluminum Foot Traffic Grating:
1. Fabricate as shown and in accordance with manufacturer's recommendations as approved.
2. Grind smooth sheared edges exposed in the finished work.
3. Swage cross bars, if used, shall be provided with equipment strong enough to deform cross bars as specified herein.
4. Eliminate any loose cross bar intersections on swaged grating.

C. Galvanizing and Repair: Hot dip galvanized after fabrication as specified in Section 055000, METAL FABRICATIONS-WWTP, Article Galvanizing and Repair.

D. Foot Traffic Grating: Any single grating section or assembly shall not be less than 1 foot 6 inches or greater than 3 feet 0 inches in width or weigh more than 150 pounds, unless otherwise shown on the Drawings or on approved shop drawings.

E. Light Vehicular Aluminum Traffic Grating: Any single grating section or assembly shall not be less than 1 foot 6 inches or greater than 3 feet 0 inches in width (except 3/8-inch thick bearing bar grating), or weigh more than 150 pounds, unless otherwise shown on the Drawings or on approved shop drawings.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Shipment:
   1. Insofar as is practical, factory assemble items provided herein.
   2. Package and clearly tag parts and assemblies that are of necessity shipped unassembled in a manner that will protect the materials from damage, and facilitate identification and final assembly in the field.

B. Storage and Handling: In accordance with manufacturer's recommendations.

3.2 PREPARATION

A. Electrolytic Protection:
   1. Where aluminum will be in contact with dissimilar metals, other than stainless steel, or is to be embedded in masonry or concrete, protect surfaces in accordance with System No. 27 as specified in Section 099600, HIGH PERFORMANCE COATINGS-WWTP. Where aluminum is to be in contact with stainless or carbon steel bolts, provide mylar, polyethylene or Engineer approved isolation sleeves and washers.
   2. Allow paint to dry before installation of the material.
   3. Protect painted surfaces during installation.
   4. Should coating become marred, prepare and touch up surface per paint manufacturer's instructions.

3.3 INSTALLATION

A. Provide equipment for lifting and placing as necessary.

B. Install in accordance with approved shop drawings, as shown on the Drawings, and as specified. Field modifications are not allowed unless written authorization is received from the manufacturer and approved by the Engineer.

C. Install plumb or level as applicable in locations as shown.

D. Anchor grating securely to supports to prevent displacement from traffic impact.

E. Completed installation shall be rigid and neat in appearance.

F. Commercially Manufactured Products:
   1. Install in accordance with manufacturer's recommendations.
   2. Secure grating to support members with fasteners.
   3. Welding is not permitted.
   4. Fasteners: Field locate and install.
   5. Permit each grating section to be easily removed and replaced.

G. Clearance Between Ends of Grating Sections and Vertical Surfaces of Supports or Concrete Walls: Not to exceed those hereinbefore specified.

H. Replace grating sections not meeting specified or detailed dimensional requirements.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking and nailers.
   3. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:
   1. Chain-of-Custody Qualification Data: For manufacturer and vendor.
   2. Product Data: For installation adhesives, indicating VOC content.
   3. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

D. Provide the following upon request:
   1. Evaluation Reports: For the following, from ICC-ES:
      a. Preservative-treated wood.
      b. Fire-retardant-treated wood.
      c. Post-installed anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Wood products shall comply with requirements of ASTM D7612-10 (FSC, SFI, ATSM, CSA or PEFC certifications are acceptable).

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
   3. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all exterior miscellaneous carpentry unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all interior miscellaneous carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
   1. Hem-fir (north); NLGA.
   2. Mixed southern pine or southern pine; SPIB.
   3. Spruce-pine-fir; NLGA.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Provide fastenersof Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002 or ASTM C954 as appropriate to the substrate, length as recommended by screw manufacturer for material being fastened.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Provide blocking as indicated and as required to support facing materials, fixtures, specialty items, and trim.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   2. ICC-ES evaluation report for fastener.

I. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive fasteners snug but do not countersink fastener heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

B. Sustainable Design Submittals:
   1. Product Data: Product Data: Environmental Product Declaration (EPD).
   2. Product Data: Material Ingredient Documentation.
   3. Product Data: For installation adhesives, indicating VOC content.
   4. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.
   1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
   2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   3. Include details of interfaces with other materials that form part of air barrier.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.
   1. Installer is to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and is to employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
   1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
      a. Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
      b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
      c. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Provide the following upon request:
1. Qualification Data: For Installer, including list of ABAA-certified installers and supervisors employed by Installer, who work on Project and testing and inspecting agency.
2. Field quality-control reports.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier and water-resistant glass-mat gypsum sheathing assemblies are to comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage in accordance with ASTM E1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate in accordance with ASTM E783.
3. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.
1. Type and Thickness: Type X, 5/8 inch thick.
2. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification where the manufacture is recognized as the participant by the program operator in accordance with ISO 14025, and EN 15804 or ISO 21930 and that has a cradle to gate scope.

3. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 (1000 ppm).

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For wall sheathing, provide fasteners of Type 304 stainless steel.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
   1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
   2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
   1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
   2. ICC-ES evaluation report for fastener.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing and Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Tests: As determined by testing agency from among the following tests:
   1. Air-Leakage-Location Testing: Air-barrier sheathing assemblies will be tested for evidence of air leakage in accordance with ASTM E1186, chamber pressurization or depressurization with smoke tracers.
   2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with ASTM E783.

D. Air barriers will be considered defective if they do not pass tests and inspections.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

END OF SECTION

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-clad architectural cabinets.
   2. Cabinet hardware and accessories.
   3. Miscellaneous materials.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data Submittals: For each product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Sustainable Design Submittals:
   1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Show large-scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
   5. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Verification: For the following:
   1. Plastic Laminates: 12 by 12 inches, for each type, color, pattern, and surface finish required.
      a. Provide one sample applied to core material with specified edge material applied to one edge.
   2. Thermally Fused Laminate (TFL) Panels: 12 by 12 inches, for each color, pattern, and surface finish.
      a. Provide edge banding on one edge.
   3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockups of typical architectural cabinets.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Provide the following upon request:
   1. Qualification Data: For manufacturer and Installer.
   2. Product Certificates: For the following:
      a. Composite wood products.
      b. Thermally fused laminate panels.
      c. High-pressure decorative laminate.
      d. Adhesives.
   3. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.
   4. Field quality-control reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. Certified Wood: Wood products shall comply with requirements of ASTM D7612-10 (FSC, SFI, ATSM, CSA or PEFC certifications are acceptable).

D. Type of Construction: Frameless.

E. Door and Drawer-Front Style: Flush overlay.

F. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

G. Exposed Surfaces:
1. Plastic-Laminate Grade: HGS.
2. Edges: Grade HGS.
3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

H. Semiexposed Surfaces:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, ISO 4586-3.
a. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.
2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.

I. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.

K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated on drawings.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Certified Wood: Wood products (including laminate) shall comply with requirements of ASTM D7612-10 (FSC, SFI, ATSM, CSA or PEFC certifications are acceptable.
   2. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
   3. Softwood Plywood: DOC PS 1.
   4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of ISO 4586.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

2.4 CABINET HARDWARE AND ACCESSORIES

A. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening, self-closing.

B. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

D. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.

F. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

G. Drawer Slides: ANSI/BHMA A156.9.
   1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): .

H. Door Locks: ANSI/BHMA A156.11, E07121.

I. Drawer Locks: ANSI/BHMA A156.11, E07041.

J. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
   1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
   2. Drawers: Provide one bumper on back side of drawer front at each corner.

K. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Color: Black.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
   1. Satin Stainless Steel: ANSI/BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Adhesive for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.

2.6 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
   2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with toggle bolts through metal backing or metal framing behind wall finish.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
   1. Inspection entity is to prepare and submit report of inspection.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 066119 - QUARTZ SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quartz agglomerate benches.

1.2 ACTION SUBMITTALS

A. Product Data: For quartz agglomerate materials.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Show materials, finishes, edge profiles, methods of joining, and cutouts.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:
   1. Quartz agglomerate material, 6 inches square.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate quartz agglomerate items similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of quartz agglomerate items.

C. Provide the following upon request:
   1. Qualification Data: For fabricator.

D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
   1. Build mockup as shown on Drawings or as directed by Architect.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of quartz agglomerate items by field measurements before fabrication is complete.

1.6 COORDINATION

A. Coordinate locations of utilities that will penetrate quartz agglomerate items.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE MATERIALS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. Provide product indicated on Drawings.

B. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

C. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

D. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate quartz agglomerate items according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Grade: Premium.

B. Edges: Straight, slightly eased at top.

C. Quartz Agglomerate Material: 3 cm- thick, quartz agglomerate.

D. Joints: Fabricate quartz agglomerate items without joints.

E. Joints: Fabricate quartz agglomerate items in sections for joining in field.
   1. Joint Type: Bonded, 1/32 inch or less in width.
   2. Joint Type: Grouted, 1/16 inch in width.
   3. Joint Type: Sealant filled, 1/16 inch in width.
   4. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

F. Cutouts and Holes:
   1. Make cutouts for in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
      a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of quartz agglomerate item and projecting 3/16 inch into fixture opening.
      b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of quartz agglomerate item, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
      c. Provide 3/4-inch eased edge projecting 3/8 inch into fixture opening.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.
   1. Adhesives shall have a VOC content of 70 g/L or less.
   2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate quartz agglomerate items and conditions under which quartz agglomerate items will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of quartz agglomerate items.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install quartz agglomerate items level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten quartz agglomerate items with adhesive unless indicated otherwise.

C. Bond joints with adhesive and draw tight as quartz agglomerate items are set. Mask areas of quartz agglomerate items adjacent to joints to prevent adhesive smears.
   1. Install metal splines in kerfs in quartz agglomerate item edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
   2. Clamp units to temporary bracing, supports, or each other to ensure that quartz agglomerate items are properly aligned and joints are of specified width.

D. Complete cutouts not finished in shop. Mask areas of quartz agglomerate items adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

E. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Product Data: For sealants, indicating VOC content.
   4. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.

C. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Marlite.
      b. Nudo Products, Inc.
      c. VALTO Engineered Materials (formerly Crane Composites, Inc.).
   2. Basis-of-Design Products: As scheduled; refer to Finish Schedule.
   3. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

4. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
5. Nominal Thickness: Not less than 0.075 inch.
6. Surface Finish: As selected by Architect from manufacturer's full range.
7. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
   1. Color: Match panels .

B. Adhesive: As recommended by plastic paneling manufacturer.
   1. Adhesives shall have a VOC content of 50 g/L or less.
   2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."
   1. Sealant shall have a VOC content of 250 g/L or less.
   2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.
   1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
   2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 068300 - COMPOSITE PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes resin panels for interior applications (RP).

1.2 ACTION SUBMITTALS

A. Product Data: For each decorative sheet product indicated.

B. Shop Drawings: Show fabrication and installation details for resin panels. Include the following:
   1. Size and location of penetrations.
   2. Mounting method.

C. Samples: For the following products:
   1. Each type of resin panel, 12 inches square.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for shipping, storing, and handling sheet materials and for removing protective coverings after installation.

B. Maintain protective coverings on sheets to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install sheet material until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify dimensions to fit by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 RESIN PANELS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. 3Form.

B. Basis-of-Design Products: As scheduled; refer to Finish Schedule

C. Optical-Grade Engineered Resin Panel (RF-1):
   1. Thickness/Gauge: As scheduled, refer to Finish Schedule.
   2. Flammability/Smoke Testing: 1/2-inch thick panel, per ASTM E84.
      a. Flame Spread: 95 (Class C).
      b. Smoke Developed: 450.
   3. Weight (1/2-inch thick panel): 3.1 lb/sf.

D. Interlayer Resin Panel (RF-*):
   1. Thickness/Gauge: As scheduled, refer to Finish Schedule.

2. Flammability/Smoke Testing: Class A up to 1/2-inch thick, per ASTM E84.
3. Weight (1/2-inch thick panel): 3.3 lb/sf.
4. Custom Interlayer: Coordinate with manuafacturer and Owner to incorporate Owner-supplied interlayer material to manufacturer.

2.2 ACCESSORY MATERIALS

A. General: Provide accessory materials compatible with sheet material and acceptable to manufacturer.

B. Adhesive and Anchors: Type recommended by sheet manufacturer to suit project conditions.

2.3 FABRICATION

A. Fabricate components to allow secure installation.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Prepare substrate by removing materials that might interfere with adhesive bond, sanding and filling to provide flat, even surface, and final substrate cleaning.

D. Condition panels by unpacking and placing in installation space before installation in accordance with manufacturer's written recommendations. Allow to reach room temperature before installing.

3.2 INSTALLATION

A. Install sheet material in accordance with manufacturer's written instructions and approved Shop Drawings.

B. Protect sheet material surfaces from abrasion and other damage during handling and installation, in accordance with the following requirements:
1. Retain sheet material manufacturer's protective covering or protect by other methods in accordance with sheet material manufacturer's written instructions.
2. Remove covering at border of each piece before installing; remove remainder of covering immediately after installation where sheet material will be exposed or where other conditions make later removal difficult.
3. Remove damaged sheets and recycle or legally dispose of off-site. Damaged paneling sheets are those containing imperfections that, when installed, result in weakened paneling and impaired performance or appearance.

C. Set decorative-sheet units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.

3.3 PROTECTING AND CLEANING

A. Protect sheet material from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with sheet material, remove immediately and wash by method recommended in writing by sheet material manufacturer.

B. Remove and replace sheet material that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

C. Clean sheet material on exposed faces at the time scheduled for Substantial Completion, using methods recommended in writing by sheet material manufacturer.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cold-applied, emulsified-asphalt dampproofing.
   2. Protection course.

B. Apply dampproofing to surfaces indicated, including:
   1. Concrete retaining walls.
   2. Masonry retaining walls.
   3. Planter walls.
   4. Apply dampproofing at conditions where indicated and above groundwater table conditions.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed in accordance with manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course auxiliary materials recommended in writing by manufacturer of primary materials.

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

C. Application Method: Based on substrate, use dampproofing designed for the following application method:
   1. For cast-in-place concrete substrates: Use roller, brush, or trowel, per manufacturer recommendations.
   2. For concrete unit masonry: Use trowel.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. Sika; Sikalastic-314.

B. Trowel Coats: ASTM D 1227, Type II, Class 1, fibered.

C. Fibered Brush and Roller Coats: ASTM D 1227, Type II, Class 1.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Primer: As recommended in writing by manufacturer of dampproofing to be applied.
   1. Primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 PROTECTION COURSE

A. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, ½ inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer’s written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
   1. Apply primer to all substrates.
   2. Apply first coat of dampproofing over primer.
   3. Embed fabric reinforcement into first ply of dampproofing.
   4. Apply second coat of dampproofing to required thickness.
   5. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
   6. Allow each coat of dampproofing to cure per manufacturers written instructions before applying subsequent coats.
   7. Allow dampproofing to cure prior to backfilling.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
   1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

3.4 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
   1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
   2. Install protection course after installation of dampproofing (while coating is tacky) to ensure adhesion and as recommended by the dampproofing manufacturer.

3.5 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Modified bituminous sheet waterproofing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, adhesion to contaminated substrate (e.g. concrete curing compounds and form release agents), substrate curing period weather related restrictions during installation, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs. Include the following:
      a. Before starting application of membrane waterproofing work, arrange a job-site meeting with the Architect, the Testing Agency and manufacturer representative to discuss the following:
         1) The waterproofing system, number of plies, termination and flashing requirements.
         2) Intermediate and final requirements of protecting the work.
         3) The different substrates that will receive the waterproofing and preparation requirements for each.
         4) Curing requirements for concrete.
         5) Concrete form release agent precautions.
         6) Verify admixtures and compatibility with waterproofing manufacturer.
         7) Adhering to coated surfaces, if applicable.
         8) Job specific recommendations on use of primers.
         9) Hot, cold and wet condition precautions.
         10) Scheduling and coordination with other construction, such as waterproofing overlaps that must be installed during construction of walls and footings both above and below grade.
         11) Protection of the work and repair procedures.
         12) Verify in writing to the Owner's representative, that the Contractor's full time on site foreman and crew etc. (as required) are certified, or meet the requirements of the manufacturer of the waterproofing, as installers.
      b. Whenever the membrane waterproofing work is to be done, notify Testing Agency in sufficient time to arrange inspections.
      c. Provide safe access to the location of the Work for proper inspection.
      d. Post installation testing (e.g. Flood Testing or Electronic Field Vector Mapping.)

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.

2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Sustainable Design Submittals:
1. Environmental Product Declaration (EPD): For each product
2. Material Ingredient Report: For Each product

C. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples: For each exposed product and for each color and texture specified, including the following products:
1. 8-by-8-inch square of waterproofing and flashing sheet.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

B. Provide the following upon request:
1. Qualification Data: For Installer.
2. Field quality-control reports.

C. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
a. Size: 100 sq. ft. in area.
b. Description: Each type of wall installation.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

C. Compatibility:
1. Where new work interfaces existing waterproofed construction, remove existing waterproofing as required to install new work. Interface new waterproofing with existing system to provide continuous system without leaks. Ensure compatibility of system materials.
2. The waterproofing manufacturer shall submit a letter stating compatibility or concerns with existing, or adjacent, waterproofing.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

C. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification where the manufacture is recognized as the participant by the program operator in accordance with ISO 14025, and EN 15804 or ISO 21930 and that has a cradle to gate scope.

D. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 (1000 ppm).
   1. Products: Subject to compliance with requirements, provide the following:
      a. GCP Applied Technologies Inc.; Bituthene 3000/Low Temperature.
   2. Physical Properties:
      a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
      b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
      c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
      d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
      e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
      f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
      g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
      h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

D. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

E. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.

F. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

G. Expansion Joints: Proprietary field fabricated expansion joints shall be used with manufacturers waterproofing or as recommended by the waterproofing manufacturer, unless stated otherwise.

H. Metal Termination Bars:
   1. Termination Bar: Stainless Steel 1 inch by 8 feet, 0.075-inch thick, with 5/16-inch holes 8 inches to 9 inches on center. Basis of design: Advanced Building Products Inc. Stainless Steel Termination Bar.
   2. Expansion Anchor: 1/4-inch x 2-inch expansion anchor consisting of a Type 304 Stainless Steel drive pin and an expanding body. Basis of design: Hilti Metal HIT Anchor.

I. Protection Course:
   1. Protection Board Horizontal and Vertical Applications: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners, 1/8-inch nominal thickness.
      a. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.

J. Reinforced Fluid Applied Flashing:
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Soprema; Alsan RS 230 Flash System.

K. Self-Adhering Stainless Steel Flexible Flashing:
   1. Subject to compliance with requirements, provide the following:
      a. York Manufacturing Inc.; York 316 SS
   2. Characteristics:
      a. Type: stainless steel with one stainless steel face (facing outward) with a butyl block co-polymer adhesive (inward facing).
      b. Stainless steel: type 316, ASTM A240. Domestically sourced per DF ARS 252.225-7008 and/or DF ARS 252.225-7009.

DELETE THIS IMAGE BEFORE ISSUING THIS SPECIFICATION.

	XPS-1	XPS-2	XPS-3	XPS-4	CGI-1
Foundation Walls, Tunnels	X				
Foundation Walls, Tunnels (contaminated soil, glycol at airport)					X
Plaza-Pavers on Pedestals (with insulation on drainage mat)		X			
Plaza-Pavers on Pedestals (without drainage mat)			X		
Plaza-Split Slab (with insulation on drainage mat)		X			
Plaza-Split Slab (without drainage mat)			X		
Split Slab Construction - In place use includes vehicle traffic (use a high density drainage mat or gravel drainage)				X	

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. For masonry substrates, apply waterproofing over concrete block and brick with mortar joints struck flush or smooth trowel parge coat.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks in accordance with ASTM D 4258.
   1. Install sheet strips of width in accordance with manufacturer's written instructions and center over treated construction and contraction joints and cracks.

G. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths in accordance with manufacturer's written instructions.

H. Corners: Prepare, prime, and treat inside and outside corners in accordance with ASTM D 6135.
   1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
      a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
      b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

I. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions in accordance with ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets in accordance with waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets, 100% back rolled, over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
   1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Two-Ply Application, as follows:
   1. Install first ply; install sheets to form a membrane with lap widths of a uniform 2-1/2-inch minimum.
   2. Install second ply; install sheets to form a membrane with lap widths of a uniform 2-1/2-inch minimum.
   3. Stagger seams of first ply and second ply. Do not align seams of first ply with second ply.

E. Horizontal Application: Install Two-Ply Application, apply sheets from low to high points of decks to ensure that laps shed water.

F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

G. Seal edges of sheet-waterproofing terminations with mastic.

H. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

J. Immediately install protection course with butted joints over waterproofing membrane.

3.4 FIELD QUALITY CONTROL

A. Site Representative: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.

B. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, waterproofing application, protection, and drainage components, and to furnish reports to Architect.

C. Post Installation Testing: All waterproofed surfaces.
   1. Engage an independent testing agency to observe testing. If breaches are discovered, the independent testing agency shall observe repairs and retesting of discovered breaches.

3.5 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071413 - HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rubberized-asphalt waterproofing membrane reinforced.
2. Molded-sheet drainage panels.
3. Insulation.
4. Plaza-deck pavers supported on pedestals.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, adhesion to contaminated substrate (e.g. concrete curing compounds and form release agents), substrate curing period weather related restrictions during installation, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs. The Contractor: Include the following activities:
a. Before starting application of membrane waterproofing work, arrange a job-site meeting with the Architect, the Testing Agency and manufacturer representative to discuss the following:
1) The waterproofing system, number of plies, termination and flashing requirements.
2) Intermediate and final requirements of protecting the work.
3) The different substrates that will receive the waterproofing and preparation requirements for each.
4) Curing requirements for concrete.
5) Concrete form release agent precautions.
6) Verify admixtures and compatibility with waterproofing manufacturer.
7) Adhering to coated surfaces, if applicable.
8) Job specific recommendations on use of primers.
9) Hot, cold and wet condition precautions.
10) Scheduling and coordination with other construction, such as waterproofing overlaps that must be installed during construction of walls and footings both above and below grade.
11) Protection of the work and repair procedures.
12) Verify in writing to the Owner's representative, that the Contractor's full time on site foreman and crew etc. (as required) are certified, or meet the requirements of the manufacturer of the waterproofing, as installers.
b. Whenever the membrane waterproofing work is to be done, notify Testing Agency in sufficient time to arrange inspections.
c. Provide safe access to the location of the Work for proper inspection.
d. Post installation testing (e.g. Flood Testing or Electronic Field Vector Mapping.)
e. Placement of Protection Course for Electronic Field Vector Mapping post installation testing.

1.3 ACTION SUBMITTALS

A. Sustainable Design Submittals:
   1. Product Data: Product Data: Environmental Product Declaration (EPD).
   2. Product Data: Material Ingredient Documentation

B. Product Data: For each type of product. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.
   1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

D. Samples: For the following products:
   1. Waterproofing System, 8 by 8 inches, showing layering of membrane components (waterproofing membrane, reinforcing fabric, and protection course).
   2. Flashing sheet, 8 by 8 inches.
   3. Insulation, 8 by 8 inches.
   4. Drainage panel, 4 by 4 inches.
   5. For plaza-deck pavers, full sized in each color and texture required.
   6. Paver pedestal assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Sample field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Mockups: Install waterproofing to 100 sq. ft. of deck and wall to demonstrate surface preparation, crack and joint treatment, corner treatment, thickness, texture, and execution quality. Install pavers and paver supports to demonstrate aesthetic effects, and set quality standards for materials and execution.
   1. For slopes greater than 2:12, mockup is required to test interface shear to determine the stability of the system "sandwich."
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Protect stored materials from direct sunlight.

1.7 FIELD CONDITIONS

A. Weather Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below zero deg F.
   1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

C. Compatibility:
   1. Where new work interfaces existing waterproofed construction, remove existing waterproofing as required to install new work. Interface new waterproofing with existing system to provide continuous system without leaks. Ensure compatibility of system materials.
   2. The waterproofing manufacturer shall submit a letter stating compatibility or concerns with existing, or adjacent, waterproofing.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.
   1. Warranty includes removing and reinstalling protection course, drainage panels, insulation, pedestals, and pedestal-mounted pavers on plaza decks.
   2. Warranty insulation retains 80 percent of original published thermal value.
   3. Warranty pavers do not dish or warp and do not crack, split, or disintegrate in freeze-thaw conditions.
   4. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Source Limitations: Obtain waterproofing materials sheet flashings, molded-sheet drainage panels, insulation, pavers, and pedestals from single source from single manufacturer.

2.2 WATERPROOFING MEMBRANE

A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.
   1. Environmental Product Declaration: Provide Type III Industry-Wide Environmental Product Declaration with external verification in the manufacture is recognized as a participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that has a cradle to gate scope.

2. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 percent (1000 ppm).

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with waterproofing.

B. Primer: ASTM D 41/D 41M, asphaltic primer.

C. Elastomeric Sheet: 50-mil- minimum, uncured sheet neoprene with manufacturer's recommended contact adhesives, if applicable, as follows:
1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

D. Expansion Joints: Proprietary field fabricated expansion joints shall be used with manufacturers waterproofing or as recommended by the waterproofing manufacturer, unless stated otherwise.

E. Metal Termination Bar: Provide the following components.
1. Termination Bar: Stainless Steel 1inch by 8 feet, 0.075” thick, with 5/16” holes 8” to 9” on center. Basis of design: Advanced Building Products Inc. Stainless Steel Termination Bar.
2. Expansion Anchor: 1/4" x 2” expansion anchor consisting of a Type 304 Stainless Steel drive pin and an expanding body. Basis of design: Hilti Metal HIT Anchor.

F. Sealants and Accessories: Manufacturer's recommended sealants and accessories.

G. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.

H. Protection Course:
1. Protection Course Horizontal and Vertical Applications: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners, 1/8-inch nominal thickness.
a. Products: Subject to compliance with requirements, provide one of the following:
1) American Hydrotech, Inc; Hydroflex 30.

I. Reinforced Fluid Applied Flashing:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Soprema; Alsan RS 230 Flash system.

J. Self-Adhering Stainless Steel Flexible Flashing:
1. Characteristics:
a. Type: stainless steel with one stainless steel face (facing outward) with a butyl block co-polymer adhesive (inward facing).
b. Stainless steel: type 304, ASTM A240. Domestically sourced per DF ARS 252.225-7008 and/or DF ARS 252.225-7009.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Type 1: Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 18 gpm per ft..

2.5 INSULATION

DELETE THIS IMAGE BEFORE ISSUING THIS SPECIFICATION.

	XPS-1	XPS-2	XPS-3	XPS-4	CGI-1
Foundation Walls, Tunnels	X				
Foundation Walls, Tunnels (contaminated soil, glycol at airport)					X
Plaza-Pavers on Pedestals (with insulation on drainage mat)		X			
Plaza-Pavers on Pedestals (without drainage mat)			X		
Plaza-Split Slab (with insulation on drainage mat)		X			
Plaza-Split Slab (without drainage mat)			X		
Split Slab Construction - In place use includes vehicle traffic (use a high density drainage mat or gravel drainage)				X	

A. XPS-3: Unfaced, Plaza-Deck, Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VII, 60-psi minimum compressive strength; unfaced; fabricated with shiplapped or channel edges and with one side having ribbed drainage channels.
   1. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.

2.6 PLAZA-DECK PAVERS

A. Plaza-Deck Pavers: Heavyweight, hydraulically pressed, concrete units, with top edges beveled 3/16 inch, manufactured for use as plaza-deck pavers; minimum compressive strength 7500 psi, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance in accordance with ASTM C 67.
   1. Thickness: As indicated.
   2. Face Size: As indicated.
   3. Color: Match Architect's sample.

B. Paver Supports: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including adjustable or stackable pedestals, shims, and spacer tabs for joint spacing of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method in accordance with ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, and other voids.

3.3 JOINTS, CRACKS, AND TERMINATIONS

A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations in accordance with manufacturer's written instructions.
   1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt in accordance with ASTM D 4258.
   2. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
   3. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.
      a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

3.4 FLASHING INSTALLATION

A. Install elastomeric sheets at terminations of waterproofing membrane in accordance with manufacturer's written instructions.

B. Prime substrate with asphalt primer.

C. Install elastomeric sheet and adhere to deck and wall substrates in a layer of hot rubberized asphalt.

D. Extend elastomeric sheet up walls or parapets a minimum of 8 inches above plaza-deck pavers and 6 inches onto deck to be waterproofed.

E. Install termination bars and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of waterproofing.

3.5 MEMBRANE APPLICATION

A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow it to dry.

B. Heat and apply rubberized asphalt in accordance with manufacturer's written instructions.
   1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.

C. Start application with manufacturer's authorized representative present.

D. Reinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils; embed reinforcing fabric, overlapping sheets 2 inches; spread another 125-mil- thick layer to provide a uniform, reinforced, seamless membrane 215 mils thick.

E. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

F. Cover waterproofing with protection course with overlapped joints using adhesive before membrane is subject to construction traffic.

3.6 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate in accordance with manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
   1. For vertical applications, install protection course and board insulation efore installing drainage panels.

3.7 INSULATION INSTALLATION

A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.

B. On waterproofing surfaces, set insulation units into adhesive in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.8 PLAZA-DECK PAVER INSTALLATION

A. Install concrete pavers in accordance with manufacturer's written instructions.

B. Accurately install adjustable-height paver pedestals and accessories to elevations required. Adjust for final level and slope with shims.

C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
   1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.

D. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.

E. Maintain tolerances of paving installation within 1/4 inch in 10 feet of surface plane in any direction.

3.9 FIELD QUALITY CONTROL

A. Site Representative: Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; and application of membrane, flashings, protection, and drainage components; furnish daily reports to Architect.
   1. Site representative shall measure membrane thickness with pin tester or other suitable device at least once for every 100 sq. ft. and include measurements in reports.

B. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, waterproofing application, protection, and drainage components, and to furnish reports to Architect.

C. Post Installation Testing: All waterproofed surfaces.
   1. Flood Testing: Flood test each deck area for leaks, in accordance with recommendations in ASTM D 5957, after completing and protecting waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water. Testing agency shall observe flood testing.
      a. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
      b. Flood each area for 72 hours.
      c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
   2. Electric Field Vector Mapping (EFVM): EFVM technician shall survey entire waterproofing area for potential leaks using EFVM.
      a. Install a permanent leak detection system by one of the following or approved equal:
         1) International Leak Detection, Ltd, Ontario, Canada
         2) Honza Group Incorporated, Columbia, Maryland
      b. Engage a company experienced in detecting breaches in the waterproofing using an electronic detection system.

c. If breaches are discovered, repair the breach and retest the affected area. Repeat this process until no breach is detected.

3. Engage an independent testing agency to observe testing. If breaches are discovered, the independent testing agency shall observe repairs and retesting of discovered breaches.

D. Post Installation Testing of Penetrations, Horizontal Expansion Joints, and, Drains.

1. Flood test each horizontal expansion joint, in accordance with recommendations in ASTM D 5957, after installation of the expansion joint but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains as required, and flood with potable water.
2. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
3. Flood each area for 72 hours.
4. After flood testing, repair leaks, repeat flood tests, and make further repairs until expansion joint installation is watertight.
5. Provided test reports upon completion of flood testing.

3.10 CLEANING AND PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:
   1. Apply at all concrete unit masonry exposed to view.
   2. Apply at all cast-in-place concrete where indicated.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's printed statement of VOC content.
   2. Include manufacturer's standard colors.
   3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, for preconstruction testing, and to set quality standards for materials and execution.
   1. Locate mockups on existing surfaces where directed by Architect.
      a. Size: 10 sq. ft. each.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing of water repellents on existing substrate assemblies.
   1. In addition to verifying performance requirements, use mockups to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrates.
   2. Propose changes to materials and methods to suit Project.
   3. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.7 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
   1. Concrete surfaces and mortar have cured for not less than 28 days.
   2. Building has been closed in for not less than 30 days before treating wall assemblies.
   3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
   4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
   5. Rain or snow is not predicted within 24 hours.
   6. Not less than seven days have passed since surfaces were last wet.
   7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance: Water repellents shall meet the following performance requirements as determined by preconstruction testing on substrates representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
   1. Concrete Masonry Units: ASTM C 140.

C. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E 514/E 514M.

D. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G 154 compared to water-repellent-treated specimens before weathering.

2.2 PENETRATING WATER REPELLENTS

A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coating of water repellent on surfaces to be treated using pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
   1. Owner will engage through the Contractor the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
   3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect. .

B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
   1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
   2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Extruded polystyrene foam-plastic board insulation.
2. Mineral-wool board insulation.
3. Glass-fiber blanket insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: Environmental Product Declarations (EPD).
3. Product Data: Embodied Carbon/LCA Optimization
4. Product Data: Material Ingredient Documentation.
5. Product Data: For adhesives, indicating VOC content.
6. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
7. Laboratory Test Reports: For insulation, indicating compliance with requirements for Formaldehyde Emissions Evaluation.

C. Fire Test Reports: Provide NFPA 285 assembly test report.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in their original containers or packages or bundles bearing label clearly identifying manufacturer's name, brand, grade, UL listing, and other pertinent information.

B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

C. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

B. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.".

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent..

D. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.

E. Environmental Product Declaration Optimization Assessment or LCA Action Plan: Provide Type III Product Specific Environmental Product Declaration that includes an embodied carbon optimization report or action plan.

F. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 percent (1000 ppm).

G. Type XPS-3: Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric; thickness and width indicated and manufacturer's standard length as required to suit job conditions manufactured with non-halogenated fire-retardants.
   1. Thermal Resistance: Of total thickness required to provide a minimum thermal resistance R-value (deg. F.h.sf/Btu) indicated.
   2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 MINERAL-WOOL BOARD INSULATION

A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

C. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.

D. Environmental Product Declaration Optimization Assessment or LCA Action Plan: Provide Type III Product Specific Environmental Product Declaration that includes an embodied carbon optimization report or action plan.

E. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 percent (1000 ppm).

F. Unfaced, Mineral-Wool Rain Screen/Cavity Wall Insulation: ASTM C 612; thickness as indicated with width and length as required to suit job conditions; with maximum flame-spread and smoke-developed indexes of zero and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Required for use in exterior rain screen/cavity wall applications.
   1. Characteristics:
      a. Nominal density of 4 lb/cu. ft., Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
      b. Nominal density of 6 lb/cu. ft., Type II, thermal resistivity of 4.16 deg F x h x sq. ft./Btu x in. at 75 deg F.
   2. Thermal Resistance: Of total thickness required to provide a minimum thermal resistance of R- value indicated (deg. F.h.sf/Btu).
   3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 GLASS-FIBER BLANKET INSULATION

A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent

C. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.

D. Material Ingredients: Documentation that demonstrate the chemical inventory of the product to at least 0.1 percent (1000 ppm).

E. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.

F. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; thickness as indicated with width and length as required to suit job conditions; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Thermal Resistance: Of total thickness required to provide a minimum thermal resistance of R-value indicated (deg. F.h.sf/Btu).

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 INSULATION FASTENERS

A. Mechanically Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inchin diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inchessquare or in diameter.
   1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
      a. Crawl spaces.
      b. Ceiling plenums.

D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of between face of insulation and substrate to which anchor is attached.

E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, air barrier, fasteners, and substrates. When in contact with air barrier, provide adhesive and chemical compatible material that is acceptable by the air barrier manufacturer.
   1. Adhesion Strength: 15 lbf/sq. in. minimum.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
      a. General Emissions Evaluation: Products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Evaluation must state the applicable exposure scenario, total VOC (TVOC) content range, as well as the amount applied in mass per surface area (for wet applied products).
      b. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
      c. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
   1. Adhesives shall have a VOC content of 70 g/L or less.
   2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
   1. If not otherwise indicated, extend insulation a minimum of 36 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive in accordance with anchor manufacturer's written instructions.

2. Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application.
3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

3.5 INSTALLATION OF RAIN SCREEN/CAVITY-WALL INSULATION

A. Mineral-Wool Board Insulation: Adhesively attach to substrate or mechanically attach impaling pin through exterior sheathing into steel stud. Space impaling pins per manufacturer to resist the weight of the Mineral-Wool Board and the wind load. Fit insulation with edges butted tightly in both directions. Fit insulation tightly around cladding attachments and other obstructions. Press units onto impaling pins and firmly against exterior surface of wall. Install locking washer onto impaling pin.

3.6 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members and/or building construction with no gaps or voids.
3. Secure insulation blankets to framing members with fasteners as recommended by the insulation manufacturer.
4. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
    a. Provide galvanized metal furring or metal bands or wire lacing as required to hold insulation blankets in place without sagging.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials, matching adjacent insulation type where possible:
1. Spray Polyurethane Insulation: Apply in accordance with manufacturer's written instructions.

3.7 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.8 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Clean and prepare concrete substrates and fasten insulation anchors to concrete substrates with insulation anchor adhesive in accordance with anchor manufacturer's written instructions. Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application indicated.

3.9 INSTALLATION OF CURTAIN WALL INSULATION

A. Install board insulation in curtain wall construction where indicated on Drawings in accordance with curtain wall manufacturer's written instructions.
   1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
   2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.10 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire-retardant, reinforced-polyethylene vapor retarders.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Provide the following upon request:
   1. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 FIRE-RETARDANT, REINFORCED-POLYETHYLENE VAPOR RETARDERS

A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 20 lb/1000 sq. ft., with maximum permeance rating of 0.1 perm.
   1. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 200, respectively, per ASTM E 84.

2.2 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape in accordance with vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fluid-applied, and vapor-permeable membrane air barriers, that incorporates the ABAA Quality Assurance Program (QAP).

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Include installers of other construction connecting to air barrier, including roofing, waterproofing, sealants, windows, glazed curtain walls, and door frames.
   2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and protection and repairs.

1.4 ACTION SUBMITTALS

A. Sustainable Design Submittals
   1. Material Ingredient Documentation: For each product

B. Product Data: For each type of product. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
   2. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
   3. Include statement that materials are compatible with adjacent materials proposed for use and the following.
      a. For materials that the air barrier system will bond to, provide letters as necessary from each manufacturer confirming materials and substrates for the air barrier system is chemically and adhesively compatible with the air barrier system and the bonded to material.

b. For materials that are proposed to bond to the air barrier system, provide letters as necessary from each manufacturer confirming materials proposed to bond to the air barrier system are chemically and adhesively compatible with the air barrier system.

4. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

C. Shop Drawings: For air-barrier assemblies.
1. Show locations and extent of air barrier. Include project specific details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Indicate total area (sq. ft.) of air barrier to be installed.
3. Include project specific details of interfaces with other materials that form part of the air barrier.
4. Include letter from manufacturer indicating that the project specific details and shop drawings have been reviewed and are approved for use.

D. Samples: Submit clearly labeled samples, 3 by 4 inch minimum size of each material specified.

E. Field Test Results: Submit mockup and in-situ test results of air leakage test and water leakage test with specified standards, including retesting if initial results are not satisfactory.

F. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
1. Provide evidence from the manufacturer that the firm is approved, authorized, or licensed to install the specified products and is eligible to receive manufacturer's special warranty.
2. Provide evidence that the installing firm is experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
3. Provide a manual that describes Installers and Manufacturers Quality Assurance / Quality Control program and procedures.
4. Sample of Installers Daily Work Sheet.
5. Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers.

G. Product Certificates: From air-barrier manufacturer, certifying permanent chemical and adhesive compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier, and certifying that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

H. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

I. Fire Test Reports: Provide NFPA 285 assembly test report.

J. Sample Warranty: Manufacturer and Installer sample warranty.

K. ABAA Audit Schedule: Submit number of ABAA audits planned based on the QAP requirements and total area of installed air barrier. Indicate anticipated timeframe of audits.

L. Installation Reports: Provide ABAA Audit Reports and Installer Daily Worksheet for project record. Provide reports weekly to Architect for each week installation of air barrier system occurs.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. A qualified firm that is approved, authorized, or licensed by the manufacturer to install manufacturer's product, that is eligible to receive manufacturer's special warranty, and is experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
2. A firm that is an ABAA-licensed contractor and employs certified and registered installers.
3. A firm that complies with ABAA's Quality Assurance Program.
4. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Manufacturer Qualifications: A qualified manufacturer regularly engaged in manufacturing air barrier membranes.

C. Quality Assurance / Quality Control Program:
1. Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors and independent testing and inspection agencies engaged by the Owner through the Contractor. Do not cover air barrier until it has been inspected, tested and accepted.
2. Notify Architect seven days in advance of the dates and times when ABAA Audits are performed.
3. Daily Inspection:
   a. Visual inspection of the substrate prior to the application of membrane to confirm the substrate is in accordance with the manufacturer’s instructions.
   b. Visual inspection on the completed air barrier for that day and fix any deficiencies.
   c. Verification of manufactures specific Wet film thickness of installed work.
   d. Adhesion Test as indicated in Field Quality Control.
4. Daily Work Sheet: Include requirements of the ABAA QAP and the following:
   a. Listing of installers
   b. Project name
   c. Type of air barrier installed
   d. Air barrier product name and lot/batch number
   e. Primer product name and lot/batch number
   f. Substrate type
   g. Substrate preparation required
   h. Installation locations (gridlines, elevations, etc)
   i. Results of visual inspection
   j. Results of verification of wet film thickness, include photo documentation
   k. Results of verification of adhesion testing, include photo documentation

l. Document and photograph observed deficiencies and corrective actions preformed
m. Date and Time of installation
n. Substrate moisture content
o. Weather Conditions including but not limited to ambient temperature, relative humidity, and precipitation.

5. Testing, Inspection, and Reporting as indicated in the Field Quality control.

D. Mockups: Before beginning installation of air barrier, build mockups to set quality standards for materials and execution and for preconstruction testing.
1. Build mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
a. Coordinate construction of mockups to permit inspection by Owner's testing agency, engaged through the Contractor, of air barrier before external insulation and cladding are installed.
b. Include junction with roofing vapor retarder, building corner condition, and below-grade waterproofing where applicable.
c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage through the Contractor a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
1. Qualitative Air-Leakage Testing: Mockups will be tested for evidence of air leakage according to ASTM E 1186, chamber depressurization with detection liquids.
a. Test Locations: For each substrate type, provide three tests for each penetration type.
b. Test Pressure: 500 Pa.
c. Pass/Fail Criteria: Visual observation of air leakage evidenced by continuous foaming "bubbling" of detection liquid is considered a failed test.
d. Provide an inspection report that indicates results.
2. Qualitative Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
a. Testing to be performed concurrent with Water Penetration Testing indicated below.

b. Testing to be performed after cladding attachment system is installed but prior to cladding installation.
c. Test Pressure: 6.24 lbf/sq.ft.
d. Failure Criteria: Visual evidence of air leakage by means of observations of smoke infiltration or exfiltration.
e. Provide an inspection report that indicates results.

3. Qualitative Water Infiltration Testing: Perform testing prior to installation of the cladding, but after cladding attachment systems have been installed. Air barrier systems shall be tested according to ASTM E 1105 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft., and shall not evidence water infiltration.
   a. Test Locations: Perform one test for each wall assembly type.
   b. Test Size: 100 sq. ft. minimum.
   c. Perform tests after cladding attachments have been installed but prior to the installation of cladding/veneer material.
   d. Water Infiltration Failure Criteria:
      1) Water leakage to the interior of the building is a failure.
      2) Water observed on interior surfaces of the system is a failure.
      3) Water observed on interior surfaces of adjacent systems, originating from the wall system or the transition to the adjacent systems, is a failure.
   e. Provide an inspection report that indicates results.
4. Water Spray Test: Areas designated by the Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
   a. Perform tests at transitions to adjacent exterior enclosure assemblies, deflection joints, and expansion joints.
   b. Perform tests at a representative sample of each condition.
   c. Water Penetration Failure Criteria:
      1) Water leakage to the interior of the building is a failure.
      2) Water observed on interior surfaces of the system is a failure.
      3) Water observed on interior surfaces of adjacent systems, originating from the wall system or the transition to the adjacent systems, is a failure.
   d. Provide an inspection report that indicates results.
5. Adhesion Testing: Mockups will be tested for minimum air-barrier adhesion of 16 lbf/sq. in. or to manufacturer's minimum adhesion level per substrates, whichever is greater, according to ABAA T0002. Perform test after curing period recommended by the manufacturer. Record mode of failure and area which failed in accordance with referenced standard.
   a. Test Locations: Perform 1 test per substrate type. (Each test site includes 3 pull tests)
   b. Provide an inspection report that indicates results.
6. Wet Film Thickness Test (to be performed by installer at time of installation and included on ABAA QAP daily worksheet):
   a. Test material using wet film gauge to confirm that membrane meets manufacturer's indicated wet film thickness requirements.
   b. Minimum one per coat per substrate type.
   c. Failure Criteria:

1) A measurement less than manufacturer's required wet film thickness is considered a failure.

d. Provide an inspection report indicating results and include photo documentation.

7. Dry Film Thickness Test:
   a. Test material in accordance with manufacturer's requirements to confirm that cured membrane meets manufacturer's indicated dry film thickness requirements.
   b. Three 1 inch x 4 inch samples removed from separate areas with gypsum facer intact to avoid stretching membrane.
   c. Failure Criteria:
      1) A measurement less than manufacturer's required dry film thickness is considered a failure.
   d. Provide an inspection report indicating results and include photo documentation.
8. Air barriers will be considered defective if they do not pass tests and inspections.
   a. Wet Film Thickness: Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   b. Upon failure of Dry Film Testing or Adhesion Testing:
      1) Determine cause of failure.
      2) Provide one additional test for each occurrence of failure on the mockup.
      3) Repair deficient air barrier components per manufacturer's recommendations.
      4) Repair tested areas per manufacturer's recommendations.
   c. Upon failure of E1186 and E1105 testing:
      1) Determine cause of failure.
      2) Repair per manufacturer's recommendations and retest deficient air barrier components.
9. Notify Architect 14 days in advance of the dates and times when mockups will be tested.
10. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
11. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.9 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard product warranty, for a minimum 10 years from date of Substantial Completion.

B. Special Installer's Warranty: Provide air barrier installer's 2 year warranty from date of Substantial Completion, including all components of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary ABAA evaluated materials and air-barrier accessories from single source ABAA evaluated manufacturer. Additional accessory products are acceptable for use provided they are approved by the primary air barrier manufacturer.

B. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

C. Provide an air barrier assembly that withstands combined positive and negative design wind, fan and stack pressures on the envelope without damage or displacement, that transfers the load to the structure, and that does not displace adjacent materials under full load. Join air barrier system materials in an airtight and flexible manner to adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier:
   1. Material Ingredients: Documentation that demonstrate the chemical inventory of the product to at least 0.1 percent (1000 ppm).
   2. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
      a. Dow Corning Corp.; Defend Air 200.
   3. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M.
c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
d. Structural-Test Performance: Test according to ASTM E 330 or ASTM E1233 at a positive or negative pressure of 30psf.
    1) No cracking within the field of the panel, substrate joints and at interface of flashing.
e. Water Penetration under Static Pressure: No evidence of water penetration through the air barrier assembly when tested according to ASTM E 331 at a minimum static-air-pressure differential of 6.24 lbf/sq.ft..
    1) Water Penetration: Water leakage to the interior of the building is a failure. Water observed on interior surfaces of the system or adjacent wall systems is a failure.

2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Transition Membrane: Between Air Barrier Membrane and Other Adjacent Materials: Comply with both air barrier manufacturer’s recommendations and adjacent material manufacturer’s recommendations.
1. Fluid-Applied Flashing: Manufacturer's standard trowel grade liquid flashing.
    a. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
2. High Temperature Modified Bituminous Strip: 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner backing.
    a. For use under metal copings and flashings directly exposed to the exterior.
3. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
4. Self-Adhering Stainless Steel Flexible Flashing:
    a. Characteristics:
        1) Type: Stainless steel with one stainless steel face (facing outwards) with a butyl block co-polymer adhesive (inward facing).
        2) Stainless Steel: Type 316, ASTM A240. Domestically sourced per DF ARS 252.225-7008 and/or DF ARS 252.225-7009.

C. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

D. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

E. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

F. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

G. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

H. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

I. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

J. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchor spacing of 9" on center minimum unless otherwise required by the manufacturer. Provide galvanized sheet metal backup plate at locations where adequate substrate is not available for securing the termination bar.

K. Provide galvanized sheet metal backup plate at locations where adequate substrate is not available for securing the cladding accessories and attachments, flashings, and termination bars.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Provide verification in writing from the air-barrier manufacturer that concrete has cured and aged for minimum time period required by air-barrier manufacturer.
   3. Perform moisture testing as required by air-barrier manufacturer for test type, rate, and quantity to validate that substrate is acceptable, dry, and free of moisture.
   4. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
   5. Verify that metal strapping has been installed where required for securing accessories such as termination bars and flashings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

E. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

A. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION MEMBRANE INSTALLATION

A. General: Install transition membrane and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane, below grade waterproofing, and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install manufacturer's recommended transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as recommended by manufacturer.

D. At end of each working day, seal top edge of transition membrane to substrate with termination mastic.

E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition membrane so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing surface.
   1. Provide fluid-applied membranes for manufacturer's that offer it as part of the air barrier system.
   2. For manufacturers that do not offer a liquid flashing, use transition membrane method that is acceptable to the air barrier manufacturer and that is chemically and adhesively compatible with the adjacent construction.

a. Self-Adhering Stainless Steel Flexible Flashing Transition Strip: Roll firmly to enhance adhesion.
b. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material. Tool sealant along edges of extrusion.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

H. Seal transition membrane around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition membrane.

J. Seal exposed edges of transition membrane at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in transition membrane. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid air-barrier material to form a seal with transition membrane and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
1. Apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats as recommended by the manufacturer and as needed to achieve required bond, with adequate drying time between coats.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
1. Apply to a total wet film thickness as required by the membrane manufacturer to meet the performance requirements indicated.

C. Apply transition membrane according to air-barrier manufacturer's written instructions.

D. Provide air barrier and accessories that are acceptable for use at horizontal surfaces without detrimental effects to material.

E. For exterior cladding and veneer attachment devices and accessories such as clips, thermal breaks, brick ties, flashings, stone/metal coping fasteners, and metal panel anchors:
1. Set device in a full bed of sealant after air barrier is cured.
2. Seal over fastener heads after device is secured.
3. Seal top edge of accessories installed in the horizontal orientation.

F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency engaged through the Contractor.

G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage through the Contractor a qualified testing agency to perform tests and inspections.

B. Inspection and Testing/ABAA Audits: Cooperate with Owner's testing agency, engaged through the Contractor, and ABAA auditors. Allow access to work areas and staging. Notify testing agency/ABAA auditor in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

C. Periodic Inspections: Provide for air barrier system manufacturer's technical personnel to inspect installation weekly during periods of ongoing installation.

D. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Air-barrier wet film thickness (to be performed by installer at time of installation and included on ABAA QAP daily worksheet).
4. Continuous structural support of air-barrier system has been provided.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in transition membranes have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Transition membranes are firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

E. Field Tests:
1. Allow sufficient time for testing and inspection and provide a schedule in advance to the Testing Agency.
2. Whenever Work is to be done, notify Testing Agency in sufficient time to provide inspections.
3. Provide to the Owner copies of Quality Assurance Program documentation including daily site reports completed by installers.

4. Submit test results in accordance with specified standards, including retesting if initial results are not satisfactory.
5. Test to be distributed uniformly across all elevations.
6. Membrane Adhesion Test: Test materials for a minimum air-barrier adhesion of 16 lbf/sq. in. or to manufacturer's minimum adhesion level per substrates, whichever is greater in accordance with ABAA T0002. Perform test after curing period recommended by the manufacturer. Record mode of failure and area which failed in accordance with referenced standard. To be performed by installer and included on ABAA QAP daily worksheet.
    a. Test Site Locations: Perform 1 test once daily per substrate during installation and a minimum of 4 test sites per major elevation per substrate. (Each test site includes 3 pull tests).
        1) Perform one test for the first 2500 sq. ft. of installed material for each wall assembly type.
    b. Provide an inspection report in accordance with referenced standard that indicates whether or not the air barrier material has met the minimum adhesion level requirement and include photo documentation.
    c. Provide reports within 3 days of test completion.
7. Qualitative Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber depressurization using detection liquids.
    a. Test Locations: Provide ten tests for each penetration type per 2500 sq. ft. of each substrate. Distribute test locations across all elevations.
    b. Test Pressure: 500 Pa.
    c. Pass/Fail Criteria: Visual observation of air leakage evidenced by continuous foaming "bubbling" of detection liquid is considered a failed test.
    d. Provide an inspection report that indicates results and include photo documentation.
8. Qualitative Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
    a. Testing to be performed concurrent with Qualitative Water Infiltration Testing below.
    b. Pass/Fail Criteria: Visual observation of air leakage evidenced by smoke tracer penetrating air barrier system is considered a failed test.
    c. Provide an inspection report that indicates results, including photos.
9. Qualitative Water Infiltration Testing: Perform testing prior to installation of the cladding, but after cladding attachment systems have been installed. Air barrier systems shall be tested according to ASTM E 1105 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft., and shall not evidence water infiltration.
    a. Test Locations:
        1) Perform one test for the first 2500 sq. ft. of installed material for each wall assembly type.
        2) Perform one subsequent test for every 5000 sq. ft. of installed material for each wall assembly type.
        3) Test locations to be selected by Architect.
    b. Test Size: 100 sq. ft. minimum.

c. Perform tests after cladding attachments have been installed but prior to the installation of cladding/veneer material.
d. Pass/Fail Criteria:
    1) Water infiltration/leakage to the interior of the building which is not controlled by a weep/drainage system that is integral to the system is a failure.
    2) Water observed on interior surfaces of the systems is a failure.
    3) Water observed on interior surfaces of the adjacent systems, originating from the wall system or the transition to the adjacent systems, is a failure.
e. Provide an inspection report that indicates results and include photo documentation.

10. Water Spray Test: Before installation of interior finishes has begun, areas designated by the Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
    a. Perform tests at transitions to adjacent wall assemblies, control joints, deflection joints, and expansion joints.
    b. Test 250 linear feet of all joint locations.
    c. Water Infiltration:
        1) Water leakage to the interior of the building is a failure.
        2) Water observed on interior surfaces of the system is a failure.
        3) Water observed on interior surfaces of adjacent systems, originating from the wall system or the transition to the adjacent systems, is a failure.
11. Wet Film Thickness Test (to be performed by installer at time of installation and included on ABAA QAP daily worksheet):
        1) Test material using wet film gauge to confirm that membrane meets manufacturer's indicated wet film thickness requirements.
        2) Regularly check per coat per substrate type during installation per ABAA QAP.
        3) Failure Criteria:
            a) A measurement less than manufacturer's required wet film thickness is considered a failure.
            b) Provide an inspection report indicating results and include photo documentation.
        4) Provide inspection report indicating results and include photo documentation.
12. Dry Film Thickness Test:
    a. Test material in accordance with manufacturer's requirements to confirm that cured membrane meets manufacturer's indicated dry film thickness requirements.
    b. Three 1 inch x 4 inch samples removed from separate areas with gypsum facer intact to avoid stretching membrane.
    c. Test Locations: Once daily per substrate during installation and a minimum of 1 test per major elevation per substrate.
        1) Perform one test for the first 2500 sq. ft. of installed material for each wall assembly type.

2) Provide an inspection report in accordance with referenced standard that indicates whether or not the air barrier material has met the minimum adhesion level requirement and include photo documentation.
3) Provide reports within 3 days of test completion.

d. Failure Criteria:
1) A measurement less than manufacturer's required dry film thickness is considered a failure.

e. Provide an inspection report indicating results and include photo documentation.

13. Infrared Evaluation:
a. In general accordance with ASTM E1186 to evaluate air leakage related to the wall assemblies in locations such as but not limited to transitions to adjacent exterior enclosure assemblies, penetrations, and terminations.
1) If anomalies are identified, provide proposed plan to confirm source of anomalies.
2) If deficiencies are identified during confirmation process, notify design team, manufacturer, and Owner of cause and extent of deficiencies.
3) Submit manufacturer approved corrective action plan for Owner and Architect's review and approval.
4) Perform infrared evaluation to confirm that deficiencies have been corrected.

14. Air barriers will be considered defective if they do not pass tests and inspections.
a. Wet Film Thickness: Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
b. Upon failure of dry film testing or Adhesion Testing:
1) Determine cause of failure.
2) Provide one additional test for each occurrence of failure.
3) Repair deficient air barrier components per manufacturer's recommendations.
4) Repair tested areas per manufacturer's recommendations.
c. Upon failure of E1186 and E1105 testing:
1) Determine cause of failure.
2) Repair per manufacturer's recommendations and retest deficient air barrier components.
3) Determine if deficient conditions are present elsewhere on the building and repair per manufacturer's recommendations.
4) Provide two additional tests for each occurrence of failure.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Clean air barrier materials that were affected by testing procedures to a level equal to or better than the original condition after testing is complete using cleaning agents and procedures recommended by manufacturer of affected construction.

H. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for longer than allowed by manufacturer, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   8. Review of procedures for repair of metal panels damaged after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Product Data: Indicating lead free flashing

C. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
   1. Include Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
   1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Provide the following upon request:
   1. Qualification Data: For Installer.
   2. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical metal panel assembly, including corner, soffits, supports, attachments, and accessories.
   2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration in accordance with AAMA 501.2.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested in accordance with ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E 1592:
   1. Wind Loads Design Criteria: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

C. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges.
   1. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
      a. Thickness: 0.040 inch.
      b. Surface: Smooth, flat finish.
      c. Exterior Finish: Three-coat fluoropolymer.
      d. Color: Match Architect's samples.

D. Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges.
   1. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
      a. Thickness: 0.040 inch.
      b. Surface: Smooth, flat finish.
      c. Exterior Finish: Three-coat fluoropolymer.
      d. Color: Match Architect's samples.

2.3 MISCELLANEOUS MATERIALS

A. Thermally-Broken Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
   1. Flashing to be lead free

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Where exposed fasteners are unavoidable, provide with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:
   1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Aluminum Panels: Use aluminum or stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
   2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
   3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:
   1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
   2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage through the Contractor a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal composite material wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
   8. Review procedures for repair of panels damaged after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Sustainable Design Submittals:
   1. Product Data: for recycled content indicating post-consumer and pre-consumer recycled content and cost.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Shop Drawings:
   1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Provide the following upon request:
   1. Qualification Data: For Installer.
   2. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical metal composite material panel assembly including corner, soffits, supports, attachments, and accessories.
   2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration in accordance with AAMA 501.2.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested in accordance with ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content: Post-consumer recycled content plus one-half pre-consumer recycled content shall not be less than 25 percent.

B. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E 330:
   1. Wind Loads Design Criteria: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

G. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

C. Aluminum-Faced Composite Wall Panels : Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.
   1. Panel Thickness: 0.157 inch.
   2. Core: Fire retardant.
   3. Exterior Finish: Three-coat fluoropolymer.
      a. Color: Match Architect's samples.

D. Attachment Assembly Components: Formed from extruded aluminum.

E. Attachment Assembly: Manufacturer's standard.

2.3 MISCELLANEOUS MATERIALS

A. Thermally-Broken Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:
   1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal composite material panels.
   2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.

3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage through the Contractor a qualified independent testing agency to perform field tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.

C. Metal composite material wall panels will be considered defective if they do not pass test and inspections.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 074213.33 - FORMED METAL SCREENWALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.
   2. Metal liner panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   8. Review of procedures for repair of metal panels damaged after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
   1. Include Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
   1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Provide the following upon request:
   1. Qualification Data: For Installer.
   2. Product Test Reports: For each product, for tests performed by a qualified testing agency.
   3. Field quality-control reports.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical metal panel assembly , including corner, supports, attachments, and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested in accordance with ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E 1592:
   1. Wind Loads Design Criteria: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels : Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. K-Wall,"Concealed Fastener Panel Systems".
   2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, ; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
      a. Nominal Thickness: 0.040 inch.
      b. Exterior Finish: Three-coat fluoropolymer .
      c. Color: Match Architect's samples.
   3. Panel Coverage: 12 inches.
   4. Panel Height: 1.5 inches.

2.3 METAL LINER PANELS

A. General: Provide factory-formed metal liner panels designed for interior side walls and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for a complete installation.

B. Metal Liner Panels : Solid panels formed with intermediate stiffening ribs symmetrically spaced between panel edges; with a flush joint between panels.
   1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
      a. Nominal Thickness: 0.040 inch.
      b. Exterior Finish: Three-coat fluoropolymer .
      c. Color: Match Architect's samples.
   2. Panel Coverage: 12 inches.
   3. Seam Profile: Flush.
   4. Seam Height: 1.5 inches.

2.4 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete panel system including trim, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, corners, endwalls, framed openings, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inchthick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine framing to verify that structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Joints and Splices:
   1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
   2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

E. Metal Liner Panels: Install panels on interior side of supports with flush appearance on the inside.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

C. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 074293 - SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes soffit panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:
   1. Include fabrication and installation layouts of panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Panels: 12 inches long by actual panel width. Include fasteners, closures, and other panel accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panels to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical soffit as shown on Drawings; approximately four panels wide by full width, including attachments and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Provide the following upon request:

1. Qualification Data: For Installer.
2. Product Test Reports: For each product, tests performed by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.

B. Unload, store, and erect panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of panel finish.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Structural Performance: Provide panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:
   1. Wind Load Design Criteria: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E283 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

2.2 HIGH PRESSURE LAMINATE (HPL) SOFFIT PANELS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Provide soffit panels designed to be installed by interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

C. Soffit Panels: Match Architect's samples.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated; as recommened by manufacturer. Provide manufacturer's standard sections as required for support and alignment of panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.
   1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Where exposed fasteners are unavoidable provide exposed fasteners with heads matching color of panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
   2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended in writing by panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. Fabricate and finish panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, panel supports, and other conditions affecting performance of the Work.
    1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by panel manufacturer.
    2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by panel manufacturer.
        a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating panels to verify actual locations of penetrations relative to seam locations of panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and panel manufacturer's written recommendations.
    1. Soffit Framing: Wire tie or clip furring channels to supports, as recommended by the manufacturer, and as required to comply with requirements for assemblies indicated.

3.3 INSTALLATION

A. Install panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving panels.
   2. Flash and seal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Panels: Use stainless steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by panel manufacturer.

D. Panels: Fasten panels to supports with fasteners at location and spacing recommended by manufacturer.
   1. Apply panels and associated items true to line for neat and weathertight enclosure.
   2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of panels.
   3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:
   1. Apply a continuous ribbon of sealant or tape to seal joints of panels, using sealant or tape as recommend by manufacturer as needed to make panels watertight.
   2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by panel manufacturer; or, if not indicated, provide types recommended by panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Adhered PVC membrane roofing system.
2. Vapor retarder.
3. Roof insulation.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure as indicated on drawings.

D. Solar Reflectance Index: Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated in accordance with ASTM E 1980, based on testing identical products by a qualified testing agency.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
2. Product Data: For adhesives and sealants, indicating VOC content.
3. Environmental Product Declaration: For each product.
4. Material Ingredient Documentation: For each product.

C. Shop Drawings: For roofing system, include plans, elevations, sections, project specific details, applicable manufacturer's standard details, and attachments to other work.
1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing, fastening spacings and patterns for mechanically fastened membrane roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

5. Adhesion patterns for insulation and cover board for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products:
1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. Walkway pads, rolls, or pavers.
4. Metal termination bars.
5. Six insulation fasteners of each type, length, and finish.
6. Six roof cover fasteners of each type, length, and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components for membrane roofing system as approved by membrane roofing manufacturer and testing.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

G. Pre-installation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

H. Provide the following upon request:
1. Qualification Data: For qualified Installer and manufacturer.
2. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
    a. Submit evidence of compliance with performance requirements.
3. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
4. Field quality-control reports.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty includes roofing assembly from top of substrate deck to top of roofing including all components such as vapor retarders, fasteners, adhesives, roofing membrane, ballast, seals and sealants, flashing and venting.

B. Warranty shall be written on form at the end of this Section.

C. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PVC MEMBRANE ROOFING

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. Basis of Design: Sika Sarnafil; G410.

B. PVC Sheet: ASTM D 4434, Type II, Grade I, glass fiber reinforced, felt backed.
   1. Thickness: 60 mils, nominal.
   2. Exposed Face Color: Match Architect's sample.
   3. Environmental product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.
   4. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 percent (1000 ppm).

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
2. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives and sealants.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.

C. Bonding Adhesive: Manufacturer's standard.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

G. Reinforced Fluid Applied Flashing:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Soprema; Alsan RS 230 Flash system.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
1. Environmental product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.
2. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 percent (1000 ppm).

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.4 ROOF AIR BARRIER/VAPOR RETARDER

A. Metal Roof Deck/Substrate Board:
1. Self-Adhering Sheet Air Barrier/Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by the manufacturer.

B. New Concrete Roof Deck Application:
1. SBS Modified Bitumen: ASTM D6164.
a. Type I.
b. Grade S.
c. Torch-applied.

2. 2-ply Built-up Asphalt Roof:
   a. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.
   b. Roofing Asphalt: ASTM D 312, Type III or Type IV.
   c. Asphalt Primer: ASTM D 41.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, of thicknesses indicated .

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 2 coated glass facer on both major surfaces.
   1. Board Size: 4'-0" x 4'-0"
   2. Thickness: Two layers minimum, total minimum thickness as indicated on drawing. Provide a minimum aged thermal resistance of R5 (deg. F.h.sf/Btu) per inch.
   3. Environmental product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.
   4. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 percent (1000 ppm).

C. Tapered Insulation: Provide factory-tapered insulation boards with identical characteristics as base insulation fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes with identical characteristics as base insulation where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
   2. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
   3. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives and sealants.

D. Cover Board: ASTM C 1177/, glass-mat, water-resistant gypsum substrate, 1/2 inch thick, factory primed.

E. Sprayed Polyurethane Foam: One- or two-component, foamed-in-place, closed cell polyurethane foam, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less in accordance with ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam manufacturer.

2.7 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D 41.

2.8 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
   4. Verify that concrete has cured and aged for minimum time period required in writing by roofing manufacturer. Perform testing as required by roofing manufacturer for test type, rate, and quantity to validate that substrate is acceptable, dry, and free of moisture.
   5. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with membrane roofing system manufacturers' written instructions.

3.4 ROOF AIR BARRIER/VAPOR RETARDER INSTALLATION

A. Metal Roof Deck/Substrate Board:
   1. Self-Adhering-Sheet Air Barrier/Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet air barrier/vapor retarder over area to receive air barrier/vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

B. New Concrete Roof Deck Application:
   1. SBS Modified Bitumen: Torch apply 1 ply of SBS modified bitumen vapor retarder in accordance with manufacturer’s written instructions and applicable recommendations in ARMA/NRCA’s “Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing.”
   2. Built-up Vapor Retarder:
      a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. or as required by manufacturer and allow primer to dry.
      b. Install two glass-fiber felt plies lapping each felt 19 inches over preceding felt.
      c. Embed each felt in a solid mopping of hot roofing asphalt.
      d. Glaze coat completed surface with hot roofing asphalt.
      e. Apply hot roofing asphalt within plus or minus 25 deg F of equiviscous temperature.

C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Provide an air tight transition to the wall air barrier.

3.5 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
   1. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. and allow primer to dry.
   2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
   3. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   4. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and adhere to roof deck.
   1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
   2. Adhered cover boards with adhesive to resist uplift pressure at corners, perimeter, and field of roof.

I. Sprayed Polyurethane Foam: Apply in accordance with manufacturer's written instructions.

3.6 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install in accordance with membrane roofing system manufacturer's written instructions.
   1. Install sheet in accordance with ASTM D 5036.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings in accordance with manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition.

3.7 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates in accordance with membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage through the Contractor a qualified testing agency to perform tests and inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

Roofing Special Warranty Form follows

ROOF SYSTEM SPECIAL WARRANTY FORM
Project Title:
Project Address:
Architect's Project No.Contractor's Job Number:
Warranted Work (and location description if less than full roof):

Specification Section No. and Title:
Length of Warranty: years
The undersigned herewith warrant that the above stated Work has been executed in conformance with the requirements of the Contract Documents for the Project named and warrant said Work to perform as specified and without failure for the above stated period of time,
starting on , 20 ___, and ending on , 20___.
This warranty does not apply to failure to perform due to abuse or neglect by the Owner, or the Owner's successor in interest, or damage by vandalism.

Contractor (the entity holding direct contract with Owner)	Firm
	Representative *
	Signed
	Title
	Notary
	Date
Roofing Installer Same as Contractor (if same as Contractor, check box; leave linesblank)	Firm
	Representative *
	Signed
	Title
	Notary
	Date
Roofing Membrane Manufacturer	Firm
	Representative *
	Signed
	Title
	Notary
	Date

*The Firm's Representative affirms they are authorized to bind the Firm to this Warranty.

END OF SPECIAL WARRANTY FORM

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:
   1. Sheet metal materials.
   2. Underlayment.
   3. Miscellaneous materials.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
   3. Review requirements for insurance and certificates if applicable.
   4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.
   1. Plans, elevations, sections, and attachment details.
   2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
   3. Identification of material, thickness, weight, and finish for each item and location in Project.
   4. Details for forming, including profiles, shapes, seams, and dimensions.
   5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   6. Details of termination points and assemblies.
   7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
   8. Details of roof-penetration flashing.
   9. Details of edge conditions, including flashings, and counterflashings.
   10. Details of special conditions.
   11. Details of connections to adjoining work.
   12. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.
   1. Sheet Metal Flashing and Trim: Manufacturers' standard size. Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments.

E. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
2. Product Data: Indicating lead free content.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers.

C. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested, shop is to be listed as able to fabricate required details as tested and approved.

D. Provide the following upon request:
1. Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
2. Product Test Reports: For each product, for tests performed by a qualified testing agency.
3. Research Reports: For copings and roof edge flashing, from ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.
4. Qualification Statements: For fabricator.

1.6 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockup of typical roof edge, approximately 10 ft. long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
   1. Wind Design Criteria: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation; . Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   1. Nominal Thickness: 0.028 inch.

2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
3. Provide manufacturer documentation or statement validating lead free flashing.
4. Surface: Smooth, flat.
5. Exposed Coil-Coated Finish:
   a. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Color: Match Architect's sample.
7. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed.
1. Nominal Thickness: 0.0250 inch.
2. Surface: Smooth, flat.
3. Exterior Finish: ASTM A480/A480M, No. 3 (coarse, polished directional satin).
   a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      1) Run grain of directional finishes with long dimension of each piece.
      2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
5. Material does not contain any lead

2.3 UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F or lower; ASTM D1970/D1970M.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized): Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

F. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

G. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated and with interlocking counterflashing on exterior face, of same metal as reglet.
1. Material: Galvanized steel, 0.022 inch thick.
2. Accessories:
   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
3. Finish: Mill.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

I. Cap Flashing/Counterflashing Fabrication - General: Provide two-piece metal cap flashings, consisting of an upper receiver portion and a lower portion extending over the composition flashing, unless otherwise specified or indicated.
1. Cap Flashing/Counterflashing Fabrication - Two Piece
a. Fabricate the receiver portion with outer edge formed into a double fold turned down one inch, unless otherwise indicated, and as follows:
1) At new masonry walls, extend the receiver portion into the wall as indicated, terminated with 1/4 inch upstand edge, unless indicated to be higher.
2) At walls faced with metal siding or pre-formed metal panels, extend the receiver portion into the wall as indicated, and terminated with edge folded over support.
3) At concrete and masonry walls, extend the receiver portion into an embedded reglet, sawcut in the profile indicated for a reglet, or form the receiver portion to retain sealant as indicated, using a 3/16 by one inchstainless steel clamping bar.

4) At parapet, extend the receiver portion over wood blocking as indicated.
5) At parapet, extend the receiver portion as indicated and form the upper edge to engage the double fold of coping

b. Form the upper edge of the lower portion of metal cap flashing to engage in the double fold of receiver portion, bent to provide spring action against the base flashing, fold the lower edge folded back 1/2 inchand lap composition base flashing not less than 4 inches.
c. Lap ends of each length of both portions of metal cap flashing not less than 3 inches. Weld corner joints. Return ends at roof edge into reglet or wall.

2. Cap Flashing/Counterflashing Fabrication - One Piece: Provide one-piece cap flashing at roof curbs, with top edge formed to retain metal joint sealant and bottom edge folded 1/2 inch to provide drip.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12 ft.- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
2. Fabricate from the following materials:
a. Galvanized Steel: 0.040 inch thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

D. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

F. Roof-Drain Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.0156 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 ft. long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:
1. Stainless Steel: 0.0156 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:
1. Stainless Steel: 0.0156 inch thick.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:
   1. Stainless Steel: 0.0188 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:
   1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
   2. Prime substrate if recommended by underlayment manufacturer.
   3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
   4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
   5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
   6. Roll laps and edges with roller.
   7. Cover underlayment within 14 days.

B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
   1. Install in shingle fashion to shed water.
   2. Lapp joints not less than 4 inches.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
   1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of welds and sealant.
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.

4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
    a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    b. Form joints to completely conceal sealant.
    c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    d. Adjust setting proportionately for installation at higher ambient temperatures.
        1) Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.5 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
   1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
   2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Copings:
   1. Install copings in accordance with ANSI/SPRI/FM 4435/ES-1.
   2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
      a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
      b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
   1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
   2. Extend counterflashing 4 inches over base flashing.
   3. Lap counterflashing joints minimum of 4 inches.
   4. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.7 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING

A. Clean and neutralize flux materials.

B. Clean off excess sealants.

3.10 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

SECTION 077129 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum roof expansion joints.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Aluminum roof expansion joints.

B. Shop Drawings: For roof expansion joints.
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
   3. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples: For each exposed product and for each color specified, 6 inches in size.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roofing membrane.

B. Provide the following upon request:
   1. Qualification Data: For Installer.
   2. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.

1.5 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Factory-Applied Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof expansion joints that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Fire-Resistance Rating: Comply with ASTM E1966 or UL 2079; testing by a qualified testing agency to resist the spread of fire and to accommodate building thermal and seismic movements without impairing its ability to resist the passage of fire and hot gases. Identify products with appropriate markings of applicable testing agency.
1. Rating: Unless otherwise indicacted, not less than fire-resistance rating of the roof assembly.
2. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ALUMINUM ROOF EXPANSION JOINTS

A. Aluminum Roof Expansion Joint: Factory-fabricated, continuous, waterproof, joint cover; consisting of a formed or extruded metal cover secured to extruded aluminum frames, with water-resistant gasketing between cover and frames, and with provision for securing assembly to substrate and sealing assembly to roofing membrane or flashing.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
1. Joint Movement Capability: Plus and minus 25 percent of joint size indicated on Drawings.
2. Frame Members: Extruded aluminum configured for curbs as indicated; with exposed finish matching cover.
3. Cover: Formed or extruded aluminum; thickness as recommended by manufacturer.
4. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
5. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
6. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the cover.
    a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture to drain.
7. Fire Barrier: Manufacturer's standard fire barrier for fire-resistance-rated expansion joint system.

C. Materials:
1. Aluminum: ASTM B209 for sheet and plate, ASTM B221 for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
    a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
    b. Class I, Clear Anodic Finish: Architectural Class I, clear coating 0.018 mm or thicker, complying with AAMA 611.

2.3 MISCELLANEOUS MATERIALS

A. Adhesives: As recommended by roof-expansion-joint manufacturer.
   1. Adhesives shall have a VOC content of 70 g/L or less.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
   1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joint openings, substrates, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.
   1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
   2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
   3. Provide for linear thermal expansion of roof-expansion-joint materials.
   4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
   5. Provide uniform, neat seams.
   6. Install roof expansion joints to fit substrates and to result in watertight performance.

B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.

C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in Section 079513.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance. Install factory-fabricated units at transitions between roof expansion joints and exterior expansion-control joint systems.

D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.
   1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

E. Fire Barrier: Install fire barrier as required by manufacturer to provide continuous, uninterrupted fire resistance throughout length of roof expansion joint, including transitions and end joints.

F. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:
   1. Roof hatches.

B. Related Requirements:
   1. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design assignment indicated in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Delegated-Design Submittal: Refer to Section 013573 "Delegated Design Requirements and Procedures" for delegated design submittal procedures and requirements.
   1. Provide delegated-design submittals for the following:
      a. Roof hatches.
   2. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
   3. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

D. Samples for Initial Selection: For each type of roof accessory indicated with factory-applied color finishes.

E. Samples for Verification: Include Samples of each type of roof accessory to verify finish and color selection, in manufacturer's standard sizes.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items, including mechanical and electrical equipment, ductwork, piping, and conduit.
   4. Required clearances.

B. Qualification Statements: For manufacturer.

C. Delegated Design Engineer Qualifications: For roof hatches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories.

1.5 QUALITY ASSURANCE

A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof accessories in contact with other materials that might cause staining, denting, or other surface damage. Store roof accessories in accordance with manufacturer's instructions.

B. Store materials off ground in dry location and in accordance with manufacturer's instructions in well-ventilated area.

C. Store and protect roof accessories from nicks, scratches, and blemishes.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-accessory substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a registered design professional, as defined in Section 013573 "Delegated Design Requirements and Procedures" to design roof hatches to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   1. Material properties indicated in this Section shall be considered as minimum properties.

C. Wind Design Criteria: As indicated on Drawings.

2.2 ROOF HATCHES

A. Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant to raise the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Babcock-Davis.
   2. BILCO Company (The).
   3. Nystrom, Inc.

D. Type and Size:
   1. Single-leaf lid, dimensions as shown.
   2. Double-leaf lid, dimensions as shown.

E. Loads: External live loads and internal uplift loads: As calculated by delegated design.

F. Hatch Material, Aluminum:
   1. Thickness: Manufacturer's standard thickness for hatch size indicated .
   2. Finish: Clear anodic .

G. Construction:
   1. Insulation: 2-inch- thick, polyisocyanurate board.
   2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
   6. Sloping Roofs: Where slope or roof deck exceeds 1/4 inch per 12 inches, fabricate curb with perimeter curb height that is . Equip hatch with water diverter or cricket on side that obstructs water flow.

H. Hardware: Spring operators, hold-open arm, stainless steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
   1. Provide two-point latch on lids larger than 84 inches.
   2. Provide remote-control operation.

I. Safety Railing System: Roof-hatch manufacturer's standard system, including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
   1. Height: 42 inches above finished roof deck.
   2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
   3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
   4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
   5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.

6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain-entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.
    a. Color: Match Architect's sample.

J. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Aluminum.
4. Post: 1-5/8-inch- diameter pipe.
5. Finish: Manufacturer's standard.
    a. Color: Match Architect's sample.

2.3 METAL MATERIALS

A. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install roof accessories in accordance with manufacturer's written instructions.
   1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.3 INSTALLATION OF ROOF ACCESSORIES

A. Roof-Hatch:
   1. Install roof hatch so top surface of hatch curb is level.
      a. Weld curbs to metal roof deck.

b. Bolt curbs to concrete roof deck with lead shield expansion type inserts through each pre-drilled hole with 3/8 inchcorrosion resistant steel bolts.

2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.
4. Attach ladder-assist post in accordance with manufacturer's written instructions.

3.4 CLEANING AND PROTECTION

A. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.

B. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

SECTION 077273 - VEGETATED ROOF SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Continuous vegetated roof assemblies.
   2. Geofoam fill.
   3. Stone Aggregate Ballast.

B. Related Requirements:
   1. Section 071413 "Hot Fluid-Applied Rubberized Asphalt Waterproofing" for waterproofing membrane, roof thermal insulation, roof-paver ballast, leak detection EFVM system,and waterproofing system warranty.

1.2 DEFINITIONS

A. Captured Water: Water that is retained in the drainage layer of a vegetated roof assembly after new water additions have ceased and that cannot escape the roof except through evaporation or plant transpiration.

B. Finish Elevation: Elevation of finished growing-media surface of planting area.

C. Planting Area: Areas to be planted.

D. Plant; Plants; Plant Material: Vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

E. Growing Medium: Manufactured, lightweight soil mixture that promotes good growing conditions for specific varieties of plants.

1.3 PERFORMANCE REQUIREMENTS

A. Roofing System Design: Vegetation system including stone aggregate ballast shall comply with structrual wind uplift requirements and IBC 1504.4 - ANSI/SPRI RP-14. Vegetation system to be successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated in accordance with ASCE/SEI 7 and uplift criteria depicted on Drawings.
   1. Built up vegetation systems shall comply with uplift requirements with temporary or permanent means as required by the vegetation manufacturer during vegetation growth period.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review vegetated roof assembly requirements including substrate, installation procedures, testing and inspection procedures, and protection and repairs. The Contractor: Include the following activities:
      a. Before starting installation of vegetated roof system work, arrange a job-site meeting with the Architect, the Testing Agency, irrigation consultant manufacturer representative and other trades utilizing the roof during construction to discuss the following:
         1) Review final test report for post installation testing performed for the waterproofing system.

2) Review manufacturer's required procedures for subsequent construction over the waterproofing membrane.
3) Review requirements for irrigation and coordination requirements related to irrigation installation.
4) Review intermediate and final requirements of protecting the work.
5) Hot, cold, and wet condition precautions.
6) Scheduling and coordination with other construction, such as waterproofing overlaps that must be installed during construction of walls and footings both above and below grade.
7) Protection of the work and repair procedures.
8) Wind uplift criteria.

b. Provide safe access to the location of the Work for proper inspection.

1.5 ACTION SUBMITTALS

A. Product Data: For each vegetated roof assembly.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include material descriptions for each growing medium.
3. Erosion control blankets, including anchor.

B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: For each vegetated roof assembly.
1. Include plans, sections, slopes, and drain locations.
2. Indicate dimensions, weights, and loads.
3. Demonstrate compliance with wind uplift criteria and IBC 1504-4 - ANSI/SPRI RP-14.
a. For built up vegetation system, demonstrate compliance during vegetation growth period and established vegetation growth.
4. Detail field assembly of components, depth of growing media, and attachments to other work.
5. Indicate walkway pavers, geofoam fill, locations of irrigation, coordination with lighting, and accessories.

D. Samples for Verification: For each of the following components of vegetated roof assembly:
1. Growing Media: 1-quart volume of each growing medium, in sealed plastic bags labeled with content and source. Each Sample shall be typical of the lots of growing media to be furnished. Provide an accurate representation of texture and composition.
2. Moisture-Retention Mat: 12 by 12 inches.
3. Drainage Panels: 12 by 12 inches.
4. Root Barrier: 12 by 12 inches.
5. Stone Aggregate Ballast: 10 lb (4.5 kg) of aggregate ballast in gradation and color indicated.
6. Separation Geotextile: 12 by 12 inches.
7. Access Boxes: One in each size and color required.
8. Soil Retainer: Manufacturer's standard size to verify configuration and color selected.

9. Erosion Control Blanket: Provide 1 square yard section and anchor.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of manufactured product.
   1. Manufacturer's certified analysis of standard products.
   2. Analysis of other materials by a recognized laboratory, in accordance with methods established by the Association of Official Analytical Chemists, where applicable.

C. Product Test Reports: For complete analysis of each growing medium, for tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For vegetated roof assembly and plants, including a recommended maintenance plan with procedures for inspection and care during a calendar year. Submit before start of required warranty and maintenance periods.

B. Continuing Maintenance Proposal: From vegetated roof assembly Installer approved by roofing-membrane manufacturer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified vegetated roof assembly Installer, approved, authorized, or licensed by roofing-membrane manufacturer, whose work has resulted in successful establishment of vegetated roofs.
   1. Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when vegetated roof assembly work is in progress.

B. Mockups: Install vegetative roof system, including waterproofing membrane, to 100 sq. ft. of deck to demonstrate waterproofing and overburden installation. Install vegetative growing media and plantings to demonstrate aesthetic effects, wind uplift measures, and set quality standards for materials and execution.
   1. For slopes greater than 2:12, mockup is required to test interface shear to determine the stability of the system sandwich.• •
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and Federal laws if applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials on or near structures, utilities, walkways and pavements, or existing roof areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of debris-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk materials with product certificates.

C. Handle and store materials, and place equipment in a manner to avoid overloading roof structure or damaging roofing membrane.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when optimum results may be obtained. Apply products during favorable weather conditions in accordance with manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty for Vegetated Roof Assembly: Installer agrees to repair or replace components of vegetated roof assembly that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, ponding water or prolonged wetness of growing medium caused as a result of failure of the assembly to properly drain.
   2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Warranty for Plant Growth: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
   1. Foliage Cover: Planted materials shall grow to achieve and maintain at least 80 percent foliage cover over planting area commencing 12 months after planting, through the duration of this warranty.
   2. Failures include, but are not limited to, death and unsatisfactory growth except for defects resulting from abuse, lack of adequate maintenance, neglect by Owner, or incidents that are beyond Contractor's control.
   3. Warranty Period: From date of Substantial Completion as follows:
      a. Trees and Shrubs: One year.
      b. Ground Covers, Perennials, Vines, and Ornamental Grasses: One year.
   4. Include the following remedial actions as a minimum:
      a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
      b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
      c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

5. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain vegetated roof assembly components, growing medium, walkway pavers and setting bed or supports, geofoam fill and separation geotextile, and accessories from single source from single manufacturer.

2.2 VEGETATED ROOF ASSEMBLIES

A. Continuous Vegetated Roof Assembly : Continuous-coverage assembly consisting of manufacturer's standard vegetated roof assembly components for installation over roofing system.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
1. American Hydrotech, Inc.
2. Assembly Depth, Nominal: As shown on Drawings, including growing medium.
3. Growing Medium Depth: As shown on Drawings.
4. Plantings: As shown on Drawings.

2.3 VEGETATED ROOF ASSEMBLY COMPONENTS

A. Moisture-Retention Mat: Assembly manufacturer's standard water-retaining fabric.

B. Drainage / Water Retention Layer: Assembly manufacturer's standard drainage board formed from geotextile-faced, molded-plastic sheet with a geotextile face and "cups" of the molded sheet facing upward like small reservoirs to retain water while allowing excess water to drain away below the board.
1. Expanded lightweight aggregate for use as fill material for drainage/water retention board as required.
2. 5/16-inch to 3/8-inch expanded shale, lightweight aggregate.

C. Filter Fabric: Non-woven, needle punched polypropylene geotextile fabric, manufacturer for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following:
1. Flow: ASTM D4491, 140 gal. / min. / ft. width.
2. Puncture: ASTM D162, 250 lb.
3. U.V. Resistance: ASTM D4355 70% at 500 hours.
4. Grab Tensile: ASTM D4632 95 lb.
5. Apparent Opening Size: ASTM D4751, 50 U.S. Standard Sieve.

D. Root Barrier: Vegetated roof assembly manufacturer's standard plastic sheet manufactured from recycled polyethylene or polypropylene plastic; formulated to resist root growth and bacteria.

E. Anti-Slip Devices: Vegetated roof assembly manufacturer's standard anti-slip devices.

F. Recycled Content: Verify moisture-retention mat, drainage panels, and root barrier material have postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.4 MANUFACTURED GROWING MEDIA

A. Growing Medium : Vegetated roof assembly manufacturer's lightweight, manufactured soil mixture designed for plants indicated on Drawings.
   1. General Condition at Time of Planting: Free of aggregates 1/2 inch or larger in any dimension; free of roots, plants, clods, pockets of sand, paint, building debris, oils, solvents, roofing materials, and other extraneous materials harmful to plant growth; free of weeds, disease-causing plant pathogens, and other undesirable organisms.
   2. Maximum Media Density: ASTM E 2399, for basic growing-medium mixture.
   3. Maximum Media Water Retention: ASTM E 2399, for basic growing-medium mixture at maximum media density.
   4. Water Permeability: ASTM E 2399, for basic growing-medium mixture at maximum media density.
   5. Organic Material Content: ASTM F 1647, Method A, organic material as measured using the loss-on-ignition procedure.
      a. Minimum: 6 percent.
      b. Maximum: 20 percent.
   6. Chemical Properties:
      a. Growing-Medium pH (Reaction): 6.0 to 7.0.
      b. Cation Exchange Capacity: Minimum 50 meq/100 g of growing medium.
      c. Nitrogen: Minimum 0.10 percent by weight.
      d. Phosphorous: Minimum 0.10 percent by weight.
      e. Potassium: Minimum 0.10 percent by weight.

2.5 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T or Class O agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

F. Superphosphate: Commercial, phosphate mixture, soluble; minimum 20 percent available phosphoric acid.

G. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of 2 percent fast- and slow-release nitrogen (50 percent derived from natural organic sources of urea formaldehyde), 4 percent phosphorous, and 2 percent potassium, by weight.

H. Slow-Release Fertilizer: Granular or pelleted fertilizer, consisting of 20 percent nitrogen (50 percent of which is water insoluble), 10 percent phosphorus, and 10 percent potassium, by weight.

2.6 GEOFOAM FILL

A. Extruded-Polystyrene Board Insulation: ASTM C 578,Type V, 3.00-lb/cu. ft. density, 100-psi compressive strength.

B. Geofoam Connectors: Geofoam-fill manufacturer's multibarbed, galvanized-steel sheet connectors.

C. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; as recommended by vegetated roof assembly manufacturer.

2.7 STONE AGGREGATE BALLAST

A. Stone Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to vegetative roof system degradation, of the following type, size, and density:
   1. Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone.
   2. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
   3. Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
   4. Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).
   5. Density: Per ANSI/SPRI RP-14, spread ballast at a minimum rate of 1,000 lbs/100 square feet to meet project specific uplift requirements.

B. Stone Aggregate Filter Fabric: Non-woven, needle punched polypropylene geotextile fabric, manufacturer for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following:
   1. Flow: ASTM D4491 60 gal. / min. / ft. width
   2. Puncture: ASTM D1621 850 lb.
   3. U.V. Resistance: ASTM D4355 70% at 500 hours.
   4. Grab Tensile: ASTM D4632 95 lb.
   5. Apparent Opening Size: ASTM D4751 40 U.S. Standard Sieve.

2.8 ACCESSORIES

A. Protection Board: As recommended by waterproofing-membrane manufacturer.

B. Access Boxes: Manufacturer's standard stainless-steel boxes with removable, rigid covers for accessing drains, valves, and switches beneath the finish elevation of growing medium; secure each cover with four noncorrosive screws.
   1. Size: As shown on Drawings for each location.

C. Soil Retainer: Vegetated roof assembly manufacturer's formed stainless-steel perforated edging with drainage openings.
   1. Configuration: As shown on Drawings.
   2. Method of Attachment: Manufacturer's standard adhesive compatible with the roofing system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine each area to receive vegetated roof assembly for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Verify that roof insulation over roofing membrane is in place, secure, and flush along all seams.
   2. Verify that perimeter and other flashings are in place and secure along entire lengths where they will be covered by vegetated roof assembly.
   3. Surfaces shall be smooth, free of debris, soil and grit.
   4. Field dimensions and elevations verify fixed site elements including, but not limited to drain locations, of roof access, paving, fire break, expansion joints, and mechanical equipment.

B. Inspect growing medium.
   1. Verify that no foreign or deleterious material or liquid, such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in growing medium within a planting area.
   2. If growing medium is contaminated by foreign or deleterious material or liquid, remove growing medium and contamination and replace with new growing medium.

3.2 INSTALLATION, GENERAL

A. Protection Course: Cover roofing system with protection board with butted and fully taped joints before roofing system is subject to vegetated roof assembly installation work.

B. Install vegetated roof assembly in accordance with manufacturer's written instructions.

C. Filter Fabric: Install filter fabric in accordance with manufacturer's written instructions. Secure Filter Fabric at terminations to mitigate misplacement of aggregate, soil, or other medium within the roof system.

D. Place roof barrier so that each sheet overlaps the adjacent sheet by 12 inches. Heat weld all seams to ensure a root proof assembly. Roof Barrier shall be turned up all vertical roofed/flashed surfaces, installing additional material as required, to completely protect waterproofing and flashings.

E. Small Plant Stabilization: Install erosion-control fabric over planting area to secure small plants in accordance with manufacturer's written instructions.

F. Geofoam Fill: Install geofoam-fill blocks in as few layers as possible with abutting edges and ends and with the long dimension of each block placed at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.
   1. Install geofoam connectors at each layer, without damaging roofing system, to resist horizontal displacement of geofoam and in accordance with geofoam-fill manufacturer's written instructions.
   2. Cover geofoam fill with separation geotextile before placing overlying growing medium.

G. Access Boxes: Install access box at each drain, valve, and switch and at locations shown on Drawings. Install top of boxes level with the finish elevation of growing medium.

H. Stone Aggregate Filter Fabric: Install filter fabric directly below areas to receive Stone Aggregate Ballast. Secure Stone Aggregate Filter Fabric at terminations and transitions to other filter fabrics to mitigate misplacement of stones within the roof system.

I. Stone Aggregate Ballast: Apply stone uniformly over the Stone Aggregate Filter Fabric roofing system at the rate required to meet uplift requirements. Spread with care to minimize possibility of damage to the roof system. Lay ballast as the roof system is installed, leaving the roof system ballasted at the end of the workday. Additional stones exceeding the density requirement may be required for full coverage, or full height required for the ballast placement.

3.3 PLANTING

A. Perform planting in accordance with vegetated roof assembly manufacturer's written instructions.

B. Do not place growing medium or plants during frozen, wet, or muddy conditions.

C. Suspend spreading, grading, and planting operations during periods of excessive moisture until the moisture content in growing medium reaches acceptable levels to attain the required results.

D. Uniformly moisten an excessively dry growing medium that is too dusty or unworkable.

E. Site Planting: Plant vegetated roofs in accordance with requirements specified in and Section 329300 "Exterior Plantings." except as otherwise indicated on Drawings and required by vegetated roof assembly manufacturer's written instructions. Perform digging carefully to prevent damaging roofing system below the vegetated roof assembly.

3.4 SOIL-RETAINER INSTALLATION

A. Install soil retainer where indicated in accordance with manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Site Representative: Engage a full-time site representative qualified by the vegetated roof system manufacturer to inspect substrate conditions; installation preparations; and installation of vegetated roof system components.
   1. For built-up vegetative roof systems, Site Representative shall inspect and verify that temporary and/or permanent growing media stabilization measures are installed as required. Include inspection in reports.
   2. Correct deficiency in work that do not comply with requirements.
   3. Furnish daily reports to Architect.

B. Testing Agency: Engage a qualified testing agency to verify that Electronic Leak Detection grounds are protected and accessible at the vegetative roof system level; and verify that grounds are installed in a permanent manner and in working condition before and after installation of vegetated roof system. Furnish final report to Architect.
   1. Correct deficiency in work that do not comply with requirements.

2. Furnish daily reports to Architect.

3.6 PROTECTION

A. Protect vegetated roof assemblies from damage, including growing-medium contamination, due to operations of other contractors and trades. Repair or replace damaged vegetated roof assemblies.

3.7 MAINTENANCE SERVICE

A. Maintenance Service: Provide maintenance by skilled employees of vegetated roof assembly Installer approved by roofing-membrane manufacturer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than the specified maintenance period.
   1. Assembly and Plant Maintenance: During maintenance period, maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing devices, resetting plants to proper elevations or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
      a. Replace growing medium that becomes displaced or eroded because of settling or other processes.
      b. Apply treatments as required to keep plant materials, planted areas, and growing medium free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
      c. Use only products and methods acceptable to roofing-membrane manufacturer.
      d. Submit maintenance reports for each site visit including the following:
         1) Date.
         2) Time.
         3) Weather (i.e. temperature, light, and atmospheric conditions).
         4) Name of site supervisor.
         5) Name of personnel performing maintenance.
         6) Description of plant material condition by type andlocation.
         7) Description of maintenance performed, including but not limited to watering, weeding, fertilizer application, plant removals/replacements, cleaning of vegetation free areas, roof drain inspection.
         8) Provide photographic documentation of green roof conditions.
   2. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sprayed fire-resistive materials.

1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
   2. Product Data: Environmental Product Declaration (EPD).
   3. Product Data: For paints and coatings, indicating VOC content.
   4. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Framing plans or schedules, or both, indicating the following:
   1. Extent of fireproofing for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of fireproofing after application.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.

B. Provide the following upon request:
   1. Qualification Data: For Installer and testing agency.
   2. Product Certificates: For each type of fireproofing.
   3. Evaluation Reports: For fireproofing, from ICC-ES.
   4. Preconstruction Test Reports: For fireproofing.
   5. Field quality-control reports.
   6. Application Certificate: Submit Applicator™™s certificate addressed to the fire safety authority having jurisdiction over the Project, stating that materials have been applied in accordance with the Contract Documents.

C. Mockups: Build mockups to set quality standards for materials and executionand for preconstruction testing.
   1. Build mockup of each type of fireproofing and different substrate .

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups of fireproofing.
   1. Provide test specimens and assemblies representative of proposed materials and construction.

B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
   1. Bond Strength: Test for cohesive and adhesive strength in accordance with ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   2. Density: Test for density in accordance with ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: To the maximum extent possible, obtain fireproofing from a single source; where not possible, obtain fireproofing for each fire-resistance design from a single source.

C. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.
   2. UL design listings shall state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor are not allowed.

D. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design.

E. Low-Emitting Materials: For field applications, verify coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Methylene Chloride and Perchloroethylene shall not be intentionally added in paints, coatings, adhesives and sealants.

G. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Standard Density Sprayed Fire-Resistive Material : Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
   1. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
      a. GCP Applied Technologies, "Monokote MK-6 Series".
   2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
   3. Bond Strength: Minimum 200-lbf/sq. ft. cohesive and adhesive strength based on field testing in accordance with ASTM E 736.
   4. Density: Not less than 15 lb/cu. ft. as specified in the approved fire-resistance design, in accordance with ASTM E605.
   5. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch .
   6. Combustion Characteristics: ASTM E 136.
   7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 0.
      b. Smoke-Developed Index: 0.

8. Compressive Strength, 10 percent deformation: Minimum 8.3 lbf/sq. in. in accordance with ASTM E 761.
9. Corrosion Resistance: No evidence of corrosion in accordance with ASTM E 937.
10. Deflection: No cracking, spalling, or delamination in accordance with ASTM E 759.
11. Effect of Impact on Bonding: No cracking, spalling, or delamination in accordance with ASTM E 760.
12. Air Erosion: Maximum weight loss of 0.000 g/sq. ft. in 24 hours in accordance with ASTM E 859.
13. Fungal Resistance: Treat products with manufacturer's standard antimicrobial No growth on specimens after 28 days, per ASTM G 21.
14. Finish: Spray-textured finish. Apply separate, colored topcoat after finishing if recommneded by manufacturer.
15. Recycled Content: Post-consumer recycled content plus one-half pre-consumer recycled content shall not be less than 5 percent.
16. Environmental Product Declaration: Provide Type III Product Specific Environmental Product Declaration with external verification in which the manufacturer is recognized as the participant by the program operator in accordance with ISO 14025, and EN15804 or ISO 21930 and that have at least a cradle to gate scope.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
   1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests in accordance with ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, in accordance with fire-resistance designs indicated and fireproofing manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.

H. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.
   1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
   2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck is complete before beginning fireproofing work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.

D. Conduct tests in accordance with fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:
   1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
   2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing in accordance with fireproofing manufacturer's written instructions.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
   1. Manufacturer's Standard Finishes: Finish in accordance with manufacturer's written instructions for each finish selected.
   2. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Test and inspect as required by the IBC

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
   2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

SECTION 078123 - INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mastic and intumescent fire-resistive coatings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Mastic and intumescent fire-resistive coatings.
   2. Substrate primers.
   3. Reinforcing fabric.
   4. Reinforcing mesh.
   5. Topcoat.

B. Sustainable Design Submittals:
   1. Product Data:For mastic and intumescent fire-resistive coatings indicating compliance with General Emissions Evaluation and VOC content requirements.

C. Shop Drawings: Framing plans or schedules, or both, indicating the following:
   1. Extent of fire protection for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum mastic and intumescent fire-resistive coating thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of mastic and intumescent fire-resistive coating after application.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by mastic and intumescent fire-resistive coating manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of each type of fire protection and different substrate and each required finish .
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Provide the following upon request:
1. Qualification Data: For Installer and testing agency.
2. Product Certificates: For each type of mastic and intumescent fire-resistive coating.
3. Evaluation Reports: For mastic and intumescent fire-resistive coating, from ICC-ES.
4. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fire protection for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.

E. Low-Emitting Materials: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives and sealants.

G. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
   1. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
      a. Albi Manufacturing; a division of StanChem, Inc.
   2. Application: Designated for "exterior" use by a qualified testing agency acceptable to authorities having jurisdiction.
   3. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design.
   4. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.
   5. Hardness: Not less than 60, Type D durometer, in accordance with ASTM D2240.
   6. Finish: As selected by Architect.
      a. Color and Gloss: Match Architect's sample.

2.3 AUXILIARY MATERIALS

A. Provide auxiliary materials that are compatible with mastic and intumescent fire-resistive coating and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by mastic and intumescent fire-resistive coating manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
   2. Low-Emitting Materials: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   3. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives and sealants.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer. Include pins and attachment.

E. Topcoat: Suitable for application over mastic and intumescent fire-resistive coating; of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.
   1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
   2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Conduct tests in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.

B. Clean substrates of substances that could impair bond of fire protection.

C. Prime substrates where included in fire-resistance design and where recommended in writing by mastic and intumescent fire-resistive coating manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fire protection Work.

B. Comply with mastic and intumescent fire-resistive coating manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
   1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and mastic and intumescent fire-resistive coating manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

E. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

F. Extend fire protection in full thickness over entire area of each substrate to be protected.

G. Install body of fire protection in a single course unless otherwise recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

I. Cure fire protection in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions.

J. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fire protection to produce the following finishes:
   1. Finish in accordance with manufacturer's written instructions for each finish selected.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Test and inspect as required by the IBC.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fire protection will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fire protection that does not pass tests and inspections, and retest.
   2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

A. Protect fire protection, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.

B. Repair fire protection damaged by other work before concealing it with other construction.

C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Penetration firestopping systems.
2. Penetrations in fire-resistance-rated walls.
3. Penetrations in horizontal assemblies.
4. Penetrations in smoke barriers.
5. Exposed penetration firestopping systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJs.

C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

D. Sustainable Design Submittals:
1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
3. Product Data: Material Ingredient Documentation.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration

firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Installation Responsibility: Assign installation of penetration firestopping and fire-resistive joint systems to a single qualified firestop contractor.

C. Manufacturer Qualifications: Entity that has received UL's "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.

D. Provide the following upon request:
1. Qualification Data: For Installer.
2. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockup of each penetration firestopping system type required for Project, including supporting construction substrates, attachments, and accessories.
2. Where one penetration firestopping system type may be used for different penetrating items or in different wall or floor constructions, install one assembly for each different combination.
3. Obtain approval of mockups from authorities having jurisdiction before proceeding.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping system materials in accordance with manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be accessed and installed in accordance with specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain penetration firestopping systems for each type of opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform penetration firestopping system tests.
   2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping systems installed with products bearing the classification marking of a qualified testing agency.
         1) UL in its online directory "Product iQ."
         2) Intertek Group in its "Directory of Building Products."

B. Provide components for each penetration firestopping system that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.

C. Provide components for each penetration firestopping system that do not contain ethylene glycol.

D. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.

E. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.

F. Meet VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.

G. Low-Emitting Materials: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

H. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives and sealants.

I. Material Ingredients: Documentation that demonstrates the chemical inventory of the product to at least 0.1 (1000 ppm).

2.3 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems must be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
   1. 3M Building and Construction.

C. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
   1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
   2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

D. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
   1. F-Rating: At least one hour, but not less than the fire-resistance rating of the floor penetrated.
   2. T-Rating: At least one hour, but not less than the fire-resistance rating of the floor. The following floor penetrations do not require a T-rating:
      a. Those within the cavity of a wall.
      b. Floor, tub, or shower drains within a concealed space.
      c. 4-inch or smaller metal conduit penetrating directly into metal-enclosed electrical switchgear.
   3. W-Rating: Provide penetration firestopping systems with a Class 1 W-rating in accordance with UL 1479.

E. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined in accordance with UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 723.
   1. Meet VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.
   2. Low-Emitting Materials: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   3. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives and sealants.Sealant shall have a VOC content of 250 g/L or less.

2.4 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

2.5 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings in accordance with manufacturer's written instructions and with the following requirements:
   1. Remove foreign materials from substrate surfaces that could interfere with adhesion of penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft..

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage through the Contractor a qualified inspection agency to conduct and report on inspections in accordance with ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Intumescent gypsum wall framing gaskets.
2. Perimeter fire-barrier system.
3. Joints in or between fire-resistance-rated construction.
4. Joints at exterior curtain-wall/floor intersections.
5. Joints in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:
1. For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

C. Sustainable Design Submittals:
1. Product Data: Material Ingredient Documentation.
2. Product Data: For sealants, indicating VOC content.
3. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written installation instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL and found to comply with UL's "UL Solutions Qualified Firestop Contractor Program."

B. Installer Qualifications: A firm experienced in installing joint firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Installation Responsibility: Assign installation of penetration firestopping and fire-resistive joint systems to a single qualified firestop contractor.

D. Provide the following upon request:
1. Qualification Data: For Installer.

2. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems in accordance with manufacturer's written installation instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed in accordance with specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform joint firestopping system tests.
   2. Test in accordance with testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
         1) UL in its online directory "Product iQ."
         2) Intertek Group in its "Directory of Building Products."

B. Rain/Water Resistance: For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

C. Material Ingredients: provide documentation demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).

D. General Emissions Evaluation: Products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Evaluation must state the applicable exposure scenario, total VOC (TVOC) content range, as well as the amount applied in mass per surface area (for wet applied products).

E. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.

F. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, and sealants.

2.3 JOINT FIRESTOPPING SYSTEM TYPES

A. General: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
   1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
   2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
   3. Provide firestop products that do not contain ethylene glycol.
   4. Provide additional component systems as may be required by manufacturers to satisfy compatibility requirement.

B. Intumescent Gypsum Wall Framing Gaskets: Applied to steel tracks, runners, and studs prior to framing installation. Provide products with fire, smoke, and acoustical ratings that allow movement of up to 100 percent compression and/or extension when tested in accordance with UL 2079 or ASTM E1966; have an L Rating of less than 1 cfm/ft. when tested in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 when tested in accordance with ASTM E90 or ASTM C919.

C. Perimeter Fire-Barrier System: Provide perimeter fire-barrier system that does not require direct screw attachment to mullions and transoms to support and fasten curtain-wall insulation for aluminum curtain-wall assemblies with one- or two-piece rectangular mullions at least 2-1/2 by 5 inches. System will be tested in accordance with ASTM E2307 for up to two-hour fire resistance and with ASTM E1233/E1233M for wind cycling equivalent to 108 mph wind for 500 cycles.

D. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined in accordance with ASTM E1966 or UL 2079, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

E. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined in accordance with ASTM E2307.

F. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined in accordance with UL 2079 based on testing at a positive pressure differential of 0.30 inch wg.
   1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

G. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined in accordance with ASTM E84.

2.4 ACCESSORIES

A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints in accordance with fire-resistive joint system manufacturer's written installation instructions and the following requirements:
   1. Remove foreign materials from substrate surfaces that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates in accordance with joint firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Apply a suitable bond breaker to prevent three-sided adhesion in applications where condition occurs.

3.3 INSTALLATION

A. General: Install joint firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
   1. Apply elastomeric fill in voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.

3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft..

B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge, so labels are visible to anyone seeking to remove joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage through the Contractor a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Latex joint sealants.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each application indicated below:
      a. Each kind of sealant and joint substrate indicated.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
         1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

A. Sustainable Design Submittals
1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

B. Product Data: For each joint-sealant product indicated.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

B. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

C. Field-Adhesion Test Reports: For each sealant application tested.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Provide the following upon request:
1. Qualification Data: For qualified Installer.
2. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
3. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
4. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

E. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
a. Silicone Sealants: 20 years from date of Substantial Completion.

B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by

joint-sealant manufacturer, based on testing and field experience.

B. General Emissions Evaluation: Products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Evaluation must state the applicable exposure scenario, total VOC (TVOC) content range, as well as the amount applied in mass per surface area (for wet applied products).

C. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.

D. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, and sealants.

E. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

F. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

G. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

H. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

PART 3 - EXECUTION

3.1 SILICONE JOINT SEALANTS

A. Sealant JS-S1 - Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, provide products from the following table that has a validation certificate from the Sealant, Waterproofing and Restoration Institute (SWRI).

			Substrate Primer Required: Yes/No/Test			
Manufacturer	Product	Manufacturer RatedMovement Capability (CLASS)	Mortar*	Anod. Alum.	Uncoated Glass	Other*
Dow Corning	790	± 50%	Yes	Test	No	Test
Dow Corning	791	± 50%	Yes	Test	No	Test
Dow Corning	795	± 50%	No	Yes	No	Test
Dow Corning	756 SMS	± 50%	No	Yes	No	Test
May National Associates, Inc.	Bondaflex Sil 295	± 50%	Yes	Test	No	Test
Momentive Performance Materials, Inc.	Silpruf SCS2000	± 50%	Yes	Test	No	Test
Momentive Performance Materials, Inc.	Silpruf NB SCS 9000	± 50%	Yes	Test	No	Test
Pecora Corporation	864	± 50%	Yes	Test	No	Test
Pecora Corporation	895	± 50%	Yes	Test	No	Test
			Substrate Primer Required: Yes/No/Test			
Manufacturer	Product	Manufacturer Rated Movement Capability (CLASS)		Anod. M	Uncoated Glasso r t	Other* A l u
Tremco Incorporated	Spectrum 3	± 50%	Yes	Test	No	Test
Tremco Incorporated	Spectrum 4-TS	± 50%	Yes	Test	No	Test

Table Notes:
* Indicates substrates with a cement component, such as concrete, that require use of a primer.
** Indicates that other substrates shall be tested for adhesion to determine if a primer will be required.

B. Sealant JS-S2 - Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide products from the following table that has a validation certificate from the Sealant, Waterproofing and Restoration Institute (SWRI).

			Substrate Primer Required: Yes/No/Test			
Manufacturer	Product	Manufacturer Rated Movement Capability (CLASS)	Mortar*	Anod. Alum.	Uncoated Glass	Other*

Dow Corning	790	+ 100/- 50%	No	Yes	No	Test
May National Associates, Inc.	Bondaflex Sil 290	+ 100/- 50%	Yes	Test	No	Test
Momentive Performance Materials, Inc.	Silpruf LM SCS2700	+ 100/- 50%	Yes	Test	No	Test
Pecora Corporation	890	+ 100/- 50%	Yes	Test	No	Test
Tremco Incorporated	Spectrum 1	+ 100/- 50%	Yes	Test	No	Test

Table Notes:
* Indicates substrates with a cement component, such as concrete, that require use of a primer.
** Indicates that other substrates shall be tested for adhesion to determine if a primer will be required.

3.2 WEATHER BARRIER SEALANTS

A. Sealant JS-W1 - Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT; tested and marketed specifically for sealing air barrier and vapor retarder sheets to common building materials, such as aluminum, vinyl, PVC, powder coat, paint and fluoropolymer coatings; UV resistant..
   1. Products: Subject to compliance with requirements, provide the following:
      a. Dow Corning Corporation; 758.

3.3 URETHANE JOINT SEALANTS

A. Sealant JS-U1 - Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type M, Grade P, Class 25, for Use T and I.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. LymTal International, Inc.; Iso-Flex 880 GB.
      b. May National Associates, Inc.; Bondaflex PUR 2 SL.
      c. Tremco Incorporated; Vulkem 445SSL or Vulkem 45SSL.

B. Sealant JS-U2 - Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Building Systems; Sonolastic NP 2.
      b. LymTal International, Inc.; Iso-Flex 881 or Iso-Flex 885 SG.
      c. May National Associates, Inc.; Bondaflex PUR 2 NS.
      d. Pacific Polymers International, Inc.; Elasto-Thane 227 High Shore Type II or Elasto-Thane 227 Type II.
      e. Pecora Corporation; Dynatred.
      f. Sika Corporation, Construction Products Division; Sikaflex - 2c NS or Sikaflex - 2c EZ Mix.
      g. Tremco Incorporated; Vulkem 227.

3.4 LATEX JOINT SEALANTS

A. Sealant JS-L1 - Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. DAP Products Inc.; ALEX Ultra 230.
d. May National Associates, Inc.; Bondaflex 600 or Bondaflex Sil-A 700.
e. Pecora Corporation; AC-20 + Silicone.
f. Protective Treatments Inc.; 738.
g. Schnee-Morehead, Inc.; SM 8200.
h. Tremco Incorporated; Tremflex 834.

3.5 MILDEW-RESISTANT JOINT SEALANTS

A. Sealant JS-M1 - Mildew-Resistant, Single-Component, Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Omniplus.
b. Dow Corning Corporation; 786 Mildew Resistant.
c. GE Advanced Materials - Silicones; Sanitary SCS1700.
d. May National Associates, Inc.; Bondaflex Sil 100 WF.
e. Pecora Corporation; 898.
f. Tremco Incorporated; Tremsil 200 Sanitary.

3.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

3.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 4 - EXECUTION

4.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

4.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

4.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Do not extend exterior sealants and primers into building interior (that is, inside the weatherproofing system) unless first verifying compliance with VOC requirements.

D. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces. Water-based tooling agents are unacceptable.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

4.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
      b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.

b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

4.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

4.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

4.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces; Type JS-U1 or JS-U2 as appropriate.
1. Joint Locations:
a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Joints between different materials listed above.
c. Other joints as indicated.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces; Type JS-S1 or JS-S2.
1. Joint Locations:
a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints between metal panels.
d. Joints between different materials listed above.

e. Perimeter joints between materials listed above and frames of doors, windows andlouvers.
f. Control and expansion joints in overhead surfaces.
g. Other joints as indicated.

C. Joint-Sealant Application: Exterior weather barrier joints; Type JS-W1.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces; Type JS-U1 or JS-U2 as appropriate.
1. Joint Locations:
a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces; Type JS-L1.
1. Joint Locations:
a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Tile control and expansion joints.
d. Perimeter joints between interior wall surfaces and frames of interior doors windowsand elevator entrances.
e. Other joints as indicated.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces; Type JS-M1.
1. Joint Sealant Location:
a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated.

END OF SECTION

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical joint sealants.

1.2 ACTION SUBMITTALS

A. Sustainable Design Submittals
   1. Product Data: For sealants, indicating VOC content.
   2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

B. Product Data: For each type of product.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

D. Samples for Verification: For each type and color of acoustical joint sealant required.
   1. Size: 1/2-inch- wide sealant joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Acoustical Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

F. Sustainable Design Submittals:
   1. Product Data: For sealants, indicating VOC content.
   2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Product Test Reports: For each type of acoustical joint sealant, for tests performed by qualified testing agency.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Warranty Documentation:
   1. Manufacturers' special warranties.
   2. Installer's special warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained between 40 and 95 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 60 and 90 deg F. Warm surfaces to be coated to 70 deg F to enhance drying.

1.7 WARRANTY

A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.

B. General Emissions Evaluation: Products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017. Evaluation must state the applicable exposure scenario, total VOC (TVOC) content range, as well as the amount applied in mass per surface area (for wet applied products).

C. VOC Content Limits: For wet applied product show compliance with VOC limits as defined in Section 018113 Sustainable Design Requirements.

D. Methylene Chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, and sealants.

E. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
   1. Colors of Exposed Acoustical Joint Sealants: Match Architect's samples.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 079513.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Floor expansion joint covers.
   2. Wall expansion joint covers.
   3. Ceiling expansion joint covers.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
   1. Floor expansion joint covers.
   2. Wall expansion joint covers.
   3. Ceiling expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples for Initial Selection: For each type of exposed finish.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.

D. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.

E. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.
   7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by a qualified testing agency.

1.4 MOCKUPS

A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of typical expansion joint cover assembly as shown on Drawings.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.
1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies to be subjected to hose stream testing.

C. Expansion Joint Design Criteria:
1. Type of Movement: Thermal and Wind sway.
a. Nominal Joint Width: As indicated on Drawings.
b. Joint Movement Capacity: Plus and Minus 25 percent of joint width.
2. Seismic Movement:
a. Joint Movement: As indicated on Drawings.

2.3 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.4 FLOOR EXPANSION JOINT COVERS

A. Center-Plate Floor Joint Cover: Assembly consisting of center plate that slides over metal frames fixed to sides of joint gaps.
1. Application: Floor to floor Floor to wall.
2. Installation: Surface mounted Recessed.
3. Load Capacity:
a. Uniform Load: 50 lb/sq. ft..
b. Concentrated Load: 300 lb.
c. Maximum Deflection: 0.0625 inch.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Cover-Plate Design: Plain.
6. Exposed Metal:

a. Aluminum: Clear anodic, Class I.

2.5 WALL EXPANSION JOINT COVERS

A. Center-Plate Wall Joint Cover: Assembly consisting of center plate that slides over gaskets in metal frames fixed to sides of joint gaps.
   1. Application: Wall to wall.
   2. Fire-Resistance Rating: Not less than that of adjacent construction.
   3. Exposed Metal:
      a. Aluminum: Clear anodic, Class I.

2.6 CEILING EXPANSION JOINT COVERS

A. Center-Plate Ceiling Joint Cover: Assembly consisting of center plate that slides over gasket in metal frames fixed to sides of joint gaps.
   1. Application: Ceiling to ceiling Wall to ceiling.
   2. Exposed Metal:
      a. Aluminum: Clear anodic, Class I.

2.7 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.

C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

E. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.9 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.
   2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   3. Directional Satin Finish: No. 4.

2.10 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
   1. Provide where indicated on Drawings.

B. Manufacturer's stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
   2. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION

SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior expansion joint covers.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
   1. Exterior expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples for Initial Selection: For each type of exposed finish.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.

E. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.
   7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by a qualified testing agency.

1.4 MOCKUPS

A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.
   1. Hose Stream Test: Wall-to-wall and wall-to-soffit assemblies shall be subjected to hose stream testing.

C. Expansion Joint Design Criteria :
   1. Type of Movement: Thermal and Wind sway.
      a. Nominal Joint Width: As indicated on Drawings.
      b. Joint Movement Capability: Plus and Minus 25 percent of joint width.
   2. Seismic Movement:
      a. Joint Movement: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Exterior Metal-Plate Joint Cover : Assembly consisting of sliding metal cover plate in continuous contact with gaskets mounted on metal frames fixed to sides of joint gap.
   1. Application: Wall to wall, wall to soffit, and soffit to soffit.
   2. Installation: Surface mounted.
   3. Fire-Resistance Rating: Not less than that of adjacent construction.
   4. Exposed Metal:
      a. Aluminum: Clear anodic, Class I.

C. Preformed Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

2.4 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

D. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.6 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
   1. Provide where indicated on Drawings.

B. Manufacturer's stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.

3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Install frames in continuous contact with adjacent surfaces.
   a. Shimming is not permitted.
5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Elastomeric Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 CONNECTIONS

A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with roof expansion joint covers specified in Section 077129 "Manufactured Roof Expansion Joints." Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.

3.5 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections.

END OF SECTION