

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT		1. CONTRACT ID CODE	PAGE OF PAGES 1 2
2. AMENDMENT/MODIFICATION NO. 000002	3. EFFECTIVE DATE 07/20/2016	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
6. ISSUED BY Bureau of Reclamation Upper Colorado Region Regional Office 125 South State Street, Room 8100 Salt Lake City UT 84138	CODE R40	7. ADMINISTERED BY (If other than Item 6)	CODE
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		(x) 9A. AMENDMENT OF SOLICITATION NO. R16PS01019	9B. DATED (SEE ITEM 11) 06/23/2016
CODE	FACILITY CODE	10A. MODIFICATION OF CONTRACT/ORDER NO.	10B. DATED (SEE ITEM 13)

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended. is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning 5 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not. is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

The purpose of AMENDMENT 000002 is as follows:

- To post revisions to the Specifications. Please see Attachment 1.
- To post revisions to the Drawings. Please see Attachment 2.
- To post Questions and Answers received. Please see Attachment 3.
- To post revised FAR clause 52.211-10 Commencement, Prosecution, and Completion of Work. Please see Attachment 4.

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9 A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Jared F. Van Buskirk
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED
16B. UNITED STATES OF AMERICA (Signature of Contracting Officer)	16C. DATE SIGNED

CONTINUATION SHEETREFERENCE NO. OF DOCUMENT BEING CONTINUED
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NAME OF OFFEROR OR CONTRACTOR

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	5. To extend the solicitation closing date and time to August 2, 2016 at 3 p.m. MDT.				

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SECTION 01 33 00
SUBMITTALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Cost:
1. Include in prices offered in the Price Schedule for other items of work.

1.02 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers (ASME)
1. ASME Y14.1-12 Decimal-inch Drawing Sheet Size and Format
- B. National Institute of Building Sciences (NIBS)
1. NIBS NCS-14 United States National CAD Standards, Version 6

1.03 DEFINITIONS

- A. Days: Calendar days.
- B. Required Submittal Number (RSN): Identifies items to be submitted together as a complete submittal.
- C. Submittal Types, as listed in Table 01 33 00A - List of Submittals:
1. A - Action:
 - a. Government will respond as to adequacy of submittal.
 - b. Action Submittals: Considered “shop drawings” within the terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction.
 2. I - Informational:
 - a. Government will acknowledge receipt of Informational submittals.
 - b. Government may reject an Informational submittal when the submittal does not satisfy contract requirements. Correct mistakes or deficiencies in rejected Informational submittals and resubmit.
 - c. Informational Submittals: Considered “shop drawings” within terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction, except that approval by Government is not required.

1.04 SUBMITTAL REQUIREMENTS

- A. In case of conflict between requirements of this section and requirements included elsewhere in these specifications, requirements included elsewhere take precedence.
- B. General:
1. Prepare in English.
 2. Label with contract number and title, and RSN.
 3. Measurement Units: US Customary Units.
 4. Electronic Documents:
 - a. Searchable .pdf.
 - b. Includes submittals which are not drawings or photographs.
- C. Drawings:
1. Minimum Identification in Title Block:
 - a. Contract number and title.
 - b. Contractor's or supplier's title and drawing number.
 - c. Date.
 2. Reserve 3 by 3 inch space next to title block for review stamps.
 3. Size: D size (22 inches by 34 inches) as defined by ASME Y14.1.
 4. Draw to scale using computer drafting or drafting equipment, unless otherwise specified.
 - a. Computer drafted drawings:
 - 1) In accordance with NIBS NCS.
 - 2) Electronic file format: Compatible with AUTOCAD, Version 2015 or later.
 - 3) Compile using "eTransmit" utility in AUTOCAD.
 - b. Drawing prepared with drafting equipment, when allowed: Lettering shall be neat.
 5. Drawings Designated as "Government Format" in Specifications:
 - a. Computer drafted.
 - b. Government will provide an electronic AutoCAD format template.
 - c. Title block and sheet format:
 - 1) As shown on standard drawing 40-D-7102.
 - 2) Government will provide template.

- 3) Government will provide specific title block information to be used.
6. Final Drawings:
 - a. Computer drafted.
 - b. Government will provide an electronic AutoCAD format template.
 - c. Show as-built changes, including revision dates, made during installation. Indicate changes by clouding.
 7. Electronic Files:
 - a. On CD or DVD discs.
- D. Product Data:
1. Mark manufacturer's data for commercial products or equipment, such as catalog cut sheets.
 - a. Identify manufacturer's name, type, model, size, and characteristics.
 - b. Illustrate that product or equipment meets requirements of specifications.
 - c. Mark items to be furnished in a manner that will photocopy (no highlighter).
 - d. Strike through items that do not apply.
- E. Certifications:
1. Certifications by a Registered Professional: Signed and sealed by registered professional.
 2. Manufacturer's Certifications: Signed by authorized representative of manufacturer.
- F. Manuals:
1. Copies:
 - a. Printed copies: Bound and indexed.
 - b. Electronic copies: Searchable Adobe pdf on CD or DVD discs.
 - 1) Bookmark longer files to assist in navigating file.
 - 2) Electronic files may be submitted as separate parts of a manual. After each separate electronic file is approved, compile each approved electronic file to assemble an entire manual which shall be consistent with a single final manual submittal.
 2. Contents:
 - a. Parts identification lists, lists of special tools, and accessories.
 - b. Schematics and wiring diagrams.

- c. Detailed instructions for installing, operating, lubricating, and maintaining equipment.
 - d. As-built drawings, photographs, and test records or reports if required by the specifications.
- G. Photographs:
 - 1. Include negatives or digital files on CD or DVD in .jpeg or similar format.
- H. Samples and Color Selection Submittals:
 - 1. Label with complete manufacturer's product and color identification.
 - 2. Include type and quantity of materials specified in the referenced section in each "set" of samples.
 - 3. Samples: Representative of product to be installed. Xerographic sheets for color selection are not acceptable.
 - 4. Color Chips: Sample paint chips. Ink color reproductions are not acceptable.
 - 5. Label each sample, sample kit, set of color chips, or color chart with contract number and title.
 - 6. Government will select architectural color and pattern after product approval.

1.05 SUBMITTALS PROCEDURES

- A. Submit only checked submittals. Submittals without evidence of Contractor's approval will be returned for resubmission.
- B. Submit complete sets of required materials for each RSN as specified in "Submittals Required" column in Table 01 33 00A - List of Submittals. A complete set includes listed items for RSNs with multiple parts.
- C. Submit sets specified in "Sets to be sent:" columns in Table 01 33 00A - List of Submittals.
 - 1. Submittals identified with "CDMS" in the "Sets to be sent" column shall be submitted electronically in accordance with Section 01 31 30 - Contract Document Management System.
- D. Include the following information in transmittal letters:
 - 1. Contract number and title.
 - 2. RSN for each attached submittal.
 - 3. Responsible code.
 - 4. Number of sets for each RSN.
 - 5. Identify submittal as initial or resubmittal.

- E. Resubmittal of submittals not approved:
 - 1. Mark changes such that they are readily identifiable and show revision date.
 - 2. Describe reasons for significant changes in transmittal letter.
 - 3. Resubmit returned submittals within 28 days after receiving the comments, unless otherwise directed.
 - 4. Requirements for initial submittals apply to resubmittals.

1.06 REVIEW OF SUBMITTALS

- A. Time Required:
 - 1. Submittal review will require 21 days for review of each submittal or resubmittal, unless otherwise specified.
 - 2. Time required for review of each submittal or resubmittal begins when complete sets of materials required for a particular RSN are received and extends through return mailing postmark date.
- B. Time in Excess of Specified:
 - 1. CO may extend contract completion date to allow additional time for completing work affected by excess review time.
 - a. Time extension will be to extent that excess review time caused delay to contract completion date.
 - b. Time extension will not exceed time used in excess of specified number of days for review of submittals or resubmittals.
 - c. Concurrent days of excess review time resulting from review of 2 or more separate submittals or resubmittals will be counted only once in extending contract completion date.
 - 2. No time extension will be allowed if Contractor fails to make complete action submittals in sequence and within time periods specified.
 - 3. Adjustment for delay will be made only to the extent that:
 - a. Approval was required under the contract, and.
 - b. Requests for approval were properly and timely submitted and were approved.
 - 4. Adjustment will be subject to terms of paragraphs (b) and (c) of clause at FAR 52.242-14, Suspension of Work; however, no such delay shall be deemed to be a “suspension order” as term is used in that clause.
- C. Return of Submittals:
 - 1. Return of submittals will be by CDMS response or hard copy, as applicable.
 - 2. Action Submittals: 1 set of submittals required for action will be returned either approved, approved with comments or not approved.

- a. Revise and resubmit submittals not approved.
 - b. Do not change designs without approval of CO after drawings, documentation, and technical data have been approved.
3. Informational Submittals: Government will acknowledge Informational submittals.
- a. Informational submittals will not be returned when they satisfy contract requirements.
 - b. Informational submittals that do not satisfy contract requirements may be returned for resubmittal or additional information may be requested.

1.07 HARD COPY TRANSMITTALS

- A. Addresses for codes listed in Table 01 33 00A - List of Submittals:
1. Contracting Officer, Bureau of Reclamation, Attn UC-840, 125 South State St, Room 6107, Salt Lake City, UT 84138-1147.
 2. Construction Engineer, Bureau of Reclamation, 1235 La Plata Hwy, Farmington, New Mexico, 87401.
 3. Technical Service Center, Bureau of Reclamation, Attn: 86-68510, P.O. Box 25007, Denver CO 80225-0007; Express Mail: Sixth and Kipling, Building 67, Room 152.
- B. Send original transmittal letter with appropriate number of sets to office listed in “Responsible Code” column in Table 01 33 00A - List of Submittals.
1. Responsible codes starting with “86-6” are located in Technical Service Center. Send these submittals to the TSC address shown above.
- C. Send copy of transmittal letter with appropriate number of sets to offices that are not responsible code, but show “Sets to be sent” in Table 01 33 00A - List of Submittals.
- D. When “Sets to be sent” is 0, send a copy of transmittal letter to that office.
- E. Submittals required by specifications, but not listed in Table 01 33 00A - List of Submittals:
1. Submit in accordance with this section.
 2. Submit to CE unless otherwise specified.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, and TSC indicates Technical Service Center. CDMS indicates Contract Document Management System.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Responsible code	Sets to be sent: **		
						CO	CE	TSC
01 14 10-1	Use of Site	Land Use and Landscape Rehabilitation Plan	At least 28 days before use of Government land	A	CE	CDMS		
01 31 19-1	Project Management and Coordination	Written Summary	Monthly once on-site construction begins	A	CE	CDMS		
01 31 19-2	Project Management and Coordination	Off Easement Land Use Coordination	At least 4 months prior to use of land	A	CE	CDMS		
01 31 30-1	Contract Document Management System	Approval Data	Within 7 days of Award	A	CE	0	1	0
01 31 30-2	Contract Document Management System	Final Data	Within 14 days of completion of work	I	CE	0	2	2
01 32 10-1	Construction Program	Representative Information	Within 7 days after receipt of Notice of Award	I	CE	CDMS		
01 32 10-2	Construction Program	Baseline Schedule	Within 21 days after receipt of Notice to Proceed	A	CE	0	5	3
01 32 10-3	Construction Program	Updated Schedule Reports	With monthly requests for progress payments.	A	CE	CDMS		
01 32 10-4	Construction Program	Time Impact Analysis	Within 28 days after CO directs a contract change, with any proposal for a future modification, with any value engineering proposal, or with any request or claim for an equitable adjustment to the contract	A	CE	CDMS		
01 35 10-1	Safety Data Sheets	Complete LHM and SDS	At least 14 days before jobsite delivery of hazardous material	I	CE	CDMS		
01 35 10-2	Safety Data Sheets	Updated LHM and SDS	At least 14 days before jobsite delivery of hazardous material not previously listed	I	CE	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, and TSC indicates Technical Service Center. CDMS indicates Contract Document Management System.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Responsible code	Sets to be sent: **		
						CO	CE	TSC
01 35 20-1	Safety and Health	Emergency Action Plans Written Program and Training Records	At least 21 days before beginning onsite work	A	CE	CDMS		
01 35 20-2	Safety and Health	Job Hazard Analyses (JHA)	At least 28 days before beginning onsite work	A	CE	CDMS		
01 35 20-3	Safety and Health	Exposer Assessment Form	At least 28 days before beginning onsite work	A	CE	CDMS		
01 35 20-4	Safety and Health	Monthly Accident Summary Report	First day of each month. See paragraph 3.8 of RSHS.	A	CE	CDMS		
01 35 20-5	Safety and Health	Respirator User Documentation	At least 30 days before beginning onsite work	A	CE	CDMS		
01 35 20-6	Safety and Health	Crane Training Certificates	At least 28 days before beginning onsite work	A	CE	CDMS		
01 35 20-7	Safety and Health	Other Training Certificates, as applicable	At least 28 days before beginning onsite work	A	CE	CDMS		
01 35 22-1	First-Aid	Medical Facilities Plan	Submitted and approved before start of operations	A	CO	CDMS		
01 35 30-1	Contractor's Onsite Safety Personnel	Resume	At least 14 days before beginning on-site construction	I	CE	CDMS		
01 35 30-2	Contractor's Onsite Safety Personnel	Safety Inspection Reports	Once each week	I	CE	CDMS		
01 46 20-1	Testing Agency Services	Testing Agency Services Plan	At least 28 days before testing is required	A	CE	CDMS		
01 55 00-1	Vehicular Access and Parking	Initial Digital Recording	At least 21 days before beginning on-site work	A	CE	0	1	0
01 55 00-2	Vehicular Access and Parking	Post Construction Digital Recording	At least 21 days before leaving site.	A	CE	0	1	0
01 55 00-3	Vehicular Access and Parking	Post Repair Digital Recording	Within 14 days of making repairs.	A	CE	0	1	0
01 55 20-1	Traffic Control	Traffic Control Plan	At least 60 days before affecting public traffic.	A	CE	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Responsible code	Sets to be sent: **		
						CO	CE	TSC
01 55 20-2	Traffic Control	Permit Applications	At least 60 days before affecting public traffic	A	CE	CDMS		
01 55 20-3	Traffic Control	Permits	At least 14 days before affecting public traffic	I	CE	CDMS		
01 56 10-1	Protection of Existing Installations	Plan for Protecting Existing Installations	At least 28 days before start of onsite construction work	A	CE	CDMS		
01 56 15-1	Protection of Existing Utilities	Utility Owner Acknowledgment	At least 28 days before start of onsite construction work	A	CE	CDMS		
01 56 15-2	Protection of Existing Utilities	Utility Investigation	At least 7 days after completing investigation	I	CE	CDMS		
01 57 20-1	Environmental Controls	Copy of Applicable Air Quality Permit	At least 14 days before beginning on-site work	I	CE	CDMS		
01 57 30-1	Water Pollution Control	Updated Stormwater Pollution Prevention Plan (SWPPP)	At least 28 days before commencing construction activities	A	CE	CDMS		
01 57 30-2	Water Pollution Control	Spill Prevention Control and Countermeasure (SPCC) Plan	At least 28 days before delivery or storage of oil	A	CE	CDMS		
01 57 50-1	Tree and Plant Protection	Protection Plan	At least 28 days before commencing on site construction work	A	CE	CDMS		
01 57 90-1	Preservation of Historical and Archeological Data	Alternate Use Area or Borrow Area	At least 28 days before commencing on site construction work	A	CE	CDMS		
01 71 20-1	Surveying	Surveying Plan	At least 28 days before beginning survey work	A	CE	CDMS		
01 71 20-2	Surveying	Resume	At least 28 days before beginning survey work; At least 28 days before personnel change	I	CE	CDMS		
01 71 20-3	Surveying	Accuracy Check Results	At least 28 days before beginning work	I	CE	CDMS		
01 71 20-4	Surveying	Completed and Reduced Survey Notes	Within 2 days of completing and reducing notes	I	CE	CDMS		
01 71 20-5	Surveying	Original Field Survey Books	Weekly	I	CE	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, and TSC indicates Technical Service Center. CDMS indicates Contract Document Management System.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Responsible code	Sets to be sent: **		
						CO	CE	TSC
01 71 20-6	Surveying	Quantity Survey Notes and Computations	Accompanying progress payment requests	I	CE	CDMS		
01 71 20-7	Surveying	Workday's Survey Notes	At conclusion of workday if requested by Government	I	CE	CDMS		
01 74 00-1	Cleaning and Waste Management	Waste Production and Disposal Plan	At least 28 days before starting onsite work	I	CE	CDMS		
01 74 00-2	Cleaning and Waste Management	Waste Production and Disposal Records	Within 7 days of waste disposal	I	CE	CDMS		
01 74 00-3	Cleaning and Waste Management	Environmental Consultant Resume	At least 28 days before beginning environmental assessment	I	CE	CDMS		
01 74 00-4	Cleaning and Waste Management	Environmental Site Assessment	Within 14 days of completion of work	I	CE	CDMS		
01 78 30-1	Project Record Documents	Progress As-built Drawings	Within 14 days of completion of structures or every 14 days whichever is fewer.	I	CE	0	1	1
						CDMS		
01 78 30-1	Project Record Documents	Final As-built Drawings	Within 14 days of completion of work	I	CE	0	1	1
						CDMS		
03 20 00-1	Concrete Reinforcing	Reinforcement Diagrams and Lists	At least 42 days before placing concrete	A	86-68530	CDMS		
03 30 00-1	Cast-In-Place Concrete	Approval Data	At least 42 days before placing concrete	A	86-68530	CDMS		
03 30 00-2	Cast-In-Place Concrete	Certifications	At least 42 days before placing concrete	A	86-68530	CDMS		
03 30 00-3	Cast-In-Place Concrete	Cementitious Materials Certification and Test Reports	At least 42 days before placing concrete	A	86-68530	CDMS		
03 30 00-4	Cast-In-Place Concrete	Test Reports	At least 42 days before placing concrete	A	86-68530	CDMS		
03 48 00-1	Precast Concrete Structures	Product Drawings and Data	At least 42 days before casting first structure	A	86-68120	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, and TSC indicates Technical Service Center. CDMS indicates Contract Document Management System.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Responsible code	Sets to be sent: **		
						CO	CE	TSC
03 48 00-2	Precast Concrete Structures	Mix Design	At least 42 days before casting first structure	I	86-68530	CDMS		
03 48 00-3	Precast Concrete Structures	Curing, Handling and Storage Requirements	At least 42 days before casting first structure	A	86-68530	CDMS		
03 63 00-1	Epoxy Grout	Approval Data	At least 42 days before placing grout	A	86-68530	CDMS		
04 22 10-1	Reinforced Concrete Unit Masonry Assemblies	Approval Data	At least 42 days before beginning construction with concrete masonry units	A	86-68120	CDMS		
04 22 10-2	Reinforced Concrete Unit Masonry Assemblies	Sample Kit	At least 42 days before beginning construction with concrete masonry units	A	86-68120	0	0	1
04 22 10-3	Reinforced Concrete Unit Masonry Assemblies	Certifications	At least 42 days before beginning construction with concrete masonry units	A	86-68120	CDMS		
04 22 10-4	Reinforced Concrete Unit Masonry Assemblies	Mix Design	At least 42 days before beginning construction with concrete masonry units	A	86-68120	CDMS		
04 22 10-5	Reinforced Concrete Unit Masonry Assemblies	Instructions	At least 42 days before beginning construction with concrete masonry units	A	86-68120	CDMS		
05 21 00-1	Steel Joists	Approval Drawings, Data, and Certification	At least 42 days before fabricating joists	A	86-68120	CDMS		
05 21 00-2	Steel Joists	Welder Qualifications	At least 42 days before fabricating joists	A	86-68120	CDMS		
05 21 00-3	Steel Joists	Inspection Reports	Within 30 days of completing inspection	A	86-68120	CDMS		
05 30 00-1	Metal Roof Deck	Approval Drawings and Data	At least 42 days before installing roof deck	A	86-68120	CDMS		
05 30 00-2	Metal Roof Deck	Welder Qualifications	At least 42 days before installing roof deck	A	86-68120	CDMS		

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Responsible code	Sets to be sent: **		
						CO	CE	TSC
07 41 13-1	Preinsulated Metal Roof Panels	Sample and Color Sample Kit	At least 42 days before installing panels	A	86-68120	0	0	1
07 41 13-2	Preinsulated Metal Roof Panels	Product Data and Shop Drawings	At least 42 days before installing panels	A	86-68120	CDMS		
07 41 13-3	Preinsulated Metal Roof Panels	Closeout Maintenance Data	Within 14 days of installing panels	A	86-68120	CDMS		
07 42 13-1	Preinsulated Metal Wall Panels	Sample and Color Sample Kit	At least 42 days before installing panels	A	86-68120	0	0	1
07 42 13-2	Preinsulated Metal Wall Panels	Product Data and Shop Drawings	At least 42 days before installing panels	A	86-68120	CDMS		
07 42 13-3	Preinsulated Metal Wall Panels	Closeout Maintenance Data	Within 14 days of installing panels	A	86-68120	CDMS		
08 34 53-1	Security Doors and Frames	Approval Drawings and Data	At least 42 days before installing doors	A	86-68120	CDMS		
08 34 53-2	Security Doors and Frames	Instructions	At least 42 days before installing doors	A	86-68120	CDMS		
08 71 00-1	Door Hardware	Approval Data	At least 42 days before installing hardware	A	86-68120	CDMS		
08 71 00-2	Door Hardware	Instructions	At least 42 days before installing hardware	A	86-68120	CDMS		
09 65 10-1	Rubber Wall Base	Approval Data and Color Sample Kit	At least 42 days before installing wall base	A	86-68120	CDMS		
09 65 10-2	Rubber Wall Base	Instructions	At least 42 days before installing wall base	A	86-68120	CDMS		
09 96 20-1	Coatings	Approval Data	At least 42 days before beginning coating work	A	86-68540	CDMS		
09 96 20-2	Coatings	Final Approval Data	At least 42 days before beginning coating work	A	86-68540	CDMS		
09 96 20-3	Coatings	Contractor Testing Data for "Shop or Field Applied" Coatings	At least 42 days before beginning coating work	A	86-68540	CDMS		
10 14 26-1	Utility Markers	Utility Marker Plan	At least 42 days before start of construction activities	A	CE	CDMS		

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						CO	CE	TSC
22 11 35-1	Pre-Manufactured Pump Station	Pre-construction Data and Drawings	At least 42 days before fabrication or procurement	A	86-68410	CDMS		
22 11 35-2	Pre-Manufactured Pump Station	Manufacturer Post Production Testing Results	At least 42 days before fabrication or procurement	A	86-68410	CDMS		
22 11 35-3	Pre-Manufactured Pump Station	Manufacturer On-site Testing Results and Final Documents	At least 42 days before fabrication or procurement	A	86-68420	0	1	1
						CDMS		
22 13 16-1	Foundation and Building Drainage Piping	Approval Data	Within 42 days after Notice to proceed	A	86-68410	CDMS		
23 05 93-1	Testing, Adjusting, and Balancing for HVAC Equipment	Approval Data	Within 42 days after Notice to proceed	A	86-68410	CDMS		
23 05 93-2	Testing, Adjusting, and Balancing for HVAC Equipment	Certified Testing Adjusting and Balance Reports	Within 14 days of final testing	A	86-68410	CDMS		
23 33 10-1	Duct Accessories	HVAC Accessories Approval Data	Within 42 days after Notice to proceed	A	86-68410	CDMS		
23 33 10-2	Duct Accessories	HVAC Accessories Final Data	Within 14 days of final testing	A	86-68410	CDMS		
23 34 00-1	HVAC Fans	Approval Data	Within 42 days after Notice to proceed	A	86-68410	CDMS		
23 34 00-2	HVAC Fans	Final Data	Within 14 days of final testing	A	86-68410	CDMS		
23 82 39-1	Unit Heaters	Approval Data	Within 42 days after Notice to proceed	A	86-68410	CDMS		
23 82 39-2	Unit Heaters	Final Data	Within 14 days of final testing	A	86-68410	CDMS		

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						CO	CE	TSC
25 00 01-1	Control and Monitoring	Approval Data - Monitoring and Control Systems Technical Specialist Work Summary	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
25 00 01-2	Control and Monitoring	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
25 00 01-3	Control and Monitoring	Approval Data - Software Development Documentation	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
25 00 01-4	Control and Monitoring	Check Prints	At same time as equipment is shipped to the site	A	86-68450	CDMS		
25 00 01-5	Control and Monitoring	Approval Data - Final Drawings, Documentation, and Operations and Maintenance Manuals	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
25 00 02-1	Programmable Controller	Approval Drawings	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
25 00 02-2	Programmable Controller	Approval Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
25 00 02-3	Programmable Controller	Final Drawings, Documentation, and Operations and Maintenance Manuals	Within 28 days after installation	I	86-68450	CDMS		
25 08 10-1	Automation System Testing, Acceptance, and Training	FAT Procedure and Start Date	At least 42 days before beginning test	A	86-68450	CDMS		
25 08 10-2	Automation System Testing, Acceptance, and Training	FAT Test Report	Not more than 28 days after test	I	86-68450	CDMS		
25 08 10-3	Automation System Testing, Acceptance, and Training	SPAT Procedure and Start Date	At least 42 days before beginning test	A	86-68450	CDMS		

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						CO	CE	TSC
25 08 10-4	Automation System Testing, Acceptance, and Training	SPAT Test Report	Not more than 28 days after test	I	86-68450	CDMS		
25 08 10-5	Automation System Testing, Acceptance, and Training	OAT Procedure and Start Date	At least 42 days before beginning test	A	86-68450	CDMS		
25 08 10-6	Automation System Testing, Acceptance, and Training	OAT Report	Not more than 28 days after test	I	86-68450	CDMS		
25 08 10-7	Automation System Testing, Acceptance, and Training	Training Plan	No less than 42 days before first commissioning is scheduled to begin	I	86-68450	CDMS		
26 05 10-1	Conductors and Cables	Approval Data	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
26 05 10-2	Conductors and Cables	Field Test Reports	Not more than 30 days after test	I	86-68430	CDMS		
26 05 13-1	Medium-Voltage Power Cable System	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
26 05 13-2	Medium-Voltage Power Cable System	Field Test Reports	Within 14 days after tests are completed	I	86-68430	CDMS		
26 05 20-1	Grounding and Bonding	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
26 05 20-2	Grounding and Bonding	Test Reports	Within 14 days after tests are completed	I	86-68430	CDMS		
26 05 33-1	Raceways and Boxes	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
26 13 26-1	Medium-Voltage Metal-Clad Switchgear	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68430	CDMS		

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						CO	CE	TSC
26-13-26-2	Medium-Voltage Metal-Clad Switchgear	Wiring Diagrams	Within 14 days after tests are completed	I	86-68430	CDMS		
26-13-26-3	Medium-Voltage Metal-Clad Switchgear	Check Prints	At same time as equipment is shipped to the site	A	86-68430	CDMS		
26-13-26-4	Medium-Voltage Metal-Clad Switchgear	Factory Test Reports	Within 14 days after tests are completed	I	86-68430	CDMS		
26-13-26-5	Medium-Voltage Metal-Clad Switchgear	Field Test Reports	Within 14 days after tests are completed	I	86-68430	CDMS		
26-13-26-6	Medium-Voltage Metal-Clad Switchgear	Final Drawings	Within 14 days after installation	A	86-68430	CDMS		
26-13-26-7	Medium-Voltage Metal-Clad Switchgear	Operation and Maintenance Instruction Book	Within 14 days after installation	I	86-68430	CDMS		
26-16-13-1	Primary Unit Substation	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
26-16-13-2	Primary Unit Substation	Schematic and Wiring Diagrams	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
26-16-13-3	Primary Unit Substation	Factory Test Notification	At least 14 days prior to testing	A	86-68430	CDMS		
26-16-13-4	Primary Unit Substation	Check Prints	At same time as equipment is shipped to the site	A	86-68430	CDMS		
26-16-13-5	Primary Unit Substation	Factory Test Reports	Within 14 days after tests are completed	A	86-68430	CDMS		
26-16-13-6	Primary Unit Substation	Field Test Reports	Within 14 days after tests are completed	A	86-68430	CDMS		
26-16-13-7	Primary Unit Substation	Final Drawings	Within 28 days after installation	A	86-68430	CDMS		
26-16-13-8	Primary Unit Substation	Operation and Maintenance Instruction Book	Within 14 days after Final Drawings acceptance	A	86-68430	CDMS		

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						CO	CE	TSC
26 22 12-1	Dry-Type Transformers	Approval Data	Within 42 days after Notice to proceed	A	86-68430	CDMS		
26 22 12-2	Dry-Type Transformers	Operation and Maintenance Instruction Book	Within 14 days after installation	I	86-68430	CDMS		
26 24 41-1	Distribution Panelboards	Approval Data	Within 42 days after Notice to proceed	A	86-68430	CDMS		
26 24 41-2	Distribution Panelboards	Approval Layouts	Within 42 days after Notice to proceed	A	86-68430	CDMS		
26 24 41-3	Distribution Panelboards	Test Data	Within 14 days after tests are completed	I	86-68430	CDMS		
26 27 40-1	Wiring Devices	Approval Data	Within 42 days after Notice to proceed	A	86-68430	CDMS		
26 42 10-1	Buried Galvanic Anode Cathodic Protection and Corrosion Monitoring Systems	Certification and Data	At least 42 days before procuring materials	A	86-68540	CDMS		
26 42 10-2	Buried Galvanic Anode Cathodic Protection and Corrosion Monitoring Systems	Final Data	Within 7 days of final testing	A	86-68540	CDMS		
26 42 11-1	Submerged Galvanic Anode Cathodic Protection System for Welded Tanks	Certification and Data	At least 42 days before procuring materials	A	86-68540	CDMS		

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						CO	CE	TSC
26 42 11-2	Submerged Galvanic Anode Cathodic Protection System for Welded Tanks	Final Data	Within 7 days of final testing	A	86-68540	CDMS		
26 42 12-1	Bolted Tank Submerged Galvanic Anode Cathodic Protection System	Certification, Design, and Manufacturer's Data	At least 42 days before procuring materials	A	86-68540	CDMS		
26 42 12-2	Bolted Tank Submerged Galvanic Anode Cathodic Protection System	Final Data	Within 7 days of final testing	A	86-68540	CDMS		
26 51 00-1	Interior Lighting	Approval Data	Within 42 days after Notice to proceed	A	86-68430	CDMS		
26 52 00-1	Emergency and Exit Lighting	Approval Data	Within 42 days after Notice to proceed	A	86-68430	CDMS		
26 56 00-1	Exterior Lighting	Approval Data	Within 42 days after Notice to proceed	A	86-68430	CDMS		
27 15 00-1	Communications Cabling	Approval Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
27 15 00-2	Communications Cabling	Approval Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
27 20 01-1	Radio Equipment	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
27 20 01-2	Radio Equipment	Operations and Maintenance Manual	Within 30 days after installation	I	86-68450	CDMS		
27 30 01-1	Telephone Equipment	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
27 30 01-2	Telephone Equipment	Check Prints	Within 14 days after installation	A	86-68450	CDMS		
27 30 01-3	Telephone Equipment	Operations and Maintenance Manual	Within 30 days after installation	I	86-68450	CDMS		

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						CO	CE	TSC
27 30 01-4	Telephone Equipment	Field Operational Checkout Test Report	At least 42 days before beginning test	I	86-68450	CDMS		
28 10 01-1	Security and Surveillance Equipment	Approval Drawings and Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
28 10 01-2	Security and Surveillance Equipment	Test Procedure and Start Date	At least 42 days before beginning test	I	86-68450	CDMS		
28 10 01-3	Security and Surveillance Equipment	Test Report	Not more than 28 days after test	I	86-68450	CDMS		
28 10 01-4	Security and Surveillance Equipment	Check Prints	At same time as equipment is shipped to the site	A	86-68450	CDMS		
28 10 01-5	Security and Surveillance Equipment	Final Drawings and Operations and Maintenance Manuals	Within 28 days after installation	I	86-68450	CDMS		
28 31 00-1	Fire Detection and Alarm	Approval Data	Within 42 days after Notice to Proceed	A	86-68450	CDMS		
28 31 00-2	Fire Detection and Alarm	Testing Procedure and Notification	At least 42 days before beginning test	I	86-68450	CDMS		
28 31 00-3	Fire Detection and Alarm	Test Reports	Not more than 28 days after test	I	86-68450	CDMS		
28 31 00-4	Fire Detection and Alarm	Training Materials	Within 28 days after installation	I	86-68450	CDMS		
28 31 00-5	Fire Detection and Alarm	Operation and Maintenance Instruction Book	Within 28 days after installation	I	86-68450	CDMS		
31 02 10-1	Water for Dust Abatement	Meter Calibration	At least 42 days before beginning on-site work	A	CE	CDMS		
31 02 30-1	Dust Palliative	Proposed Application Area for Dust Palliative	At least 42 days before beginning on-site work	A	CE	CDMS		
31 23 02-1	Compacting Earth Materials	Test Results	Within 7 days after completion of tests	I	CE	CDMS		

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						CO	CE	TSC
31 23 70-1	Controlled Low Strength Material (CLSM)	Approval Data For CLSM Produced Without Native Soil	At least 42 days before placing	A	86-68530	CDMS		
31 23 70-2	Controlled Low Strength Material (CLSM)	Approval Data For CLSM Produced With Native Soil	At least 42 days before placing	A	CE	CDMS		
31 23 70-3	Controlled Low Strength Material (CLSM)	Contractor Field Quality Testing Results	Within 7 days of testing	A	CE	CDMS		
31 31 30-1	Soil-Applied Herbicide	Use Plan	At least 28 days before placing	A	CE	CDMS		
31 31 30-2	Soil-Applied Herbicide	Applier Certification	At least 28 days prior to beginning work	A	CE	CDMS		
31 37 00-1	Riprap	Approval Data and Test Results	At least 42 days before placing lining	A	CE	CDMS		
32 15 10-1	Gravel Surfacing	Gravel Certification	At least 42 days before placing surfacing	A	CE	CDMS		
32 15 10-2	Gravel Surfacing	Geofabric Installation	At least 42 days before placing surfacing	A	CE	CDMS		
32 15 10-3	Gravel Surfacing	Geofabric Certification	At least 42 days before placing surfacing	A	CE	CDMS		
32 31 10-1	Chain Link Fence	Certification	At least 42 days before installing fencing	A	CE	CDMS		
32 91 60-1	Erosion Control Blanket	Manufacturer's Information	At least 28 days before placing blanket	A	CE	CDMS		
32 91 60-2	Erosion Control Blanket	Installation Plan	At least 28 days before placing blanket	A	CE	CDMS		
32 92 20-1	Seeding	Seeding Plan	At least 28 days before seeding	A	CE	CDMS		
32 92 20-2	Seeding	Certifications	At least 28 days prior to beginning work	A	CE	CDMS		
33 05 21-1	Bored Utility Crossings	Placement Plan	At least 28 days prior to beginning work	A	CE	CDMS		

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						CO	CE	TSC
33 05 21-1	Bored Utility Crossings	Material Certification	At least 28 days prior to beginning work	A	CE	CDMS		
33 09 08-1	Probe Magnetic Flowmeter	Approval Data	At least 42 days before procurement	A	86-68410	CDMS		
33 09 08-2	Probe Magnetic Flowmeter	Final Data	Within 14 days prior to shipment to site	I	86-68410	CDMS		
33 09 08-3	Probe Magnetic Flowmeter	Test Reports	Within 14 days of completion of tests	I	86-68410	CDMS		
33 11 10-1	Pipeline General Requirements	Qualifications	At least 42 days before pipe fabrication or procurement	A	CE	CDMS		
33 11 10-2	Pipeline General Requirements	Pipelaying Diagrams	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 10-3	Pipeline General Requirements	Filling and Testing Plan	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 10-4	Pipeline General Requirements	Floatation Prevention Plan	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 12-1	Steel Line Pipe	Shop Drawings	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 12-2	Steel Line Pipe	Ventilation Plan	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 13-1	Ductile Iron Pipe	Shop Drawings	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 16-1	PVC Pressure Pipe	Shop Drawings	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 16-2	PVC Pressure Pipe	Pipe Manufacture Certification	Within 24 hours of taking measurements	A	CE	CDMS		

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						CO	CE	TSC
33 11 16-3	PVC Pressure Pipe	Test Results	Within 14 days of completion of tests	I	CE	CDMS		
33 11 18-1	HDPE Pressure Pipe	Heat Fusion Joint Operator Qualifications	At least 42 days before pipe fabrication or procurement	A	CE	CDMS		
33 11 18-2	HDPE Pressure Pipe	Shop Drawings	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 18-3	HDPE Pressure Pipe	Certification	14 days before shipping	A	CE	CDMS		
33 11 18-4	HDPE Pressure Pipe	Fusion Procedures	At least 42 days before pipe fabrication or procurement	A	CE	CDMS		
33 11 19-1	Fiberglass Pipe	Shop Drawings	At least 42 days before pipe fabrication or procurement	A	86-68140	CDMS		
33 11 19-2	Fiberglass Pipe	Joint Repair Plan	At least 42 days prior to delivery	A	86-68140	CDMS		
33 11 50-1	Pipe Crossings at Existing Utility Pipelines	Rubber Gasket Data	At least 42 days before pipe fabrication or procurement	A	CE	CDMS		
33 12 10-1	Valves and Equipment for Line Pipe Installations	Commercial Product Data	At least 42 days before fabrication or procurement	A	86-68140	CDMS		
33 12 10-2	Valves and Equipment for Line Pipe Installations	Service Manuals	Within 14 days after installation	I	86-68140	CDMS		
33 16 14-1	Air Chambers	Qualifications	At least 42 days before fabrication or procurement	A	86-68420	CDMS		
33 16 14-2	Air Chambers	Shop Drawings, Design Calculations, and Design Data	At least 42 days before fabrication or procurement	A	86-68420	CDMS		
33 16 14-3	Air Chambers	Surge Analysis	At least 42 days before fabrication or procurement	A	86-68420	CDMS		

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						CO	CE	TSC
33 16 14-4	Air Chambers	Commercial Products Data	At least 42 days before fabrication or procurement	A	86-68420	CDMS		
33 16 14-5	Air Chambers	Service Manuals	Within 14 days after installation	I	86-68420	CDMS		
33 16 50-1	Steel Tanks	Shop Drawings, Design Calculations and Design Data	At least 42 days before fabrication or procurement.	A	86-68420	CDMS		
33 16 50-2	Steel Tanks	Qualifications	At least 42 days before fabrication or procurement.	A	86-68420	CDMS		
33 16 50-3	Steel Tanks	Nondestructive Weld Test Reports	Within 7 days after installation.	I	86-68420	CDMS		
33 16 50-4	Steel Tanks	Commercial Products Data	At least 42 days before fabrication or procurement.	A	86-68420	CDMS		
33 16 50-5	Steel Tanks	Final Drawings and Data	Within 14 days after installation.	I	86-68420	CDMS		
33 21 95-1	Metal Piping for Line Pipe Installations	Shop Drawings	At least 42 days before fabrication or procurement	A	86-68140	CDMS		
33 21 95-2	Metal Piping for Line Pipe Installations	Commercial Products Data	At least 42 days before fabrication or procurement	A	86-68140	CDMS		
33 21 95-3	Metal Piping for Line Pipe Installations	Final Drawings	Within 14 days after installation	I	86-68140	CDMS		
35 21 95-1	Steel Pipe	Shop Drawings	At least 42 days before fabrication or procurement.	A	86-68420	CDMS		
35 21 95-2	Steel Pipe	Commercial Products Data	At least 42 days before fabrication or procurement.	A	86-68420	CDMS		
35 21 95-3	Steel Pipe	Final Drawings	Within 14 days after installation	I	86-68420	CDMS		
35 22 15-1	Valves and Equipment	Commercial Product Data	At least 42 days before fabrication or procurement.	A	86-68420	CDMS		
35 22 15-2	Valves and Equipment	Service Manuals	Within 14 days after installation.	I	86-68420	CDMS		
35 42 35-1	Bank Protection	Samples	Within 14 days after tests are completed	A	86-68240	0	0	1
35 42 35-2	Bank Protection	Certifications	Within 14 days after tests are completed	A	86-68240	CDMS		

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						CO	CE	TSC
48 14 00-1	Solar and Electrical Equipment	Approval Data	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
48 14 00-2	Solar and Electrical Equipment	Approval Drawings	Within 42 days after Notice to Proceed	A	86-68430	CDMS		
48 14 00-3	Solar and Electrical Equipment	Test Report	Within 14 days after tests are completed	I	86-68430	CDMS		

END OF SECTION

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SECTION 03 11 10
CONCRETE FORMING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. **Include transformer foundation forming in the price in the Price Schedule for Complete Electrical System.**

B. Cost:

1. Include thrust block forming in the price in Price Schedule for Line Pipe.

C. Cost:

1. Include in the price in Price Schedule for Air Chamber No. 1.

D. Cost:

1. Include in the price in Price Schedule for Air Chamber No. 2.

E. Cost:

1. Include in the price in Price Schedule for Regulating Tank No. 1.

F. Cost:

1. Include in the price in Price Schedule for Regulating Tank No. 2.

1.02 REFERENCE STANDARDS

A. American Concrete Institute

1. ACI 318-11 Building Code Requirements for Structural Concrete and Commentary

B. APA - The Engineered Wood Association (APA)

1. APA PS 1-09 Structural Plywood

C. Bureau of Reclamation (USBR)

1. RSHS Reclamation Safety and Health Standards, including revisions posted at <http://www.usbr.gov/ssle/safety/RSHS/rshs.html>

- D. Western Wood Products Association (WWPA)
1. WWPA WLGR-11 Western Lumber Grading Rules

PART 2 PRODUCTS

2.01 THRUST BLOCKS

- A. See Section 33 11 10 - Line Pipe.

2.02 AIR CHAMBER NO. 1 AND NO. 2

- A. See Section 33 16 14 - Air Chambers.

2.03 REGULATING TANK NO. 1 AND NO. 2

- A. See Section 33 16 50 - Steel Tanks.

PART 3 EXECUTION

3.01 FORM MATERIALS

- A. Sheathing or Lining: Conform to Table 03 11 10A - Form Sheathing or Lining Materials, or provide other materials which will produce equivalent results.

Table 03 11 10A - Form Sheathing or Lining Materials

Finish	Wood sheathing or lining	Steel sheathing or lining
F1	Any grade common board or plywood	Steel sheathing permitted Steel lining permitted
F2	No. 2 common or better, shiplap, or plywood	Steel sheathing permitted Steel lining permitted if approved
F3	Plywood	Steel sheathing permitted Steel lining not permitted

- B. Steel sheathing is steel sheets not supported by wood backing. Steel lining is thin sheets supported by wood backing.
- C. Wood Sheathing or Lining: Softwood or plywood of such kind and quality and treated or coated so that deterioration or discoloration of formed concrete surfaces due to chemical action, contamination, or uneven absorption of water from concrete is prevented.
- D. Plywood: APA PS1, Exterior, Grade B-B Concrete Form, Class I, mill oiled and edge sealed.

- E. Softwood Lumber:
 - 1. Meet requirements of WWPA WLGR for dressed lumber or worked lumber of specified grade.
 - 2. Use common boards surfaced on both edges (S2E) in accordance with WWPA WLGR.
 - 3. Use 6 or 8 inch wide lumber for shiplap forms.
 - 4. Use same lumber width in forms for F2 finishes.
- F. F3 Finish Forms: Use material with basic modular size of 4 by 8 feet.

3.02 INSTALLATION

- A. Construct forms to confine and shape concrete to required lines so that completed work meets specified structural deviations, surface tolerances, and finish requirements.
- B. Construct forms with sufficient strength to withstand pressure from placing and vibrating concrete. Maintain in proper position.
- C. Adjust formwork design and concrete placing rate to compensate for hydraulic pressures exerted on forms by concrete with high fluidity.
- D. Where form vibrators are to be used, construct forms with sufficient rigidity to effectively transmit energy from form vibrators to concrete without damaging formwork or altering form position.
- E. Seal surfaces and joints of forms to prevent absorption of water into forms or loss of mortar from concrete.
- F. Place chamfer strips in corners of forms and at tops of wall placements to bevel edges of permanently exposed concrete surfaces. Do not bevel interior angles of intersecting concrete surfaces and edges of construction joints except as indicated on drawings.
- G. Install sufficient plumb and string lines to monitor formwork positions before concrete placement. Monitor plumb and string lines during concrete placement and correct deficiencies in formwork.
- H. F2 Finish:
 - 1. Use 1 type of form sheathing or lining material for exposed F2 surfaces.
 - 2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
 - 3. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
 - 4. For forms constructed of plywood form lining or shiplap panels, make vertical form marks continuous for entire height of surface.

5. For forms constructed of shiplap which is not paneled, cut boards square, stagger vertical joints in boards, and place vertical joints at studs.
- I. F3:
1. Use 1 type of form sheathing or lining material for F3 surfaces. Fabricate filler panels for corners, soffits, and similar offsets from same material as used for forms.
 2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
 3. Align sheathing or lining horizontally and vertically and place to minimize joint marks on surfaces.
 4. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
 5. Make vertical form marks continuous for entire height of surface.
 6. Fill and smooth finish voids at joints in plywood form lining or sheathing.
 7. Do not construct forms continuously from lift to lift. Remove forms after concrete in a lift has hardened and reset forms for next lift.
 8. Reset forms to overlap hardened concrete in previous lift by 1 inch, maximum.
 9. Tighten forms snugly against hardened concrete so that forms will not spread and cause offsets or loss of mortar at construction joints when concrete placement is resumed. Provide additional bolts or form ties required to hold reset forms tight against hardened concrete.
- J. Form Ties and Anchors:
1. Embed ties for holding forms.
 2. Terminate ties not less than 2 diameters or twice minimum dimension of tie, whichever is greater, from formed surface of concrete, except where F1 finish is permitted.
 3. Install ties so ends or end fasteners can be removed without causing spalling at face of concrete.
 4. Provide form anchors as required to ensure that concrete surfaces will meet specified tolerances. Replace form anchors embedded in concrete which are loosened before placement of adjoining concrete with other supports firmly embedded in hardened concrete.
- K. Cleaning and Oiling Forms:
1. Clean form surfaces of encrustations of mortar, grout, or other foreign material.
 2. Coat form surfaces with a form oil which will prevent sticking and will not soften or stain concrete surfaces or cause concrete surface to become chalky or dust producing.

3.03 REMOVAL

- A. Remove forms within 24 hours after concrete has gained sufficient strength to prevent damage by form removal.
 - 1. Nonsupporting forms such as sides of beams, walls, columns, and similar items: Remove after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement when:
 - a. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
 - b. Curing protection is maintained.
- B. Do not remove forms until concrete strength is such that form removal will not result in perceptible cracking, spalling, or breaking of edges or surfaces, or other damage to concrete.
- C. Remove forms in a manner which prevents damage to concrete.
- D. Repair damaged concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- E. Begin required repair and curing immediately after form removal.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include transformer foundation reinforcing and transformer enclosure reinforcing in the price in the Price Schedule for Complete Electrical System.

B. Cost:

1. Include thrust block reinforcing in the price in the Price Schedule for Line Pipe.

C. Cost:

1. Include valve box reinforcing in the price in the Price Schedule for NAPI Turnout.

D. Cost:

1. Include in the price in the Price Schedule for Air Chamber No. 1.

E. Cost:

1. Include in the price in the Price Schedule for Air Chamber No. 2.

F. Cost:

1. Include in the price in the Price Schedule for Regulating Tank No. 1.

G. Cost:

1. Include in the price in the Price Schedule for Regulating Tank No. 2.

H. Cost:

1. Include valve box reinforcing in the price in the Price Schedule for Valves and Equipment.

1.02 PAYMENT PROCEDURES

- A. Includes splices located as shown on drawings or relocated splices approved by COR. Does not include splices allowed for Contractor convenience.
- B. Does not include weight of accessories.

1.03 REFERENCE STANDARDS

- A. American Concrete Institute (ACI)
1. ACI 315-99 Details and Detailing of Concrete Reinforcement (Part of SP-66-04 ACI Detailing Manual)
- B. ASTM International (ASTM)
1. ASTM A615/A615M-14 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 2. ASTM A996/A996M-14 Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
- B. RSN 03 20 00-1, Reinforcement Diagrams and Lists:
1. Bar-placing diagrams, bar lists, and bar-bending diagrams required for reinforcement fabrication and placement.
 - a. Prepare bar-placing diagrams, bar lists, and bar-bending diagrams in accordance with ACI 315 and drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid rusting.
- B. Protect from contaminants such as grease, oil, and dirt.
- C. Provide for identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.01 LINE PIPE

- A. See Section 33 11 10 - Line Pipe.

2.02 NAPI TURNOUT

- A. See Section 33 12 05 - NAPI Turnout.

2.03 AIR CHAMBER NO. 1 AND NO. 2

- A. See Section 33 16 14 - Air Chambers.

2.04 REGULATING TANK NO. 1 AND NO. 2.

- A. See Section 33 16 50 - Steel Tanks.

2.05 VALVES AND EQUIPMENT

- A. See Section 35 22 15 - Valves and Equipment.

2.06 STEEL REINFORCING

- A. Reinforcing Bars:

1. ASTM A615, Grade 60; or ASTM A996, Type A, Grade 60.
2. Deformed steel bar.

2.07 ACCESSORIES

- A. Chairs, hangers, spacers, and other supports:

1. Material: Concrete, metal or other approved material.
 - a. Compressive strength of precast concrete blocks: Equal to or greater than surrounding concrete.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Clean reinforcement surfaces of heavy, flaky rust; loose mill scale; dirt; grease; and other foreign substances before placement.
- B. Field bending not allowed unless approved by COR.
1. Do not use heat to bend.
- C. Do not use torch to cut.
- D. Accurately place reinforcement:
1. Place reinforcement as shown on standard drawing 40-D-6263, unless otherwise shown on reinforcement design drawings.
 2. Unless otherwise prescribed, placement dimensions shall be to the centerline of the bars.
 3. Place reinforcement with a clear distance of 1 inch, minimum, between reinforcement and anchor bolts, form ties, or other embedded metalwork unless otherwise shown on drawings.
- E. Splices:

1. Locate where shown on drawings, unless otherwise approved by COR.
 2. Reinforcement may be spliced at additional locations for the convenience of the Contractor, subject to approval of COR.
- F. Do not weld or tack weld reinforcing bars.
- G. Secure reinforcement in place so that it will not be displaced during concrete placement.
- H. Do not disturb reinforcement in concrete that has been placed.
- I. Tolerances:
1. Maintain concrete cover over reinforcement within 1/2 inch of specified cover where specified cover is greater than 2-1/2 inches.
 2. Maintain concrete cover over reinforcement within 1/4 inch of specified cover where specified cover is 2-1/2 inches or less.
 3. Maintain spacing of reinforcing bars within 1 inch of required spacing.
- J. Embedded Dowels:
1. Place dowels at locations shown on drawings.
 2. Position dowels parallel to each other and to concrete surface as shown on drawings.
 3. Maintain dowels accurately in position during concrete placement.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include concrete for transformer foundation and enclosure in the price in the Price Schedule for Complete Electrical System.

B. Cost:

1. Include concrete for thrust blocks in the price in the Price Schedule for Line Pipe.

C. Cost:

1. Include concrete for valve box in the price in the Price Schedule for NAPI Turnout.

D. Cost:

1. Include in price in the Price Schedule for Air Chamber No. 1.

E. Cost:

1. Include in price in the Price Schedule for Air Chamber No. 2.

F. Cost:

1. Include in price in the Price Schedule for Regulating Tank No. 1.

G. Cost:

1. Include in price in the Price Schedule for Regulating Tank No. 2.

H. Cost:

1. Include encasements and blocking in the Price Schedule for Steel Pipe.

I. Cost:

1. Include concrete for valve box in the Price Schedule for Valves and Equipment.

1.02 ACRONYMS

- A. NRMCA: National Ready Mixed Concrete Association.

1.03 DEFINITIONS

- A. Supplementary Cementitious Materials (SCM): Cementitious materials other than portland cement.

1.04 REFERENCE STANDARDS

- A. American Concrete Institute (ACI)
1. ACI 201.2R-08 Guide to Durable Concrete
 2. ACI 301-10 Structural Concrete
 3. ACI 304R-00(2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
 4. ACI 305.1-14 Hot Weather Concreting
 5. ACI 306.1-90(2002) Cold Weather Concreting
- B. ASTM International (ASTM)
1. ASTM C31/C31M-12 Making and Curing Concrete Test Specimens in the Field
 2. ASTM C33/C33M-13 Concrete Aggregates
 3. ASTM C39/C39M-15a Compressive Strength of Cylindrical Concrete Specimens
 4. ASTM C42/C42M-13 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 5. ASTM C94/C94M-15 Ready-Mixed Concrete
 6. ASTM C114-17 Chemical Analysis of Hydraulic Cement
 7. ASTM C117-13 Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
 8. ASTM C136-14 Sieve Analysis of Fine and Coarse Aggregates
 9. ASTM C138/C138M-14 Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
 10. ASTM C143/C143M-12 Slump of Hydraulic-Cement Concrete
 11. ASTM C150/C150M-12 Portland Cement
 12. ASTM C171-07 Sheet Materials for Curing Concrete
 13. ASTM C231/C231M-14 Air Content of Freshly Mixed Concrete by the Pressure Method
 14. ASTM C260/C260M-10a Air-Entraining Admixtures for Concrete

15.	ASTM C295/C295M-12	Petrographic Examination of Aggregates for Concrete
16.	ASTM C309-11	Liquid Membrane-Forming Compounds for Curing Concrete
17.	ASTM C494/C494M-13	Chemical Admixtures for Concrete
18.	ASTM C566-13	Total Evaporable Moisture Content of Aggregate by Drying
19.	ASTM C595/C595M-14	Blended Hydraulic Cements
20.	ASTM C618-12a	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
21.	ASTM C920-14a	Elastomeric Joint Sealants
22.	ASTM C989/C989M-14	Slag Cement for Use in Concrete and Mortars
23.	ASTM C1017/C1017M-13	Chemical Admixtures for Use in Producing Flowing Concrete
24.	ASTM C1064/C1064M-12	Temperature of Freshly Mixed Hydraulic-Cement Concrete
25.	ASTM C1260-14	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
26.	ASTM C1293-08b	Determination of Length of Change of Concrete Due to Alkali-Silica Reaction
27.	ASTM C1315-11	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
28.	ASTM C1567-13	Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
29.	ASTM C1602/C1602M-12	Mixing Water Used in the Production of Hydraulic Cement Concrete
30.	ASTM D1752-04a(2013)	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
C.	Bureau of Reclamation (USBR)	
1.	USBR M-47	Repair of Concrete, August 1996 (Appendix A of "Guide to Concrete Repair" available at http://www.usbr.gov/tsc/techreferences/mands/mands-pdfs/guide.pdf)

- 2. USBR Concrete Manual Concrete Manual, Eighth Edition, Revised Reprint, 1981
- D. U.S. Army Corps of Engineers (COE)
 - 1. COE CRD-C662-10 Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)
- E. International Concrete Repair Institute (ICRI)
 - 1. ICRI 310.2-13 Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays (formerly No. 03732)
- F. National Sanitation Foundation (NSF)
 - 1. NSF 61-14a Drinking Water System Components - Health Effects

1.05 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
- B. RSN 03 30 00-1, Approval Data:
 - 1. Mix Design: For each concrete mix.
 - a. Mixture proportions.
 - b. Material sources.
 - 1) Name and manufacturer of each cementitious material.
 - 2) Name of aggregate source(s).
 - 3) Product name and manufacturer of admixtures to be used in mix. Certify that admixtures:
 - a) Contain no purposefully added chlorides.
 - b) Chloride ion limits in accordance with ACI 201.2R.
 - 4) Government reserves the right to require submission of samples of concrete materials for testing before or during use in concrete.
 - c. Physical properties:
 - 1) Compressive strength:
 - a) Test data: ACI 301, paragraph 4.2.3.4.
 - b) Field test data: Performed within past 24 months for compressive strength.

- c) Laboratory trial mixtures:
 - i. Incorporate admixtures that will be used in production mixes into trial mixes.
 - ii. Results from trial batches made within past 6 months.
 - iii. Trial mix test results, 3 six inch diameter cylinders each at 7 and 28 days.
 - iv. Average compressive strength of trial batch cylinders at specified design age.
 - d. Resubmit mix design for change in material source or type.
 - 2. Name and manufacturer of curing compounds, and joint filler.
 - a. Include application instructions for curing compound.
 - 3. Certifications and test reports:
 - a. Sealed by Professional Engineer.
 - b. Less than 12 months old for aggregates.
 - c. Certifications and test reports:
 - 1) Cementitious materials manufacturer.
 - 2) Aggregate producer for:
 - a) ASTM C33 physical properties.
 - b) ASR testing reports for each aggregate source.
 - 3) Mixing water: ASTM C1602.
 - d. Submittal of certifications and test reports shall not relieve Contractor of responsibility for furnishing materials meeting specified requirements.
- C. RSN 03 30 00-2, Certifications:
 - 1. NRMCA Certification of Production Facilities. NRMCA certification shall include automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures.
 - 2. ACI Aggregate Testing Technician certification(s).
 - 3. ACI Concrete Field Testing Technician certification(s).
 - 4. ACI Concrete Strength Testing Technician certification(s).
- D. RSN 03 30 00-3, Cementitious Materials Certification and Test Reports.
 - 1. Less than 3 months old.
 - 2. Certify materials were tested during production or transfer in accordance with specified reference standards.

- E. RSN 03 30 00-4, Test Reports.
 - 1. Aggregate test results as required by Table 03 30 00B - Contractor Batch Plant Quality Testing.
 - 2. Concrete test reports as required by Table 03 30 00E- Contractor Field Quality Testing.

1.06 QUALIFICATIONS

- A. Ready mix plant:
 - 1. Certified by NRMCA.
 - a. NRMCA certification shall include automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures.
- B. Aggregate Testing Technician: Currently certified ACI Aggregate Testing Technician - Level 1.
- C. Flatwork foreman with at least 5 years of experience with similar type placements.
- D. Concrete Field Testing Technician: Currently certified ACI Concrete Field Testing Technician - Grade I.
- E. Strength Testing Technician: Currently certified ACI Strength Testing Technician.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Furnish legible and digitized batch ticket with each batch of concrete in accordance with ASTM C94. Deliver ticket to COR at jobsite during batch delivery.
- B. Sponge rubber joint filler storage:
 - 1. Store in protected area at temperature of 70 degrees F (21 degrees C) or less.
 - 2. Do not expose to direct sun.

1.08 PRE-PLACING MEETING

- A. At least 14 days before first concrete placement, meet with COR for pre-placement meeting.
- B. Coordinate time and place of meeting with COR at least 14 days before meeting.
- C. Contractor attendees shall be at least the following:
 - 1. Contractor onsite supervisor.
 - 2. Concrete forming, placing, and finishing onsite supervisor(s); Contractor or subcontractor(s) employee as applicable.

3. Technical specialist from ready-mix supplier.
4. Concrete pump subcontractor onsite supervisor, if applicable.
5. Testing agency onsite supervisor(s).

PART 2 PRODUCTS

2.01 LINE PIPE

- A. See Section 33 11 10 - Line Pipe.

2.02 NAPI TURNOUT

- A. See Section 33 12 05 - NAPI Turnout.

2.03 AIR CHAMBER NO. 1 AND NO. 2

- A. See Section 33 16 14 - Air Chambers.

2.04 REGULATING TANK NO. 1 AND NO. 2

- A. See Section 33 16 50 - Steel Tanks.

2.05 STEEL PIPE

- A. See Section 35 21 95 - Steel Pipe.

2.06 VALVES AND EQUIPMENT

- A. See Section 35 22 15 - Valves and Equipment.

2.07 CEMENTITIOUS MATERIALS

- A. Portland cement:
1. ASTM C150, Type V.
 - a. Meet equivalent alkalis requirements of ASTM C150 - Table 2.
 - 1) Low-alkali limitation for portland cement may be waived when tests of concrete aggregate source show that low-alkali cement is not required for ASR mitigation. See Concrete Aggregate Materials article (2.03).
 - b. Meet false-set requirements of ASTM C150 - Table 4.
- B. Blended hydraulic cement:
1. ASTM C595, Type HS.

2. Meet equivalent alkalies requirement of ASTM C595, Table 2, Option G. or Table 3.

C. SCM:

1. Pozzolan:

a. ASTM C618, Class F:

1) Except:

- a) Sulfur trioxide, maximum: 4.0 percent.
- b) Loss on ignition, maximum: 2.5 percent.

2) In addition:

- a) Meets Effectiveness in Controlling Alkali-Silica Reaction in Table 3 Supplementary Optional Physical Requirements of ASTM C618.
- b) Calcium oxide, maximum: 8.0 percent.
- c) Pozzolan "R" factor less than 2.5. Pozzolan with this "R" factor shall not decrease sulfate resistance of concrete.
 - i. R: (C-5)/F.
 - ii. C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C114.
 - iii. F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C114.

2. Slag Cement: ASTM C989, Grade 120.

2.08 WATER

- A. ASTM C1602, including optional requirements of Table 2.

2.09 AGGREGATE MATERIALS

- A. Fine aggregate: ASTM C33.

1. Percent material passing No. 200 sieve: Less than 3 percent.

- B. Coarse aggregate: ASTM C33, Class 4S, Size No. specified in Table 03 30 00A - Concrete Mixes.

- C. Alkali Silica Reaction (ASR):

1. Test fine and coarse aggregates in accordance with ASTM C1260 for potential deleterious ASR.

- a. For ASTM C1260, and other tests when required, continue readings for 28 days after the zero readings.

- b. Acceptance criteria specified below are based on 14 day readings after the zero readings.
- c. Expansion is no greater than 0.10 percent: Aggregates are acceptable.
- d. Expansion is greater than 0.10 percent:
 - 1) Test aggregates according to ASTM C1567 using components (e.g. coarse aggregate, fine aggregate, cementitious materials, and ASR inhibiting admixtures) in proportions proposed for mixture design.
 - a) For mixes using lithium admixtures use test procedure COE CRD-C 662.
 - b) Expansion of proposed mixture design test specimens, tested in accordance with ASTM C1567 does not exceed 0.10 percent:
 - i. Aggregates are acceptable.
 - c) Expansion of proposed mixture design test specimens is greater than 0.10 percent:
 - i. Aggregates are not acceptable unless adjustments to mixture design can reduce expansion to less than 0.10 percent, or testing by ASTM C1293 indicates aggregates will not experience deleterious expansion.
 - 2) Use tested materials. Materials may be rejected if they do not match tested materials.
- 2. ASTM C1293 test results may be substituted for ASTM C1260 test results.
 - a. Average ASTM C1293 concrete prism expansion less than 0.04 percent at one year: Aggregates acceptable.
- D. Appropriate for use in accordance with ASTM C295.

2.10 ADMIXTURES

- A. Air-entraining admixture: ASTM C260.
- B. Chemical admixtures:
 - 1. Do not use chemical admixtures which contain more than 0.1 percent chloride, by weight.
 - 2. Admixtures shall be compatible with each other.
 - 3. Allowable chemical admixtures:
 - a. ASTM C494, Type A, D, F, G, or S.
 - b. ASTM C1017, Type I or II.

- c. ASTM C494, Type C and E, provided they do not contain chlorides.
- C. Specialized chemical admixtures:
1. When batch plant has not previously used a specialized chemical admixture, admixture manufacturer shall provide on-site representative to assist with mix design and to train batch plant personnel in dispensing and mixing operations.
 2. Do not use specialized chemical admixtures which contain more than 0.1 percent chloride, by weight.
 3. Alkali Silica Reaction (ASR) Inhibiting Admixture:
 - a. Lithium Nitrate Admixture for ASR mitigation of reactive aggregates having the following characteristics:
 - 1) Meets NSF 61.
 - 2) Nominal 30 percent aqueous solution of Lithium Nitrate.
 - a) Density: 10 pounds per gallon or 1.2 kilograms per liter.
 - b) Approximate chemical constituents (percent by mass):
 - i. LiNo₃ (Lithium Nitrate): 30 plus or minus 0.5.
 - ii. SO₄-2 (Sulfate Ion), maximum: 0.1.
 - iii. Cl⁻ (Chloride Ion), maximum: 0.2.
 - iv. NA⁺ (Sodium Ion), maximum: 0.1.
 - v. K⁺ (Potassium Ion), maximum: 0.1.
 - b. Coordinate with manufacturer regarding Lithium Nitrate dosage.
 - c. Do not use Lithium Nitrate Admixture for concrete in continuous or nearly continuous contact with water.
 4. Extended set control admixture:
 - a. Delvo Stabilizer manufactured by BASF Construction Chemicals, Inc. www.basf-admixtures.com; or equal, with the following essential characteristics:
 - 1) Meets ASTM C494, Type B.
 - 2) Retards setting.
 - 3) Does not reduce concrete strength.
 - b. Use within manufacturer's time limits.
 - c. Include admixture on batch ticket.
 - d. Admixture quantity required to stabilize concrete shall be pre-determined using jobsite materials. Initial concrete setting time shall be monitored and adjusted during project by qualified concrete technician.

2.11 CURING MATERIALS

- A. Water: ASTM C1602, including optional requirements of Table 2.
- B. Curing compound: ASTM C309.
 - 1. Capable of meeting moisture retention at manufacturer's application rate.
 - 2. Meet Federal, state, and local regulations for VOCs.
- C. Sheet materials:
 - 1. Polyethylene film: ASTM C171, clear.
 - 2. White burlap-polyethylene sheeting: ASTM C171.

2.12 ACCESSORIES

- A. Sponge rubber joint filler:
 - 1. ASTM D1752, Type I, except:
 - a. Test specimen compression load: 50 to 150 pounds per square inch.
 - 2. Joint filler adhesive: Nonbituminous adhesive recommended by filler manufacturer.
- B. Elastomeric sealant: ASTM C920, polyurethane, Use M, Grade NS, Class 25.
- C. Evaporation control:
 - 1. MasterKure ER 50 manufactured by BASF Construction Chemicals, Inc., www.basf-admixtures.com; or equal having the following essential characteristics:
 - a. Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
 - b. For application after finishing and prior to applying curing compound.
 - c. For use when the evaporation rate is high.
 - 2. Do not use as finishing aid.
- D. Plastic vapor retarder:
 - 1. Preformed flexible membrane meeting ASTM E1745.
 - a. Thickness: 10 mils, minimum.
 - 2. Sealing materials for laps and protrusions: Recommended by manufacturer.

2.13 MIX

- A. Design and adjust concrete mix.

1. The Government reserves the right to adjust mix proportions when need for adjustment is indicated by results of materials testing.
 - a. When required, adjustment of mix proportions by the Government will be in accordance with USBR Concrete Manual.

- B. Cementitious materials options:
 1. Specified portland cement plus specified pozzolan by percent weight specified in Table 03 030 00A - Concrete Mixes.
 2. Specified portland cement plus specified slag cement by percent weight specified in Table 03 03 00A - Concrete Mixes.
 3. Blended Hydraulic: ASTM C595 provided, specified portland cement with percent of specified pozzolan or specified slag cement specified in Table 03 03 00A - Concrete Mixes.

- C. Design concrete mixes in accordance with Table 03 30 00A - Concrete Mixes. General concrete mix shall be used for concrete unless otherwise specified.
 1. Net water-cementitious materials ratio (w/c) is maximum, by weight. Cementitious material weight is cement plus SCM.
 2. Slump at point of placement: In accordance with ASTM C143.
 3. Air Entrainment: Percent air by volume of concrete as discharged at point of placement, in accordance with ASTM C231.

Table 03 30 00A - Concrete Mixes

Mix No	Feature	f'c (pounds per square inch)	Max w/c*	NMSA**	Percent SCM*** A: Class F Pozzolan B: Slag Cement C: Silica Fume	Slump (in)	Air Content (percent)	Notes
1	General Concrete	4500 at 28 days	0.45	No. 57, or 67	A or B: 20 plus or minus 5	2 to 4	4.5 to 7.5	1, 2
2	Air Chamber Foundations and Pre-manufactured Pump Station Foundations, Regulating Tank Foundations	4500 at 28 days	0.45	No. 57, or 67	A or B: 20 plus or minus 5	2 to 4	4.5 to 7.5	1, 2

Table 03 30 00A - Concrete Mixes

Mix No	Feature	f'c (pounds per square inch)	Max w/c*	NMSA**	Percent SCM*** A: Class F Pozzolan B: Slag Cement C: Silica Fume	Slump (in)	Air Content (percent)	Notes
3	Pipe Encasements and Thrust Restraint	4500 at 28 days	0.45	No. 57, or 67	A or B: 20 plus or minus 5	3 to 5	4.5 to 7.5	1, 2

*Maximum water/cementitious materials ratio.

**Nominal Maximum Size Aggregate.

*** SCM as percent of total cementitious material, by weight.

NOTES:

1. Ternary blended cementitious materials which meet the specifications may be submitted for approval.
2. Concrete with ASTM C1017, Type I or II plasticizing admixtures, ASTM C494 Type F high-range water-reducing admixtures, or Type G high-range water-reducing and retarding admixtures:
 - i. Admixture shall be incorporated into trial batch or historical data.
 - ii. Use slump appropriate for placing conditions.

D. Submit design mixes for each type and strength of concrete substantiated by either laboratory trial batch or field performance methods as specified in ACI 301. For trial batch method, mix shall be proportioned and stamped by a professional engineer.

E. Concrete trial mixes:

1. Average compressive strength of trial batch cylinders at design age: Design strength plus 1,200 psi for concrete between 3,000 and 5,000 psi.
2. Admixtures to be used in mix shall be incorporated into mix design submitted for approval.
3. Air content: Within 1 percent of top of specified range.
4. Slump: Within 1 inch of top of specified range.

2.14 BATCHING, MIXING, AND TRANSPORTING

A. Batch plant: NRMCA certified with automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures.

B. Manufacture and deliver in accordance with ASTM C94 and ACI C304R.

1. Prepare batch ticket in accordance with ASTM C94 for every batch of concrete.

- C. Cold weather: When air temperature has fallen to or is expected to fall below 40 degrees F, prepare ingredients and mix in accordance with ACI 306.1.
 - 1. Do not use frozen materials or materials containing ice or snow.
 - 2. Uniformly heat water and aggregates before mixing to obtain concrete mixture temperature of not less than 50 degrees F.
- D. Hot Weather: When precautions are necessary, prepare ingredients and mix in accordance with ACI 305.1.
 - 1. Cool ingredients before mixing to maintain specified maximum concrete temperature at time of placement.
 - 2. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Ice replacing batch water shall be melted prior to discharge.
 - 3. Using liquid nitrogen to cool concrete is Contractor's option.
- E. Prevent appreciable segregation of ingredients.
- F. Place concrete within 90 minutes from introduction of cement to water or aggregates.
 - 1. For placing times exceeding 90 minutes, extended set control admixtures may be used when approved by COR.

2.15 CONCRETE TEMPERATURE

- A. Concrete temperature at placing:
 - 1. 50 to 85 degrees F (10 to 29 degrees C).

2.16 CONTRACTOR QUALITY TESTING

- A. Perform sampling, testing, and reporting as required in Table 03 30 00B - Batch Plant Testing.
 - 1. Independent testing agency in accordance with Section 01 46 20 - Testing Agency Services.
 - 2. Personnel conducting tests: Qualified as ACI Aggregate Testing Technician, Level 1; or equal.
- B. Perform tests at least as often as frequencies specified in Table 03 30 00B - Batch Plant Testing.
- C. Notify COR immediately of test results showing failure of materials to meet specifications. Provide passing test to COR within 24 hours. Submit reports of test results as specified.

2.17 GOVERNMENT CONTRACT QUALITY ASSURANCE - SOURCE

- A. The Government will perform, as a minimum, tests listed in Table 03 30 00B - Batch Plant Testing. This testing is in addition to the Contractor’s Quality Control program and does not relieve the Contractor of performing adequate Quality Control testing. The list of tests is provided to alert the Contractor to potential impacts to work scheduling.
- B. Government testing frequency is at the discretion of the COR. Greater frequency testing is normally performed at start of placing a mix design, when changing a mix design, when inconsistencies of materials is noticed, or when significant changes are made at batch plant. Testing frequency listed in Table 03 30 00B - Batch Plant Testing is provided only as approximation of Government testing.
- C. In addition to specified Contractor Quality Testing, the Government may also perform the tests listed in Table 03 30 00B - Batch Plant Testing.

2.18 BATCH PLANT TESTING

Table 03 30 00B- Batch Plant Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	REQUIREMENT	TESTING FREQUENCY
Aggregate Gradation	ASTM C136	Sieve Analysis of Fine and Coarse Aggregates	Fine and Coarse Aggregate meets sizing requirements per ASTM C33.	At beginning of placing each mix. At change in mix design. At least every 500 yd3 of placing a mix.
Aggregate Fines content	ASTM C117	Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing	Fine aggregate meet specified allowable fines content (material passing No. 200 sieve)	At beginning of placing each mix. At change in mix design. At least every 500 yd3 of placing a mix.
Aggregate moisture content	ASTM C566	Total Evaporable Moisture Content of Aggregate by Drying	Verify that moisture meter at batch plant is accurate with the material batched.	At beginning of placing each mix. At change in mix design. At least every 500 yd3 of placing a mix.

PART 3 EXECUTION

3.01 PREPARATION

- A. Remove standing water, mud, and debris from foundation surfaces to be covered by concrete.

- B. Prepare rock surfaces free from oil, objectionable coatings, and loose, semidetached, and unsound fragments. Immediately before placement of concrete, wash rock surfaces with air-water jet and dry to uniform surface-dry condition.
- C. Prepare earth foundations free from frost or ice.
- D. Thoroughly moisten surfaces of absorptive foundations to be covered with concrete so that moisture will not be drawn from fresh concrete. Keep subgrade moisture uniform without puddles or dry areas.
- E. Clean, roughen, and surface dry surfaces of construction joints to be covered with fresh concrete.
 - 1. Remove laitance, loose or defective concrete, coatings, sand, curing compound, and other foreign material.
 - 2. Sandblast, steel shotblast, or high-pressure water jet surfaces, or use other method approved by COR to create a surface equivalent to or larger than CSP 5 in accordance with ICRI 310.2.
 - 3. Wash surface thoroughly, and surface dry immediately before placement of adjoining concrete.

3.02 PLACING

- A. Notify COR at least 24 hours before placing concrete.
- B. Provide placement checkout cards in a watertight container. COR will approve placement card format.
 - 1. Sign each line item indicating work is completed in accordance with specifications.
 - 2. Obtain COR signature after each line item.
 - 3. Do not place concrete without required signatures.
 - 4. Use of placement checkout cards shall be required by COR.
- C. Do not place concrete without approval of the COR.
- D. Place concrete in presence of COR.
- E. Perform concrete placing under the direct supervision of a qualified flatwork foreman for placements. Allow at least 7 days between adjacent placements, or as approved by COR.
- F. Do not use aluminum pipes and chutes for placing or pumping concrete.
- G. Adding water to concrete batch at site will be allowed only once and only when approved by the COR.
 - 1. Add additional water before concrete is discharged.

2. Do not exceed specified water to cement ratio.
 3. After water is added, mix concrete for at least 30 revolutions of mixer drum at mixing speed.
 4. Record added water on the batch ticket to nearest gallon.
- H. Adding air entraining admixtures to concrete batch at site will be allowed only once when approved by the COR.
1. After air entraining admixture is added, concrete shall be mixed for minimum of 30 revolutions of mixer drum at mixing speed.
 2. Take slump and air content after air-entraining admixture addition and additional revolutions.
 3. Record added air entraining admixture on batch ticket to nearest ounce.
- I. Do not use concrete which has become so stiff that concrete cannot be properly placed.
- J. Place formed concrete in continuous, approximately horizontal layers. Do not exceed 20 inches in depth of layers.
- K. Vibrate concrete until concrete has been consolidated to maximum practical density, is free from pockets of coarse aggregate, and closes snugly against surfaces of forms and embedded materials.
- L. Hot Weather:
1. Place concrete in accordance with ACI 305.1.
 2. Protect reinforcing steel so that steel temperature does not exceed ambient air temperature immediately before placing concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
- M. Cold weather:
1. Place concrete in accordance with ACI 306.1.
 2. Do not place concrete on frozen subgrade or subgrade containing frozen materials.

3.03 FINISHING

- A. Notify COR before finishing concrete.
- B. Finish concrete in presence of Government inspector unless inspection is waived in each specific case.
- C. Perform placement finishing under the direct supervision of a qualified flatwork foreman.

- D. Finish surfaces as specified in Table 03 30 00F - Formed Surfaces and Table 03 30 00G - Unformed Surfaces.
- E. Where finishes are not specified or shown on drawings for a particular surface, finish concrete as specified for similar work.
- F. Formed surfaces:
1. Finish class is designated by symbols F1, F2, and F3.
 2. Finish F1:
 - a. Applies to formed surfaces to be covered by fill material, grout, or concrete, and construction joint surfaces as specified in Table 03 30 00F - Formed Surfaces.
 - b. Protect form tie rod ends on surfaces in contact with fill material from moisture where they will be below water table or waterline.
 - 1) Recess tie rod ends and fill recess with dry pack or other material approved by COR.
 - c. Cut off flush with formed surface form tie rod ends on surfaces in contact with concrete or fill material and above maximum water table or waterline elevation.
 3. Finish F2:
 - a. Applies to exposed formed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish F3 or F4, and to contraction joint surfaces and expansion joint surfaces as specified in Table 03 30 00F - Formed Surfaces.
 - 1) Recess tie rod ends and fill recess with dry pack or other material approved by COR.
 4. Finish F3:
 - a. Applies to formed surfaces with special appearance requirements, such as surfaces exposed to view, and not required to receive finish F4, as specified in Table 03 30 00F - Formed Surfaces.
 - b. After required patching and correction of imperfections has been completed, sack rub surface as follows:
 - 1) Thoroughly wet surface and sack rub while surface is still damp.
 - 2) Use mortar consisting of 1 part cement; 2 parts, by volume, of sand passing No. 16 screen; and enough water so that mortar has consistency of thick cream. Blend standard cement with white cement as necessary to obtain color which will match surrounding concrete surface.

- 3) Thoroughly rub mortar over area with clean burlap or sponge rubber float to fill pits, bugholes, and other defects.
- 4) While mortar in pits is still plastic, rub surface with dry mix of above proportions and material to remove excess plastic material and place enough dry material in pits to stiffen and solidify mortar so that filling will be flush with surface. Remove material remaining on surface except material within pits.
- 5) Continue curing surface as specified.

G. Unformed surfaces:

1. Do not use dry portland cement or additional water during finishing.
2. Do not use “jitterbugs” or other tools to force coarse aggregate away from surface.
3. Finish class is designated by symbols U1, U2, or U3.
4. Finish U1 (Screeded Finish):
 - a. Applies to unformed surfaces to be covered by fill material, grout, or concrete as specified in Table 03 30 00G - Unformed Surfaces.
 - b. Use as first stage of finish U2 and U3.
 - c. After concrete is placed and consolidated, strike off and level concrete to produce even uniform surface.
5. Finish U2 (Floated Finish):
 - a. Applies to unformed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish U3, as specified in Table 03 30 00G - Unformed Surfaces.
 - b. Begin floating as soon as screeded surface has sufficiently stiffened and bleed water sheen has disappeared.
 - c. Use hand- or power-driven equipment.
 - d. Finish surface with minimum floating necessary to produce surface that is free of screed marks and is uniform in texture.
 - e. Use as second stage of finish U3. Floating shall bring small amount of mortar without excess water to surface, so as to permit effective troweling.
6. Finish U3 (troweled finish):
 - a. Applies to unformed surfaces where appearance and porosity is considered by Government to be of special importance as specified in Table 03 30 00G - Unformed Surfaces.
 - b. Begin steel troweling after bleed water has disappeared and floated surface has sufficiently hardened to prevent excess of fine material from being drawn to surface.

- c. Trowel with firm pressure to flatten sandy texture of floated surface.
- d. Trowel to a dense uniform surface free from blemishes and trowel marks. Do not excessively trowel surface.
7. Slope interior surfaces for drainage where shown on drawings or as directed by COR. Slope surfaces exposed to weather for drainage as directed by COR.
8. Slope narrow surfaces, such as tops of walls and curbs, approximately 3/8 inch per foot of width, unless use of other slopes or level surface is indicated on drawings or is directed by the COR.
9. Slope broader surfaces; such as walks, platform, and decks; approximately 1/4 inch per foot unless use of other slopes or level surfaces is indicated on drawings or is directed by the COR.

3.04 JOINTS AND EDGES

A. Construction joints (CJ):

1. Construction joints are joints which are purposely placed in concrete to facilitate construction, reduce initial shrinkage stresses and cracks, allow time for installation of embedded metalwork, or allow for subsequent placing of other concrete.
2. Bond is required at construction joints regardless of whether or not reinforcement is continuous across joint.
3. Locate construction joints where shown on drawings. Relocation, addition, or elimination of construction joints will be subject to approval by the COR.
4. Clean, roughen, and surface dry surfaces of construction joints to be covered with fresh concrete. See Preparation article.
5. Do not use a mortar layer on construction joints.

B. Expansion joints (EJ):

1. Cut sponge rubber joint filler to size and shape of joint surface to receive filler.
2. Adhere filler to concrete in accordance with adhesive manufacturer's recommendations.
3. Butt sections of filler with tight-fitting butt joints to prevent mortar from seeping through joint.

C. Edges:

1. Permanently exposed concrete, except slabs and top edges of curbs: Chamfer edges with 45 degree bevel 3/4 inch by 3/4 inch; unless otherwise shown on drawings.
2. Exposed edges of slabs and top edges of curbs: Tool to radius of 1/4 inch.

D. Prefomed joints consisting of plastic or metal strips not allowed.

3.05 STRUCTURAL DEVIATIONS AND SURFACE TOLERANCES

- A. Structural deviations are defined as allowable variations from specified lines, grades, and dimensions.
- B. Surface tolerances are defined as maximum allowable magnitude of surface irregularities.
- C. Specified structural deviations and surface tolerances are consistent with modern construction practice and governed by effects that permissible variations may have upon a structure. COR reserves the right to diminish specified structural deviations and surface tolerances where such variations impair structural action, operational function, or architectural appearance of a structure or portion of structure.
- D. Construct concrete within stated variations even though more than one may be specified.
1. Specified variation for one element of a structure will not apply when it will permit another element of same structure to exceed its allowable variation.
 2. Where variations are not specified or shown on drawings for a particular structure, variations shall be those specified for similar work. As an exception to clause at FAR 52.236-21 "Specifications and Drawings for Construction", specific tolerances shown on drawings in connection with dimension shall govern.
- E. Structural deviations:
1. Check variations from specified lines, grades, and dimensions in hardened concrete to determine that structures are within tolerances specified in Table 03 30 00C - Deviations from Specified Lines, Grades, and Dimensions.
 2. Variation is distance between actual position of structure or element of structure and specified position in plan for structure or particular element.
 - a. Plus or minus variations indicate a permitted actual position up or down and in or out from specified position in plan.
 - b. Variations not designated as plus or minus indicate maximum deviation permitted between designated successive points on completed element of construction.
 3. Specified position in plan is defined as lines, grades, and dimensions described in this section, shown on drawings, or prescribed by COR.

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

AIR CHAMBER, PRE-MANUFACTURED PUMP STATIONS, REGULATING TANKS AND OTHER BUILDINGS		
1.	Footings:	
(a)	Variation in length and width dimensions from those specified	minus 1/2 inch plus 2 inches
(b)	Horizontal misplacement or eccentricity:	2 percent of footing width in direction of misplacement, but not more than 2 inches
(c)	Reduction in thickness	5 percent of specified thickness
2.	Variation of horizontal dimensions at all floor and roof levels from specified position in plan:	
(a)	Overall building dimensions	plus or minus 1/2 inch per 100 foot length with maximum for entire length of plus or minus 1 inch
(b)	Overall bay dimensions limited by (c) below, but not to exceed	plus or minus 3/8 inch
(c)	Intermediate dimensions for column, wall, and partition locations:	
	For dimensions less than 10 feet	plus or minus 1/4 inch
	For dimensions equal to or greater than 10 feet but less than 20 feet	plus or minus 3/8 inch
	For dimensions 20 feet or more	plus or minus 1/2 inch

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

3.	Variation of vertical dimensions from specified position in plan:	
(a)	Overall building dimensions	plus or minus 1/2 inch
(b)	Overall story height limited by (c)below, but not to exceed	plus or minus 3/8 inch
(c)	Intermediate dimensions:	
	Less than 10 feet	plus or minus 1/4 inch
	10 to 20 feet, inclusive	plus or minus 3/8 inch
	20 feet or more	plus or minus 1/2 inch
4.	Variation from plumb or specified batter for lines and surfaces of columns, piers, walls, and for arrises:	
(a)	When overall height of line or surface is:	
	Less than 10 feet	plus or minus 1/4 inch
	10 to 20 feet, inclusive	plus or minus 3/8 inch
	More than 20 feet, but less than 40 feet	plus or minus 1/2 inch
	40 feet or more	plus or minus 1 inch
(b)	For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	1/4 inch
	More than 20 feet	3/8 inch

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

5.	Variation from plumb for lines and surfaces of corner columns, control joint grooves, and other conspicuous lines:	
(a)	When overall height of line or surface is:	
	Less than 10 feet	plus or minus 1/4 inch
	10 to 20 feet, inclusive	plus or minus 3/8 inch
	More than 20 feet	plus or minus 1/2 inch
(b)	For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	1/4 inch
	More than 20 feet	3/8 inch
6.	Variation from level or established grades for floors, roof decks, ceilings, beam soffits, and arrises:	
(a)	When overall length of line or surface is:	
	Less than 10 feet	plus or minus 1/4 inch
	10 to 20 feet, inclusive	plus or minus 3/8 inch
	More than 20 feet, but less than 40 feet	plus or minus 1/2 inch
	40 feet or more	plus or minus 3/4 inch
(b)	For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	1/4 inch
	More than 20 feet	3/8 inch

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

7.	Variation from level or specified grades for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:	
(a)	When overall length of line or surface is:	
	Less than 10 feet	plus or minus 1/4 inch
	10 to 20 feet, inclusive	plus or minus 3/8 inch
	More than 20 feet	plus or minus 1/2 inch
(b)	For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	1/4 inch
	More than 20 feet	3/8 inch
8.	Variation in location from specified position in plan of sleeves and wall openings	plus or minus 1/2 inch
9.	Variation in sizes from those specified for sleeves, floor openings, and wall openings, except wall openings for swinging doors and louvers without tubular frames	plus or minus 1/4 inch
10.	Variation in sizes from those specified for wall openings for swinging doors and louvers without tubular frames	minus 0 inch plus 1/4 inch
11.	Variation in cross-sectional dimensions from those specified for columns and beams and in thicknesses from those specified for slabs and walls	minus 1/4 inch plus 1/2 inch
12.	Variation in rise and tread of steps from that specified:	
(a)	Flight of stairs:	
	Rise	plus or minus 1/8 inch
	Tread	plus or minus 1/4 inch
(b)	Consecutive steps:	
	Rise	1/16 inch
	Tread	1/8 inch

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

PIPELINE STRUCTURES		
1.	Footings:	
(a)	Variation of length and width dimensions from those specified	minus 1/2 inch plus 2 inches
(b)	Misplacement or eccentricity:	2 percent of footing width in direction of misplacement, but not more than 2 inches
(c)	Reduction in thickness from that specified	5 percent of specified thickness not to exceed 1 inch
2.	Monolithic siphons and culverts:	
(a)	Departure from established alignment	plus or minus 2 inches
(b)	Departure from established profile grade	plus or minus 2 inches
(c)	Variation from specified thickness	minus 2.5 percent of specified thickness or minus 1/4 inch, whichever is greater; or plus 5 percent of specified thickness or plus 1/2 inch, whichever is greater
(d)	Variation from specified inside dimensions	plus or minus 0.5 percent of inside dimensions

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

3.	Checks, overchutes, drops, turnouts, inlets, chutes, and similar structures:	
(a)	Departure from established alignment	plus or minus 1 inch
(b)	Departure from established grade	plus or minus 1 inch
(c)	Variation from plumb or specified batter for lines and surfaces of columns, piers, walls, and for arrises:	
(1)	When overall length of line or surface is:	
	Less than 10 feet	Exposed: plus or minus 3/8 inch Buried: plus or minus 3/4 inch
	10 feet or more	Exposed: plus or minus 1/2 inch Buried: plus or minus 1 inch
(2)	For any two successive intermediate points	
	10 to 20 feet, inclusive	Exposed: 3/8 inch Buried: 3/4 inch
	More than 20 feet	Exposed: 1/2 inch Buried: 1 inch

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

<p>4.</p>	<p>Variations from level or specified grades for slabs, beams, and horizontal grooves:</p> <p>(a) When overall length of line or surface is: Less than 10 feet</p> <p>10 feet or more</p> <p>(b) For any two successive intermediate points on the line or surface separated by: 10 to 20 feet, inclusive</p> <p>More than 20 feet</p>	<p>Exposed: plus or minus 3/8 inch Buried: plus or minus 3/4 inch</p> <p>Exposed: plus or minus 1/2 inch Buried: plus or minus 1 inch</p> <p>Exposed: 3/8 inch Buried: 3/4 inch</p> <p>Exposed: 1/2 inch Buried: 1 inch</p>
<p>5.</p>	<p>Variation in cross-sectional dimensions of columns, piers, slabs, walls, beams, and similar parts of structure(s) in 3. above from those specified</p>	<p>minus 1/4 inch plus 1/2 inch</p>
<p>6.</p>	<p>Variation in sizes and locations from those specified for slab and wall openings</p>	<p>plus or minus 1/2 inch</p>
<p>7.</p>	<p>**Variation from plumb or level for sills and sidewalls for radial gates and similar watertight joints</p> <p>_____</p> <p>** Dimensions between sidewalls for radial gates: No more than shown on drawings at sills and not less than shown on drawings at top of walls.</p>	<p>Not greater than a rate of 1/8 inch in 10 feet</p>
<p>8.</p>	<p>Variation from plumb of pipe erected vertically in any length of 10 feet</p>	<p>plus or minus 1/2 inch</p>

Table 03 30 00C - Deviations from Specified Lines, Grades, And Dimensions

4.	Variation from level or specified grades for slabs, other than bridge deck; beams; horizontal grooves; railing offsets; and diaphragms:	
	(a) Exposed construction:	
	(1) When overall length of line or surface is:	
	Less than 10 feet	plus or minus 3/8 inch
	10 feet or more	plus or minus 1/2 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	3/8 inch
	More than 20 feet	1/2 inch
	(b) Buried construction:	
	(1) When overall length of line or surface is:	
	Less than 10 feet	plus or minus 3/4 inch
	10 feet or more	plus or minus 1 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	3/4 inch
	More than 20 feet	1 inch
5.	Departure of bridge deck and rails from specified grades	plus or minus 1/4 inch
6.	Variation in cross-sectional dimensions from those specified for piers; slabs, other than bridge deck; walls; beams; and similar parts of bridge structures	minus 1/4 inch plus 1/2 inch
7.	Variation from that specified in thickness of bridge slabs	minus 1/8 inch plus 1/2 inch

F. Surface irregularities:

1. Bulges, depressions, and offsets are defined as surface irregularities or roughness.
2. Surface irregularities are classified as “abrupt” or “gradual” and allowable tolerances are specified in Table 03 30 00D - Surface Tolerances.

- a. A surface tolerance is designated by a capital “T” followed by a number 1 through 5.
 - b. Surface tolerance designations are separate from surface finishes and structural deviations.
3. Abrupt surface irregularities:
- a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms in which maximum dimension of irregularity perpendicular to surface is greater than maximum dimension of irregularity in plane of surface.
 - b. Abrupt surface irregularities include isolated surface irregularities which exceed specified gradual irregularities.
4. Gradual surface irregularities:
- a. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on surface.
 - b. Gradual surface irregularities are further defined as isolated undulations on surface. Maximum dimension of undulation perpendicular to surface is small relative to maximum dimension of undulation in plane of surface.
5. Check magnitude of surface irregularities of formwork and finished surfaces to ensure that surfaces are within specified tolerances.

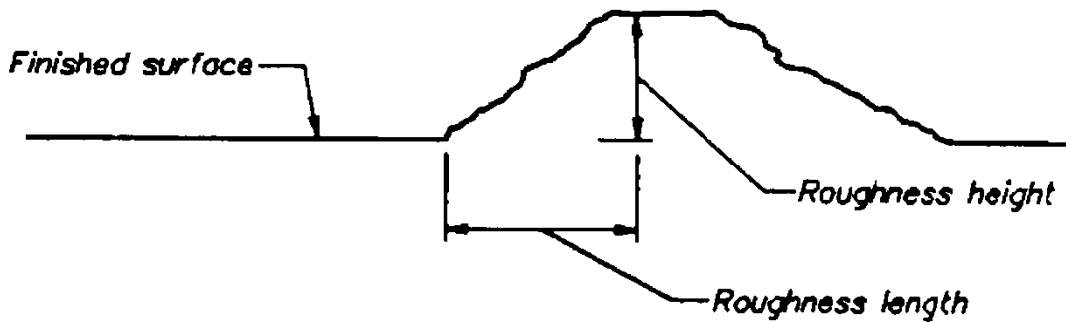
G. Surface tolerances:

Table 03 30 00D - Surface Tolerances

Concrete surface	Maximum allowable surface irregularity tolerance	
	Abrupt	Gradual
T1	1 inch	1/4 inch/inch
T2	1/2 inch	1/8 inch/inch
T3	1/4 inch	1/16 inch/inch
T4	1/8 inch	1/32 inch/inch
T5	1/32 inch	1/120 inch/inch

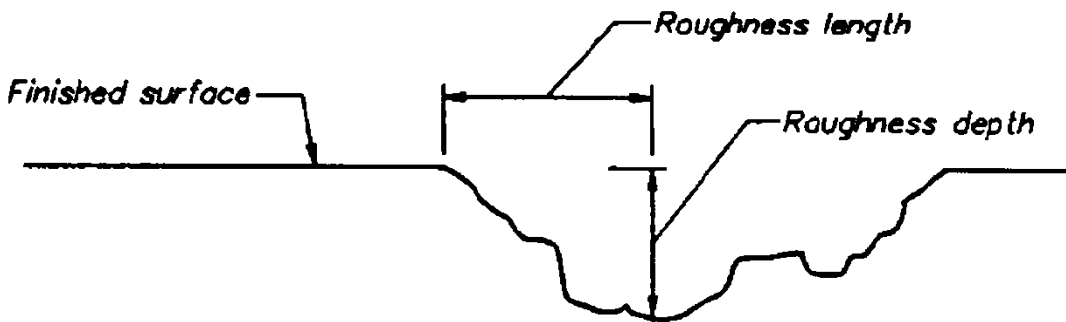
- H. Repair of hardened concrete not within specified tolerances:
1. Repair hardened concrete which is not within specified tolerances to bring it within those tolerances.
 2. Perform repair after consultation with Government inspector regarding method of repair. Notify COR as to time when repair will be performed.
 3. Repair concrete which will be exposed to view in manner which will result in concrete surface with uniform appearance.

- a. When grinding surfaces exposed to view, limit depth of grinding such that no aggregate particles are exposed more than 1/16 inch in cross section at finished surface.
 - b. Where grinding has caused or will cause exposure of aggregate particles greater than 1/16 inch in cross section at finished surface, repair concrete by excavating and replacing concrete.
- I. Field verification of surface tolerances:
1. Determine compliance of surface with specified surface tolerances.
 2. Evaluate surface roughness.
 - a. Measure roughness height or depth and check for compliance with values specified in Table 03 30 00D - Surface Tolerances and Table 03 30 00C - Deviations from Specified Lines, Grades, and Dimensions.
 - b. When measured height or depth of roughness is less than value in abrupt tolerance specification and height or depth of roughness does not cause structure to exceed applicable value specified in Table 03 30 00C - Deviations from Specified Lines, Grades, and Dimensions, surface roughness is acceptable.
 - c. When roughness height or depth exceeds abrupt tolerance specification, determine roughness slope for comparison to gradual tolerance specification.
 - 1) Measure roughness length and determine roughness slope by dividing roughness height or depth by roughness length (see Figure 1).
 - 2) When roughness slope is greater than slope specified by gradual tolerance specification, surface roughness is unacceptable.
 - 3) When roughness slope is less than gradual slope specified and gradual roughness does not cause structure to exceed allowable structural deviations, surface roughness is acceptable.



$$\text{Roughness slope ratio} = \frac{\text{Roughness height}}{\text{Roughness length}}$$

CASE 1 = Offset on the Surface



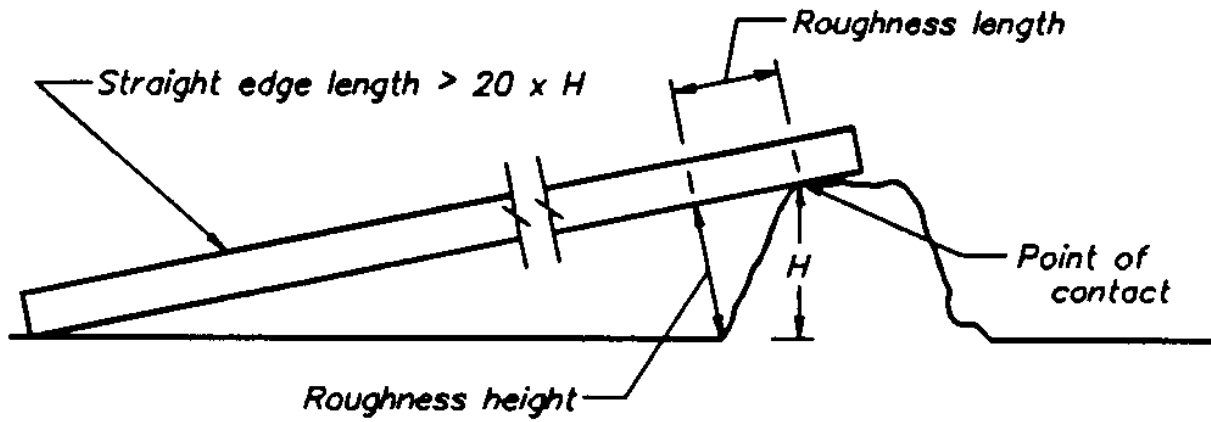
$$\text{Roughness slope ratio} = \frac{\text{Roughness depth}}{\text{Roughness length}}$$

CASE 2 = Offset into the Surface

FIGURE 1

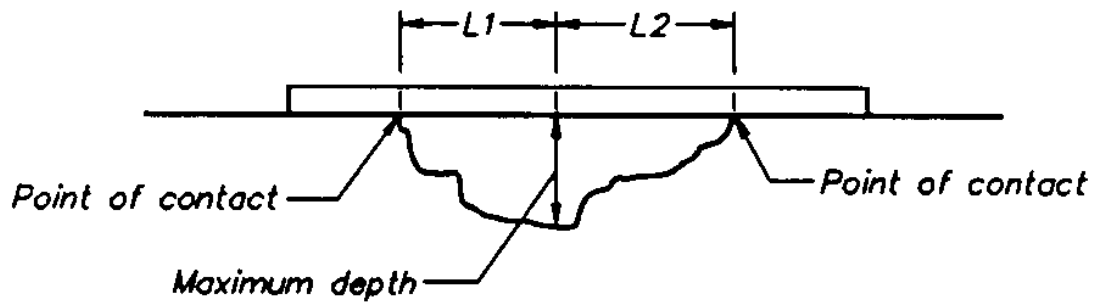
J. Measuring surface roughness:

1. Examples below illustrate how to make necessary surface measurements for typical roughness.
2. Case 1 - Roughness Protruding above Surface:
 - a. Measure roughness protruding above surface with straightedge that is at least 20 times longer than roughness height being measured.
 - b. Position straightedge with one end resting on top of roughness, as shown in Figure 2 (case 1).
 - c. Determine roughness height by measuring maximum gap that occurs normal to straight edge.
 - d. Note position on the straightedge from which normal distance is measured.
 - e. To determine roughness length, measure distance along straightedge from point where the height was measured to point of contact between straightedge and top of roughness.
 - f. Roughness slope is defined as ratio of roughness height to roughness length.
 - g. As roughness is seldom symmetric, moving position of straightedge about roughness may be necessary to locate point where maximum height and slope exists.
3. Case 2 - Roughness Extending below the Surface:
 - a. A roughness occurring as an indentation to surface is measured by placing straightedge across indentation, as shown in Figure 2 (case 2).
 - b. Measure maximum gap between straightedge and surface and note location of measurement on straightedge.
 - c. From point of depth measurement, measure along straightedge in both directions to point of contact with surface.
 - d. Use shortest length measured as roughness length.
 - e. Divide roughness depth by roughness length to determine roughness slope.



CASE 1

$$\text{Roughness slope} = \frac{\text{Roughness depth}}{\text{The shortest distance } L1 \text{ or } L2}$$



CASE 2

FIGURE 2

- K. Prevention of repeated failure to meet tolerances:
1. When concrete placements result in hardened concrete which does not meet specified tolerances, submit to COR an outline of preventive actions such as modifications to forms, modified procedure for setting screeds, and different finishing techniques to be implemented to avoid repeated failures. Submit when requested by COR.
 2. Government reserves the right to delay concrete placements until preventive actions which have been approved by COR are implemented.

3.06 CURING

- A. Water curing:
1. Keep concrete surface wet for 14 days, minimum, from time concrete has attained sufficient set to prevent detrimental effects to surface.
 2. Cure methods:
 - a. Water-saturated material.
 - b. System of perforated pipes, mechanical sprinklers, or porous hose.
 - c. Other methods which will keep surfaces wet.
 - d. Subject to approval by COR.
- B. Curing with curing compound:
1. Apply to concrete surface to provide water-retaining film. Reapply as necessary to maintain continuous, water-retaining film on surface for 28 days.
 2. Thoroughly mix compound and spray apply in one coat to provide continuous, uniform film over surface.
 3. Do not exceed coverage rate recommended by curing compound manufacturer. Decrease coverage rate on rough surfaces as necessary to obtain required continuous film.
 4. Ensure ample coverage on edges, corners, and rough surfaces.
 5. Use spray equipment recommended by curing compound manufacturer.
- C. Sheet material curing:
1. Includes curing with {polyethylene film.
 2. Thoroughly moisten concrete surface by lightly spraying with water as soon as concrete has hardened sufficiently to prevent damage.
 3. Completely cover concrete surface with sheet material to provide airtight, water-retaining film over entire surface.
 4. Lap edges of sheet material to seal adjacent sheets.

5. Place tightly against concrete surface at extreme edge of curing area.
6. Secure sheet material to withstand wind and prevent circulation of air inside sheet material.
7. Keep surface covered for 14 days, minimum.

3.07 CONTRACTOR FIELD QUALITY TESTING

- A. Contractor shall perform sampling, testing, and reporting as required in Table 03 30 00E - Field Testing.
 1. Independent testing agency shall meet requirements specified in Section 01 46 20 - Testing Agency Services.
 2. Personnel conducting plastic concrete field tests: Qualified as ACI Concrete Field Testing Technician, Grade 1; or equal.
 3. Personnel conducting concrete specimen tests: Qualified as ACI Concrete Strength Testing Technician; or equal.
- B. Perform tests at least as often as frequencies specified in Table 03 30 00E - Field Testing.
- C. Notify COR immediately of test results showing failure of materials to meet specifications. Notify COR within 2 hours of test results showing materials meet specifications. Submit reports of test results as specified.

3.08 GOVERNMENT CONTRACT QUALITY ASSURANCE - FIELD

- A. The Government will perform, as a minimum, tests listed in Table 03 30 00E - Field Testing. This testing is in addition to the Contractors Quality Assurance/Quality Control (QA/QC) program and does not relieve the Contractor of performing adequate QA/QC testing. The list of tests is provided only to alert the Contractor to potential impacts to work scheduling.
- B. Government testing frequency is at discretion of the COR. Greater frequency testing is normally performed at beginning of new work, new crew, or new equipment. Testing frequency listed in Table 03 30 00E - Field Testing is provided only as approximation of Government testing.

C. In addition to specified Contractor Quality Field Testing, the Government may also perform tests listed in Table 03 30 00E - Field Testing.

3.09 FIELD TESTING

Table 03 30 00E - Field Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	TESTING FREQUENCY
Fresh Concrete Properties - tests performed at site	ASTM C143	Slump of Hydraulic-Cement Concrete	1 set of tests per load for first two loads.
	ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method (alternative to ASTM C138 gravimetric method)	When tested concrete meets specifications, 1 set of tests each day of placement for each mixture for first 50 or less cubic yards, and 1 set of tests for each additional 100 cubic yards of concrete. Minimum of 1 set of tests per hour during placements.
	ASTM C1064	Temperature of Freshly Mixed Hydraulic-Cement Concrete	When concrete does not meet specifications, test each load until 2 consecutive loads meet specifications, then resume testing frequency specified above.
	ASTM C138	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete	
Compressive Strength,	ASTM C31	Making and Curing Concrete Test Specimens in the Field	<p>1 set of samples (6 inch by 12 inch) for each day of placement for each mixture for the first 50 or less cubic yards, and 1 set of samples for each additional 100 cubic yards of concrete. A minimum of 5 samples for strength testing shall be made each time strength samples are collected.</p> <p>2 additional field cured test cylinders during placement in adverse (hot or cold) weather. Cure these samples on jobsite under same conditions as concrete the cylinders represent for minimum of 7 days, then transfer to testing laboratory until testing at strength design days.</p> <p>Test 2 cylinders each at 7 days age and 2 cylinders at strength design age. Maintain last cylinder for testing in event that the strength design age test results fall below the required strength.</p>
	ASTM C39	Compressive Strength of Cylindrical Concrete Specimens	

Table 03 30 00E - Field Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	TESTING FREQUENCY
Concrete Cores	ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	At discretion of the Government when cylinder strengths fail to meet minimum requirements. The Contractor shall obtain core specimens in accordance with ASTM C42 at locations directed by COR, at no additional cost to the Government. The Contractor shall repair the core holes in accordance with USBR M-47 as directed by COR

A. Acceptance criteria:

1. Cylinder compressive strength:
 - a. In accordance with ASTM C94, except as follows:
 - 1) 90 Percent of test cylinders exceed specified compressive strength at design age.
 - 2) Average compressive strength of six consecutive test cylinders exceeds specified compressive strength at design age.
 - 3) No individual strength test falls below specified compressive strength by more than 500 pounds per square inch.
2. Drilled concrete cores:
 - a. Concrete in placement represented by core tests will be considered structurally adequate when average compressive strength of three cores is equal to at least 85 percent of specified compressive strength and no single core has a compressive strength of less than 75 percent of specified compressive strength.

3.10 PROTECTION

- A. Protect concrete from damage until final acceptance by Government.
 1. Do not load, remove forms or shoring, or backfill against concrete until concrete has gained sufficient strength to safely support its weight and imposed loads.
 2. Protect fresh concrete against erosion from rain, hail, sleet, or snow; contamination from foreign materials; and damage from foot traffic until the concrete has hardened.
 3. Protect concrete from heavy foot traffic and other construction activities by covering with plywood or other suitable material. Remove and dispose of temporary covering when no longer required.
- B. Protect concrete when freezing temperatures are imminent:

1. Maintain concrete at a temperature of 50 degrees F (10 degrees C) or greater for 72 hours, minimum, after placement. Vent heater and prevent concrete from drying where artificial heat is employed.
2. Protect concrete from freezing during water curing. After discontinuance of water curing, maintain at a temperature of 50 degrees F (10 degrees C) or greater for next 72 hours.
3. Discontinue protection against cold weather such that the drop in temperature of the concrete will be gradual and will not exceed 5 degrees F per hour and 40 degrees F in 24 hours.

3.11 REPAIR

- A. Repair concrete in accordance with USBR M-47.
- B. Use repair or replacement method directed by COR.

3.12 FINISH, SURFACE TOLERANCES, AND CURING SCHEDULES

Table 03 30 00F - Formed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces upon or against which fill material will be placed	F1	T1	Water, White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces.
Surfaces not permanently concealed by fill material or concrete where appearance is not critical	F2	T2 and T3	Water, White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces.
Surfaces exposed prominently to view or where appearance is important	F3	T5	ASTM C1315 Class A Clear curing compounds, water-emulsified resin-base if outdoors
Interior walls and ceilings of vaults, sumps, pullboxes, and entry boxes	F2	T4	White ASTM C309, Class B curing compound

Table 03 30 00F - Formed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Indoor and outdoor curbs	F2	T5	Polyethylene film or White Burlap-polyethylene, ASTM C309 Class A or B curing compound
Pedestals and equipment foundations	F2	T5	ASTM C1315 Class A Clear curing compounds, water-emulsified resin-base if outdoors, Polyethylene film
Construction joints and surfaces to be covered by grout	F1	T	Water White, ASTM C309 Class A curing compound
Expansion joints	F2	T	Water White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces

Table 03 30 00G - Unformed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces to be covered by fill material or concrete	U1	T1	White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces
Outdoor entrance slabs, and walks and stoops	U2	T3 T5	ASTM C1315 Class A Clear curing compounds, water-emulsified resin-base, Polyethylene film or White Burlap-polyethylene sheet

Table 03 30 00G - Unformed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Outdoor curbs and gutters	U2	T3 T5	White ASTM C309 Class A or B curing compound Polyethylene film or White Burlap-polyethylene sheet
Outdoor equipment slabs and foundations	U2	T3 T5	White ASTM C309 Class A or B curing compound, Polyethylene film or White Burlap-polyethylene sheet
Floors of vaults, sumps, pullboxes, and entry boxes	U2	T5	White wax-base or white water-emulsified resin-base curing compound
Interior floors	U3	T5	Polyethylene film Water
Masonry substrate	U2	T5	Water Polyethylene film

END OF SECTION

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SECTION 04 22 10
REINFORCED CONCRETE UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. **Include transformer enclosure in the price in the Price Schedule for Complete Electrical System.**

B. Cost:

1. Include in the price in the Price Schedule for Air Chamber No. 1.

C. Cost:

1. Include in the price in the Price Schedule for Air Chamber No. 2.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

- | | | |
|-----|---------------------|---|
| 1. | ASTM A615/A615M-14 | Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| 2. | ASTM C90-14 | Loadbearing Concrete Masonry Units |
| 3. | ASTM C140/C140M-14B | Sampling and Testing Concrete Masonry Units and Related Units |
| 4. | ASTM C144-11 | Aggregate for Masonry Mortar |
| 5. | ASTM C150/C150M-12 | Portland Cement |
| 6. | ASTM C207-06(2011) | Hydrated Lime for Masonry Purposes |
| 7. | ASTM C270-14a | Mortar for Unit Masonry |
| 8. | ASTM C404-11 | Aggregates for Masonry Grout |
| 9. | ASTM C426-10 | Linear Drying Shrinkage of Concrete Masonry Units |
| 10. | ASTM C476-10 | Grout for Masonry |

B. International Code Council (ICC)

1. IBC-15 International Building Code

C. Masonry Industry Council (MIC)

1. MIC Manual-99 Hot and Cold Weather Masonry
Construction Manual

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 04 22 10-1, Approval Data:

1. Manufacturer's product data for each masonry unit and accessory material.
2. Include the independent testing agency test results which show minimum compressive strength and maximum water absorption for masonry units.

C. RSN 04 22 10-2, Sample Kit:

1. Manufacturer's color sample kit for color selection of masonry unit and precast wall cap.

D. RSN 04 22 10-3, Certifications:

1. Manufacturer's certification that masonry units meet specified requirements. Attach results from specified source sampling and testing to each certification.
2. Manufacturer's certification that portland cement and lime meet specified requirements.

E. RSN 04 22 10-4, Mix Design:

1. Mortar mix design indicating type and proportions of ingredients in compliance with the proportion specifications of ASTM C270.
2. Grout mix design indicating type and proportions of ingredients in compliance with the proportion specification of ASTM C476.

F. RSN 04 22 10-5, Instructions:

1. Manufacturer's instructions for cleaning masonry units.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store materials off ground and under cover to prevent contact with moisture.

PART 2 PRODUCTS

2.01 AIR CHAMBER NO. 1 AND NO. 2

A. In accordance with Section 33 16 14 - Air Chambers.

2.02 MASONRY UNITS

- A. ASTM C90, lightweight, hollow and solid units.
- B. Finish:
 - 1. Split face; rough exposed aggregate, uneven natural split texture.
 - 2. One-sided.
- C. Nominal size:
 - 1. 16 inches long by 8 inches high (15-5/8 inches long by 7-5/8 inches actual); thickness as shown on the drawings.
 - 2. Furnish necessary shapes and sizes, bond-beam units, lintel units, and corner units as required to satisfy conditions indicated on the drawings. Include half-size units where required.
- D. Color: Selected by Government from manufacturers standard chart.

2.03 MORTAR MATERIALS

- A. Portland cement: ASTM C150; Type I, II, or III; standard gray color.
- B. Hydrated lime: ASTM C207, Type S.
- C. Aggregate: ASTM C144.
- D. Water: Clean water free of detrimental amounts of silt, organic matter, alkali, salts, and other impurities.
- E. Color: Selected by Government from manufacturers standard chart.

2.04 GROUT MATERIALS

- A. Portland cement: ASTM C150; Type I, II, or III.
- B. Aggregate: ASTM C404.
- C. Water: Clean water free of detrimental amounts of silt, organic matter, alkali, salts, and other impurities.

2.05 REINFORCEMENTS

- A. Reinforcing bars: ASTM A615, Grade 60, deformed steel bar, uncoated.

2.06 MORTAR MIX

- A. Type: ASTM C270, Type S, proportion specification using specified materials.

- B. Do not add calcium chloride or anti-freeze compounds.
- C. Retemper mortar in accordance with ASTM C270 except use and place mortar within 1-1/2 hours after mixing.

2.07 GROUT MIX

- A. Coarse Grout: ASTM C476, proportion specification using specified materials.

2.08 CONTRACTOR SOURCE QUALITY TESTING

- A. Independent testing agency shall sample and test masonry units in accordance with ASTM C140 and ASTM C426 before shipment to jobsite.
- B. Independent testing agency in accordance with Section 01 46 20 - Testing Laboratory Services.

2.09 ACCESSORIES

- A. Precast Wall Cap:
 - 1. Furnish necessary peaked wall cap shapes and sizes as required to satisfy conditions indicated on the drawings.
 - 2. Color: Selected by Government from manufacturers standard chart.

PART 3 EXECUTION

3.01 PREPARATION

- A. Comply with recommended practices of MIC Manual for hot and cold weather masonry.
- B. Clean and roughen concrete substrate surfaces to be in contact with mortar or grout. Remove curing compounds, laitance, efflorescence, loose or defective concrete, sand, dirt, and foreign material.
- C. Clean top of unfinished masonry of loose mortar and foreign material before resuming work.
- D. Lay concrete masonry units dry. Do not prewet.
- E. Clean excess concrete and loose rust from dowel bars to be embedded in masonry.
- F. Clean loose rust and coatings from reinforcing bars, joint reinforcements, and metal items to be embedded in masonry.

3.02 COURSING

- A. Place masonry plumb, level, and true to required lines.

- B. Maintain masonry courses to uniform width.
- C. Make vertical and horizontal joints equal and of uniform thickness.
- D. Lay units in running bond except as indicated on drawings. Course one unit and one mortar joint to equal nominal unit dimension.
- E. Form concave mortar joints.

3.03 PLACING AND BONDING

- A. Lay masonry with completely filled mortar joints. Buttering corners of joints and deep or excessive furrowing of mortar joints are not permitted.
- B. Do not shift or tap units after mortar has taken initial set. Remove and replace with fresh mortar where adjustment must be made.
- C. Keep concrete foundation surfaces to be in contact with grout free of mortar.
- D. Keep cells to be grouted free of mortar.
- E. Keep wall cavities free of mortar.
- F. Remove excess mortar.
- G. Saw cut to form straight unchipped edges where jobsite cutting is required. Cut units dry.

3.04 TOLERANCES

- A. Variation from unit to adjacent unit: 1/32 inch, maximum.
- B. Variation from plane of wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- C. Variation from plumb: 1/4 inch per story noncumulative, 1/2 inch in two stories or more.
- D. Variation from level coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch, maximum.
- E. Variation of joint thickness: 1/8 inch in 3 feet.
- F. Maximum variation from cross sectional thickness of walls: Plus or minus 1/4 inch.

3.05 REINFORCEMENT INSTALLATION

- A. Reinforcing bars:
 - 1. Place reinforcing bars supported and secured against displacement.
 - 2. Maintain position within 1/2 inch of true dimension.
 - 3. Lap bar splices: As indicated on the drawings.

3.06 GROUTING

- A. Place and consolidate grout fill without disturbing reinforcements.
- B. Maintain grout thickness of 1/2 inch, minimum, between bar and masonry units.
- C. Place grout in lifts of 4 feet, maximum, as wall is built.
- D. Stop grout 1-1/2 inches below top of masonry when grouting is stopped for 1 hour or more.
- E. Agitate to consolidate grout and fill space.
- F. Grout all reinforced and unreinforced masonry cells.

3.07 BUILT-IN WORK

- A. Build in steel doorframes and other built-in items.
- B. Build in items plumb and level.
- C. Bed doorframe anchors in mortar joints.
- D. Fill doorframes solid with mortar.
- E. Rake joint between doorframes and masonry to 1/4 inch depth for sealant installation.

3.08 CUTTING AND FITTING

- A. Cut and fit for pipes, conduits, sleeves, and similar items. Provide correct size, shape, and location.

3.09 POINTING AND CLEANING

- A. Cut out and replace defective mortar. Match adjacent work.
- B. Remove excess mortar and mortar and grout smears.
- C. Clean soiled surfaces.
- D. Clean masonry in accordance with manufacturer's instructions. Do not mottle, discolor, stain, damage, or acid burn masonry.
- E. Obtain approval of each cleaning method from COR at jobsite before using method on work.

3.10 PROTECTION

- A. Provide temporary bracing during erection to support finished work and withstand wind loads. Maintain bracing until structure provides permanent support.
- B. At workday's end, cover unfinished work with secure waterproof covers to prevent moisture infiltration. Keep unfinished work covered during work shutdown.

3.11 FIELD QUALITY ASSURANCE

- A. Facilitate access and materials necessary for the Government's Quality Assurance inspection.
- B. Special Inspection: Government will complete a Level 1 special inspection of the construction of the masonry walls that is in compliance with the IBC, Sections 1704 through 1708.
- C. Mortar Mix: Government will verify that the actual mortar mix used in the construction of the masonry walls agrees with the approved mix design and that it is in compliance with ASTM C270.
- D. Grout Mix: Government will verify that the actual grout used in the construction of the masonry walls agrees with the approved mix design and that it is in compliance with ASTM C476.
- E. Concrete Masonry Units: Government will verify that the concrete masonry units used in the construction of the masonry walls are in compliance with ASTM C90. In addition, the Government will randomly select 3 concrete masonry units to determine their compressive strengths are in compliance with ASTM C90.

END OF SECTION

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SECTION 09 96 20
COATINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Cost:
1. Include in the price in the Price Schedule for Pre-manufactured Pump Station No. 1.
- B. Cost:
1. Include in the price in the Price Schedule for Pre-manufactured Pump Station No. 2.
- C. Cost:
1. Include in the price in the Price Schedule for Buried Galvanic Anode Cathodic Protection and Corrosion Monitoring Systems.
- D. Cost:
1. Include in the price in the Price Schedule for Submerged Galvanic Anode Cathodic Protection System For Welded Tanks.
- E. Cost:
1. Include in the price in the Price Schedule for Bolted Tank Submerged Galvanic Anode Cathodic Protection System.
- F. Cost:
1. Include in the price in the Price Schedule for Line Pipe.
- G. Cost:
1. Include in the price in the Price Schedule for NAPI Turnout.
- H. Cost:
1. Include in the price in the Price Schedule for Class 150B Two Inch Diameter Air Valve Assemblies.
- I. Cost:
1. Include in the price in the Price Schedule for Class 250B Two Inch Diameter Air Valve Assemblies.

- J. Cost:
1. Include in the price in the Price Schedule for Class 150B Four Inch Diameter Blowoffs.
- K. Cost:
1. Include in the price in the Price Schedule for Class 250B Four Inch Diameter Blowoffs.
- L. Cost:
1. Include in the price in the Price Schedule for Air Chamber No. 1.
- M. Cost:
1. Include in the price in the Price Schedule for Air Chamber No. 2.
- N. Cost:
1. Include in the price in the Price Schedule for Regulating Tank No. 1.
- O. Cost:
1. Include in the price in the Price Schedule for Regulating Tank No. 2.
- P. Cost:
1. Include in the price in the Price Schedule for Steel Piping.
- Q. Cost:
1. Include in the price in the Price Schedule for Valves and Equipment.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM)
1. ASTM A380-13 Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
 2. ASTM A780/A780M-09(2015) Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
 3. ASTM C920-14a Elastomeric Joint Sealants
 4. ASTM D870-09 Testing Water Resistance of Coatings Using Water Immersion
 5. ASTM D2244-15a Calculation of Color Differences From Instrumentally Measured Color Coordinates
 6. ASTM D2794-93(2010) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

7. ASTM D4060-14 Abrasion Resistance of Organic Coatings by the Taber Abraser
 8. ASTM D4285-83(2012) Indicating Oil or Water in Compressed Air
 9. ASTM D4541-09 Pull-Off Strength of Coatings Using Portable Adhesion Testers
 10. ASTM D4587-11 Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus
 11. ASTM D5894-10 Cyclic Salt Fog/UV Exposure of painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
 12. ASTM D6677-07(2012) Evaluating Adhesion by Knife
 13. ASTM G8-96(2010) Cathodic Disbonding of Pipeline Coatings
 14. ASTM G154-12a Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- B. American Water Works Associations (AWWA)
1. AWWA C104-13 Cement-Mortar Lining and for Ductile-Iron Pipe and Fitting
 2. AWWA C205-12 Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4In. (100mm) and Larger - Shop Applied
 3. AWWA C222-08 Polyurethane Coatings for the Interior and Exterior of Steel Pipe and Fittings
 4. AWWA C602-11 Cement Mortar Lining of Water Pipelines in Place - 4 In. (100mm) and Larger
 5. AWWA D103-09 ~~Factory-Coated Bolted~~ Two-Layer Nylon-11-Based Polyamide Coating System for the Interior and Exterior of Steel Tanks for Water Storage Pipe, Connections, Fittings, and Special Connections
- C. Bureau of Reclamation (USBR)
1. USBR M47-15 Repair of Concrete
- D. General Services Administration (GSA)
1. FED-STD-595-15 Colors Used in Government Procurement

- E. International Organization For Standardization (ISO)
1. ISO 8502-3-92 Assessment of dust on Steel Surface Prepared for Painting (Pressure-Sensitive Tape Method)
- F. Master Painters Institute (MPI)
1. Approved Product List (APL) www.paintinfo.com or www.mpi.net
- G. National Association of Pipe Fabricators (NAPF)
1. NAPF 500-03-04-06 Abrasive Blast Cleaning of Ductile Iron Pipe
 2. NAPF 500-03-05-06 Abrasive Blast Cleaning of Cast Ductile Iron Fittings
- H. NSF International (NSF)
1. NSF 61-14 Drinking Water System Components
- I. The Society for Protective Coatings (SSPC)/NACE International (NACE)
1. SSPC-AB1-15 Mineral and Slag Abrasives
 2. SSPC-AB2-15 Cleanliness of Recycled Ferrous Metallic Abrasives
 3. SSPC-AB3-04 Newly Manufactured or Re-Manufactured Steel Abrasives
 4. SSPC-Paint Manual-95 Good Painting Practices, Fourth Edition
 5. SSPC-PA2-15 Measurement of Dry Paint Thickness with Magnetic Gages
 6. SSPC-SP1-15 Solvent Cleaning
 7. SSPC-SP3-04 Power Tool Cleaning
 8. SSPC-SP5/NACE 1-07 White Metal Blast Cleaning
 9. SSPC-SP6/NACE 3-07 Commercial Blast Cleaning
 10. SSPC-SP10/NACE 2-07 Near-White Blast Cleaning
 11. SSPC-SP11-13 Power Tool Cleaning to Bare Metal
 12. SSPC-SP13/NACE6-03 Surface Preparation of Concrete
 13. SSPC-VIS1-02 Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning
 14. SSPC-VIS3-04 Visual Standard for Power- and Hand-Tool Cleaned Steel

- | | | |
|-----|----------------|--|
| 15. | NACE RP0287-02 | Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape |
| 16. | NACE SP0188-06 | Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates |

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
1. Include the following information with each set of data or certification:
 - a. Applicable tabulation number from Coating Tabulations.
 - b. Identification of “Items to be coated” including sub-letter and sub-number listed in Coating Tabulations.
- B. RSN 09 96 20-1, Approval Data:
1. For each coating material, manufacturer’s product data, application, and SDS sheets.
 - a. Supplier’s name, address, and phone number.
 - b. Manufacturer’s designated product name.
 - c. Applicable tabulation number from Coating Tabulations.
 - d. Identification of “Items to be coated” including sub-letter and sub-number listed in Coating Tabulations.
 2. “Equal” Products:
 - a. For coating materials proposed as “equal” products to specified brand name products in Coating Categories, submit following with specified approval data:
 - b. List of projects (not less than 3) where material has been successfully used in applications similar to this project. Include:
 - 1) Project name and location.
 - 2) Type of structure.
 - 3) Owner’s name, address, and telephone number.
 - 4) Application dates.
 - c. Manufacturer’s certification substitute coating material meets specified requirements. Include:
 - 1) Manufacturer’s name, address, and phone number.
 - 2) Batch number(s) for each material, except thinners.

- 3) Signature of manufacturer's technical representative and date of signature.
 - d. Certified test reports that demonstrates substitute material meets or exceeds specified coating category requirements for physical and performance characteristics from each of following:
 - 1) Coating manufacturer.
 - 2) Independent laboratory.
 3. Paint Chip Samples:
 - a. Color chip samples approximately 4 by 6 inch.
 - b. Label each sample to include manufacturer's designated product name, color, and gloss.
- C. RSN 09 96 20-2, Final Approval Data:
1. For each coating material:
 - a. Purchase orders.
 - 1) Supplier's name, address, and phone number.
 - 2) Purchase order number and date.
 - 3) Manufacturer's designated product name.
 - 4) Batch number(s) for each material, except thinners.
 - 5) Quantities ordered for each material, except thinners.
 - b. Product Certifications:
 - 1) Manufacturer's certification that materials certified by a Qualified Products List (QPL) meet specified requirements.
 - 2) NSF 61 certification that materials meet specified requirements for coating systems in-contact with potable water.
- D. RSN 09 96 20-3, Contractor Testing Data for "Shop or Field Applied" Coatings:
1. Note - Not required for an equipment manufacture's standard coating system.
 2. Date of work.
 3. Description of areas and work performed.
 4. Surface preparation.
 5. Surface cleanliness (visible contaminates).
 6. Surface profile.
 7. Substrate soluble salt concentration.
 8. Ambient conditions.
 9. Dry film thickness after each coat.

1.04 QUALIFICATIONS

- A. Painting contractor:
 - 1. References showing painting contractor has previous successful experience applying coating systems.
 - 2. Include name, address, and telephone number of project owners.
- B. Coating applicators qualifications: SSPC-certified Level 2 Coating Application Specialist.
- C. Coating inspector: NACE certified Level 2 Coating Inspector or SSPC-certified Level 2 Protective Coatings Inspector.

1.05 DELIVERY, STORAGE, HANDLING

- A. Deliver materials to jobsite in original, undamaged, unopened containers labeled with manufacturer's name, designated product name, batch number, date of manufacture, and any special instructions.
- B. Deliver materials in containers not larger than 5 gallons as packaged by manufacturer unless suitable equipment is provided at jobsite to handle and thoroughly mix materials in larger containers.
- C. Store paints and thinners in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 50 to 95 degrees F.
- D. Do not expose to direct sunlight during storage.
- E. Do not use coating material which has exceeded manufacturer's specified storage stability period (shelf life).

1.06 AMBIENT CONDITIONS

- A. Do not apply coatings under following environmental conditions:
 - 1. Substrate surface temperature less than 5 degrees F above dewpoint.
 - 2. Temperatures of ambient air or receiving surface are less than 35 degrees F.
 - 3. Temperature of receiving surface is higher than 125 degrees F.
 - 4. Ambient air temperature, substrate surface temperature, or humidity are outside of manufacturer's recommended range.
- B. Do not perform surface preparation or apply coatings when environmental conditions are not expected to meet specified requirements during surface preparation, coating application, and curing period.

- C. Maintain environmental conditions to meet specified requirements during coating application and curing period. Provide heating or cooling, and dehumidification required to maintain temperature and humidity. Maintain environmental conditions in accordance with the recommendations of the coating material manufacturer. Complete curing before placing the coating systems into service.

PART 2 PRODUCTS

2.01 PRE-MANUFACTURED PUMP STATION NO. 1 AND NO. 2

- A. See Section 22 11 35 - Pre-manufactured Pump Stations.

2.02 BURIED GALVANIC ANODE CATHODIC PROTECTION AND CORROSION MONITORING SYSTEMS

- A. See 26 42 10 - Buried Galvanic Anode Cathodic Protection and Corrosion Monitoring Systems.

2.03 SUBMERGED GALVANIC ANODE CATHODIC PROTECTION SYSTEM FOR WELDED TANKS

- A. See Section 26 42 11 - Submerged Galvanic Anode Cathodic Protection System for Welded Tanks.

2.04 BOLTED TANK SUBMERGED GALVANIC ANODE CATHODIC PROTECTION SYSTEM

- A. See Section 26 42 12 - Bolted Tank Submerged Galvanic Anode Cathodic Protection System.

2.05 LINE PIPE

- A. See 33 11 10 - Pipeline General Requirements.

2.06 NAPI TURNOUT

- A. See Section 33 12 05 - NAPI Turnout.

2.07 CLASS 150B AND 250B TWO INCH DIAMETER AIR VALVE ASSEMBLIES AND CLASS 150B AND 250 B FOUR INCH DIAMETER BLOWOFFS

- A. See Section 33 12 10 - Valves and Equipment for Line Pipe Installations.

2.08 AIR CHAMBER NO. 1 AND NO. 2

- A. See Section 33 16 14 - Air Chambers.

2.09 REGULATING TANK NO. 1 AND NO. 2

A. See Section 33 16 50 - Steel Tanks.

2.10 STEEL PIPING

A. See Section 35 21 95 - Steel Piping.

2.11 VALVES AND EQUIPMENT

A. See Section 35 22 15 - Valves and Equipment.

2.12 MATERIALS

A. Abrasives:

1. Mineral and slag abrasives: Meets SSPC-AB1, type I (natural minerals) and type II (slags), class A, except flint minerals are not permitted.
2. SSPC-AB2 for recycled cleanliness.
 - a. In addition to the SSPC-AB2, include:
 - 1) Screen and air wash abrasive recycled at the job site to remove dirt and fines.
 - 2) Add new abrasive so that the combined new and recycled abrasive mixture meets specified requirements.
 - 3) Do not recycle abrasive which has picked up toxic or hazardous materials.
3. SSPC-AB3 Class I (steel) or II (iron) for angular shaped grit.
4. Use commercially available processes to render the hazardous waste stream non-hazardous.
5. Do not exceed toxicity threshold limit for hazardous materials.

B. Coatings:

1. Specified in Coating Tabulations.
2. Apply 1 coating category per option in Coating Tabulations.
3. Volatile Organic Compounds (VOC):
 - a. Do not exceed maximum permitted by Federal, State, and local air pollution control regulations.
 - b. Do not exceed maximum content as supplied in container or by addition of coating thinner material.
 - c. Factory color or tint. Do not color or tint at jobsite. Tint each coat progressively darker to enable confirmation of the number of coats.
 - d. Use thinners recommended by manufacturer for each coating material.

- e. Use of accelerator products is not permitted unless approved by COR.

C. Caulking and Fillers:

1. Fillers and Caulks Flexible gaps or crevices:
 - a. Coating manufacturer's standard or compatible flexible filler or caulk material.
 - b. Caulk material: Meet or exceed ASTM C920 type S or M, grade NS, class 25, suitable for water immersion service.
2. Nonflexible gaps or crevices: Coating manufacturer's standard filler or caulk material.

PART 3 EXECUTION

3.01 PROTECTION OF ADJACENT SURFACES, EQUIPMENT AND NEWLY COATED SURFACES

- A. Protect items or surfaces not to be coated from contamination and damage during cleaning and coating operations.
 1. Protect from abrasive blast particles and airborne coating particles.
 2. Includes surfaces and equipment in physical contact and in the vicinity of cleaning and coating operations.
 3. Examples include: Mating and machined surfaces, mechanical and electrical equipment (open or enclosed); instruction and similar plates; and wet and newly coated surfaces.
- B. Do not move newly coated items until coating is thoroughly dry as determined by one of following:
 1. Coating manufacturer's instructions for handling.
 2. Coating film cannot be distorted or removed by exerting substantial, but less than maximum, pressure with thumb and turning thumb through 90 degrees in plane of film.

3.02 REPAIR OF CONTRACTOR DAMAGED SURFACES

- A. Repair items, equipment, or surfaces which are damaged or contaminated by the contractor or as a result of transportation and insulation as determined by the COR.
 1. Repair damaged items of restore manufacturer coated equipment to original condition and appearance.
 2. Before coating any damaged coated surfaces, re-clean exposed surfaces and apply coating materials in accordance with the coatings manufacturer's instructions.

3.03 COATING OF METALWORK EMBEDDED IN CONCRETE

- A. For metal pipe embedded in concrete extend primer coats 6 inches, minimum, into concrete embedment measured from face of concrete and along surface of embedded. Caulk or seal gaps between the steel and the concrete at the exposed faces. Follow manufacturer's instructions to apply caulking material with maximum thickness of 1/2 inch.
- B. Coat ferrous surfaces in direct contact with concrete or grout overlapping concrete surfaces by 2 inches. Examples include: sill or anchor plates for impacted immersion
- C. Extend primer coat continuously through solid concrete structure with burial or immersion service exposure on either side of concrete faces. Examples include: thrust or anchor blocks.

3.04 SURFACE PREPARATION FOR FERROUS SURFACES

- A. Remove or repair surface irregularities before specified surface preparation.
 - 1. Welds:
 - a. Welds: Smooth and continuous.
 - b. Weld spatter, buckshot, laminations, and slivers: Remove and grind smooth.
 - c. Undercuts and pinholes: Fill with weld metal and grind smooth.
 - d. Projections, sharp edges, high points, fillets and corners: Grind smooth to radius of at least 1/16 inch.
 - 2. Pitting, gouges, scratches, porosity, and similar defects: Grind sharp edges smooth.
 - 3. Slag burrs, and laminations: Remove and grind smooth.
- B. Grind full length of free edges and corners to 1/16 inch chamfer before specified surface preparation.
- C. Specific preparation method and profile:
 - 1. See Coatings Tabulations.
 - 2. Remove deposits of rust and scale from the edges of beam flanges, angles and plates, bearings, rivets, the heads of nuts and bolts, and similar surfaces that are marginally accessible and difficult to clean. Hand pound using a hammer, or power tool cleaning using a needle gun or de-scaler before abrasive blast cleaning work begins.

- D. Surface profile:
1. Prepare in accordance with manufacturer's instructions for metallic or existing coating surfaces and service environment, unless specified in Coating Tabulations.
 2. Where manufacturer's instruction do not specify a surface profile, prepare blasted surfaces to following profile:
 - a. Atmospheric Service Environments: 1 mil or greater angular profile and less than specified millage of first applied coat.
 - b. Burial and Immersion Service Environments: Angular profile between 2 to 3 mils minimum and less than specified millage of first applied coat.
 3. Perform tests in accordance with surface profile inspection procedures specified.
 4. Heat cast iron components to between 140 and 180 degrees F to evaporate moisture in crystalline matrix for 2 hours minimum.

3.05 SURFACE PREPARATION FOR CONCRETE AND MASONRY SURFACES

- A. Specific surface preparation methods for concrete and masonry:
1. Before surface preparation and coatings application, cure cementitious materials for 28 days minimum.
 2. Before coating application, repair cementitious defects greater than 3/4 inch in depth by one of the following:
 - a. In accordance with USBR M47.
 - b. In accordance with manufacture's product instructions.
 3. Specific surface preparations:
 - a. See coatings Tabulations.
 - b. Surfaces shall be free of dirt, dust, grease, oil, laitance, efflorescence, from oil, and curing compounds.
 - c. Perform moisture tests one per 1000 square feet, minimum.
 - d. Perform moisture tests in accordance with moisture content inspection procedures specified and coatings manufacture allowable moisture content

3.06 APPLICATION EQUIPMENT

- A. Air compressor and spray application equipment:
1. Provide appropriate type equipment, adequately sized, and in proper operating order.
 2. Equip with pressure gauges and pressure regulators.

3. Equip with air supply lines free from oil and moisture. Keep lines free of oil and moisture during work.
 4. Perform tests in accordance with oil and moisture inspection procedures specified.
- B. Inspect air supply lines on air compressors for oil and moisture in accordance with ASTM D4285. Remove oil or water before proceeding with work.

3.07 COATING APPLICATION

- A. Apply number of coats and coating thickness specified in Coating Tabulations, and if not specified apply in accordance with manufacturer's instructions.
- B. After surface preparation and cleaning, apply stripe coat and primer coat before rust bloom (flash rust) occurs or the same day, whichever is sooner. Re-clean surface areas not receiving stripe coats and primer coat within this period.
- C. Apply coatings so that surfaces exposed to public view display a uniform texture and color matched appearance.
- D. Apply an even film of uniform thickness which tightly bonds to substrate or previous coats. Each coat shall be smooth, free from defects, such as skips, runs, sags, drips, pinholes, laps, brush marks, voids, or defects as defined in SSPC Paint Manual, Volume 1, Chapter 23. Each coat shall be free from pinholes, blisters and holidays, with no evidence of defects or blemishes with the defects repaired before applying the next coat. Coatings shall be sharply cut to lines.
- E. Surfaces which become contaminated in the intervals between applications of coatings shall be re-cleaned prior to applying the next coat. For each coat, apply a stripe coat by brush, roller, or dauber to welds, corners, and behind angles, edges of beams etc. and areas not fully reachable by spray in order to obtain the specified coverage and thickness.
1. Fill crevices and cover other irregularities before coating.
 2. Brush stripe welds, corners, seams, edges, nuts, threads, and bolts, a minimum of 2 inches around, prior to the application of first coat, as practicable.
- F. Eliminate over spray or dry spray. Clean surface the over spray or dry spray prior to the application of succeeding coats.
- G. Avoid contamination of painted surfaces between coats. Remove contamination before coating.
- H. Stripe Coat:
1. Stripe Coat Application:
 - a. Apply stripe coats by brush, dauber, or roller.
 - b. Spraying of stripe coat is not permitted.

- c. Apply to edges, corners, interior angles, pits, seams, and crevices, junctions of joining members, rivets, nuts, threads, bolts, washers, weld lines, and similar surface before applying primer, intermediate, and finish coats.

I. Primer Coats:

1. Apply immediately after surface preparation, cleaning, and stripe coat, if applicable. Apply before rust bloom occurs or the same day, whichever is less.
2. Cover peaks of surface profile by specified dry film thickness.
3. Apply number of coats and coating thickness specified in Coating Tabulations.
4. Apply within re-coat window at referenced humidity and temperature recommended by manufacturer.
5. Tint coats to differentiate between coats.

J. Intermediate and Topcoats:

1. Apply number of coats and coating thickness specified in Coating Tabulations.
2. Apply within re-coat window at referenced humidity and temperature recommended by manufacturer.
3. Tint intermediate coats to differentiate between coats.

3.08 FILLERS AND CAULK APPLICATION

- A. Apply fillers and/or caulks in a uniform texture, neatness, and color matched appearance.
- B. Apply fillers and/or caulks in accordance with manufacturer's instructions which tightly bonds to substrate or previous coats.
 1. Fill crevices and other gaps where coatings cannot bridge.
 2. Apply caulk after the coating has been applied.
 3. Areas shall include crevices, steel plates butted together, bolts, rivets, seams, skip welds, and conduit through metal.

3.09 PROTECTION OF NEWLY COATED SURFACES

- A. Do not walk on, subject to abrading action, or move items until coats are hardened sufficiently to resist damage.

3.10 CONTRACTOR QUALITY TESTING

A. Inspection Devices:

1. Provide inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint.

2. Use calibration plates and/or plastic shims to calibrate thickness gauge prior to every use.
- B. Conduct tests.
- C. Perform tests in presence of the COR. Tests performed in absence of the COR will not be accepted and subject coating shall be retested in the COR's presence.
- D. Complete the following quality control tests, and prepare and submit reports of results:
1. Surface Profile: Inspect surface profile in accordance with NACE RP0287 for compliance with specified requirements.
 - a. Use replica tape suitable for surface profile depth range.
 2. Visual Comparison of Prepared Surfaces:
 - a. Compare prepared steel surfaces to following visual reference photographs for allowable visible contaminants and stains:
 - 1) SSPC-VIS1 for abrasive blast cleaning.
 - 2) SSPC-VIS3 for power and hand tool cleaning.
 3. Assessment of dust on newly prepared metal surfaces:
 - a. Visually inspect and conduct pressure sensitive clear tape test method in accordance with ISO 8502-3 to verify surface cleanliness at a minimum of three random tests per each blasted section per shift.
 - b. Clear tape test shall meet cleanliness with a No. 3 grade maximum contamination allowed.
 4. Compressed air quality: ASTM D4285.
 5. Post Cure Evaluation:
 - a. Dry Film Thickness (DFT):
 - 1) After each coat, inspect hardened coating system for DFT compliance in accordance with SSPC-PA2.
 - 2) Acceptance Criteria: no single spot measurement less than specified minimum.
 - b. Discontinuity (Holiday) Testing:
 - 1) Inspect in accordance with NACE SP0188.
 - a) Use maximum test voltage for DFT as recommended by coating manufacturer to prevent coating damage.
 - b) Use of detergent wetting solution is not permitted.
 - c) Subtract thickness of zinc-rich primer from applied coating systems to determine test voltage.

- c. Adhesion test:
 - 1) Perform when and where directed by COR.
 - a) COR will direct performance of this test when inadequate procedures are suspected.
 - 2) Test procedure: ASTM D6677.

E. Reports:

- 1. Prepare report for each shift performing coating work, including surface preparation. Complete report for coating work performed on the shift. Make reports available for ongoing review by Government personnel.
- 2. Report shall signed by Contractor qualified inspection personnel. Include:
 - a. Date of work.
 - b. Description of areas and work performed.
 - c. Surface preparation.
 - d. Surface cleanliness (visible contaminates).
 - e. Surface profile.
 - f. Substrate soluble salt concentration.
 - g. Ambient conditions.
 - h. Dry film thickness after each coat.

3.11 COATING TABULATIONS

Tabulation No. 01		
Items to be coated - shop or factory applied coating systems using a coating manufacturer's standard coating material: <ol style="list-style-type: none"> a. Air Chamber buildings metal wall and metal roof panels. b. Valve actuators and motors. c. Air valve assemblies. d. Flow meters. e. Overhead traveling crane, rail, hoist, and trolley. 		
Coating materials	Number and thickness of coats	Surface preparation method
<ol style="list-style-type: none"> 1. Factory or Shop applied permanent coating system: 2. Factory or shop standard surface preparation and permanent coating system. 3. Items subject to sunlight shall be topcoated with ultraviolet (UV) stable materials. 4. Permanent coating system shall have 10-year corrosion-free protection without significant defects stored in atmospheric exposure. 5. Color and gloss: Manufacturer's standard color unless a specific color is otherwise specified in the color schedule. 6. Unless otherwise specified, unexposed surfaces that require coatings, such as interior of cabinets, enclosures, and equipment, shall be given the manufacturer's standard permanent coated finish. 		
Field Repair: Repair damaged areas of coated surfaces with compatible materials to equal thickness and color match of undamaged areas, unless otherwise tabulated herein.		

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Tabulation No. 02		
Items to be coated: <ol style="list-style-type: none"> a. Air chamber building doors and frames. Match to the exterior building roof panel color and gloss. b. Barrier posts and guard posts. 		
Notes: <ol style="list-style-type: none"> 1. Shop applied coatings: Standard surface preparation and shop applied permanent coating system that meets the following: 2. Color and gloss to be manufacturer's standard unless specified below or in color schedule. 3. Unexposed interior surfaces of cabinets, enclosures, and equipment to be given the manufacturer's standard permanent coated finish. 4. Shop coating to meet one or more of following application alternatives: 5. Alternative 1 - Complete shop applied permanent 3-coat system that consists of 1-prime coat and 2-finish coats. 6. Alternative 2 - Baked-on, coil, extrusion, or fusion bonded that consists of 1 or more coats of UV stable system. 7. Alternative 3 - Shop applied primer and field finish coating system that consists of: 2-mil DFT primer, minimum, and 2-field finish coats compatible with shop applied primer as specified below in coating material options. 8. Repair damaged areas with same shop applied primer and finish coat materials or compatible materials. 9. Do not coat surfaces of crane rails or monorail crane beam that contacts trolley or end truck wheel treads 10. Remove stabilizing or storage treatments on galvanizing by one of following (a) SSPC-SP1 and sweep blasting or (b) manufacturer's compatible wash treatment. 		
Coating materials - Option 1 Alkyd/Silicone Alkyd	Number and thickness of coats	Surface preparation method

Tabulation No. 02		
<p>Prime or spot repair coats: Carboline: Carbocoat 115 VOC</p> <p>International Paint: Devguard 4160</p> <p>Sherwin Williams: Kem Kromik Universal Primer</p> <p>Tnemec: Chem-Prime HS Series 37H</p>	<p>1 or more prime coats for uncoated or repair of damaged surfaces. Apply at 2 to 3 mils DFT, per coat, plus stripe coats.</p>	<p>Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: Uncoated surfaces: SSPC-SP6 Damaged coated surfaces: SSPC-SP6/NACE 3 and/or SSPC-SP11 where abrasive blasting is impractical</p>
<p>Topcoat</p> <p>Carboline: Carbocoat 30R</p> <p>International Paint: Devshield 877</p> <p>Sherwin Williams: Steel Master 9500</p> <p>Tnemec: Versatone Series 82HS</p> <p>Color and gloss: see color schedule</p>	<p>2 or more compatible manufacturer's finish coats. Apply at 2 to 3 mils DFT, per coat. Total system, excluding stripe coats: 6 mil DFT, minimum 9 mil DFT, maximum</p>	<p>Follow manufacturer's surface preparation instructions and application instructions to apply subsequent coats.</p>
Coating materials - Option 2 Water-borne acrylic	Number and thickness of coats	Surface preparation method
<p>Prime or spot repair: Carboline: Carbocrylic 3358</p> <p>International Paint: Devflex 4020PF DTM</p> <p>Sherwin Williams: DTM Waterborne Acrylic Primer series B66W1</p>	<p>1 or more prime coats for uncoated or repair of damaged surfaces. Apply at 2 to 3 mils DFT, per coat, plus stripe coats.</p>	<p>Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: Uncoated surfaces: SSPC-SP6/NACE 3 Damaged coated surfaces: SSPC-SP6/NACE 3 and/or SSPC-SP11 where abrasive blasting is impractical</p>

Tabulation No. 02		
<p>Topcoat:</p> <p>Carboline: Carbocrylic 3359</p> <p>International Paint: Devflex 4216HP</p> <p>Sherwin Williams: DTM Finish B66-100 or B66-200</p> <p>Color and gloss: see color schedule</p>	<p>2 or more compatible manufacturer's finish coats. Apply at 2 to 3 mils DFT, per coat.</p> <p>Total system, excluding stripe coats: 6 mil DFT, minimum 9 mil DFT, maximum</p>	<p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
PERFORMANCE REQUIREMENTS:		
Testing Protocol	Acceptance Criteria	
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1 kg load:	250 mg loss or less	
Direct impact, ASTM D2794	40 inch-pounds for alkyd/silicone alkyd 140 inch-pounds for waterborne acrylics	
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	250 psi or greater for alkyd/silicone alkyd 500 psi or greater for waterborne acrylics	
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs.	
QUV accelerated weathering test, ASTM D4587, ASTM G154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244.	

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Tabulation No. 03		
Items to coated: <ol style="list-style-type: none"> a. Exterior surfaces of exposed valves, fittings, and appurtenances located above ground. b. Exterior surfaces of exposed valves, fittings, and appurtenances located in concrete vaults. Valves may be coated with fusion bonded epoxy at no additional cost to the project. c. Exterior surfaces of exposed pipe, fittings, and appurtenances located in concrete vaults. d. Exterior surfaces of exposed pump manifolds and mounts. e. Exterior surfaces of exposed piping and fittings. f. Exterior of exposed pipe couplings. g. Exterior of exposed blow off piping, fittings, and valves. h. Coat associated fasteners to include nuts, bolts and washers. 		
Notes: <ol style="list-style-type: none"> 1. Do not coat stainless steel, bronze, or non-metallic surfaces. 2. Do not coat mating surfaces, machine surfaces, seals, and surfaces that would be functionally impaired by the coating. 3. Coat exposed machined surfaces after assembly. 		
Coating materials - Option 1 Epoxy/ polyurethane	Number and thickness of coats	Surface preparation method
Prime coat for ferrous surfaces: Carboline: Carboguard 691 PPG: Amerlock 400 or Amerlock 2 Sherwin Williams: Duraplate 235 or Macropoxy 646 Tnemec: Epoxoline Series N69 or Epoxoline Series V69	2 or more prime coats. Apply at 6 to 8 mils DFT, per coat, plus stripe coats.	SSPC-SP1 followed by: For steel: SP10/NACE 2 For cast-iron: NAPF 500-03-05 Blast Clean No. 4

Tabulation No. 03		
Finish coats: Carboline: Carbothane 134 HB, HG, or VOC PPG: Amercoat 450H or Amershield VOC Sherwin Williams: Hi solids polyurethane or Hi solids polyurethane 250 Tnemec: Endura-shield 175 Color and gloss: see color schedule	1 or more compatible manufacturer's finish coats, apply at 3 to 4 mils DFT, per coat. Total system, excluding stripe coats: 15-mil DFT, minimum 20-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Coating materials - Option 2 Moisture-cured urethane	Number and thickness of coats	Surface preparation method
Prime coat for ferrous surfaces: Sherwin Williams: Corothane I Mio-zinc Wasser: MC-Miozinc 2.8 or 100	1 or more prime coats. Apply at 3 to 5 mils DFT, per coat, plus stripe coats.	SSPC-SP1 followed by: For steel: SP10/NACE 2 For cast-iron: NAPF 500-03-05 Blast Clean No. 4
Intermediate coat: Sherwin Williams: Corothane I Ironox B Wasser: MC Ferrox B 2.8 or 100	1 or more compatible manufacturer's finish coats, apply at 3 to 5 mils DFT, per coat.	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Tabulation No. 03		
Finish coats: Gloss: Sherwin Williams: Corothane I Aliphatic Finish Coat Wasser: MC Shieldcoat 2.8 or 100 Color and gloss: see color schedule	2 or more compatible manufacturer's finish coats, apply at 2 to 3 mils DFT, per coat. Total system, excluding stripe coats: 10-mil DFT, minimum 16-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
PERFORMANCE REQUIREMENTS:		
Testing Protocol	Acceptance Criteria	
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Epoxy/polyurethane: 100 milligram loss or less MC urethanes: 100 milligram loss or less	
Direct impact, ASTM D2794	Epoxy/polyurethane: 30 inch-pounds MC Urethanes: 100 inch-pounds	
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	Epoxy polyurethane, and MC urethane: 800 psi or greater	
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs	
QUV accelerated weathering test, ASTM D4587:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244.	

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Tabulation No. 04		
<p>Items to be coated:</p> <ol style="list-style-type: none"> Exterior surfaces of immersed or buried valves. Valves may be coated with fusion bonded epoxy at no additional cost to the project. Exterior of bypass piping. Exterior of fill line piping. Exterior of buried or immersed piping (not encased in concrete and not in tanks). Coat fasteners to include nuts, bolts, washers, and exposed anchors. 		
<p>Notes:</p> <ol style="list-style-type: none"> Do not coat stainless steel, bronze, or non-metallic surfaces. Do not coat mating surfaces, machine surfaces, seals, and surfaces that would be functionally impaired by the coating. Coat exposed machined surfaces after assembly. 		
Coating materials - Option 1 Abrasion Resistant Epoxy	Number and thickness of coats	Surface preparation method
<p>For ferrous surfaces:</p> <p>Carboline: Carboguard 690GF</p> <p>Carboline: Carboguard 890GF2 or 890LTGF</p> <p>International Paint (Devoe) Dev-Grip 238</p> <p>Jotun: Marathon 500</p> <p>PPG: Amerlock 2/400GF</p> <p>Color and gloss: manufacturer's standard light gray or other light color and gloss</p>	<p>3 or more base coats, apply at 8 to 10 mils DFT, per coat, plus stripe coats.</p> <p>Total base coat system, excluding stripe coats: 24-mil DFT, minimum 30-mil DFT, maximum</p>	<p>SSPC-SP1 followed by -</p> <p>For steel: SP10/NACE 2</p> <p>For cast-iron: NAPF 500-03-05 Blast Clean No. 4</p> <p>2-4 mil surface profile</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
Coating materials - Option 2 High Solids Abrasion Resistant Epoxy	Number and thickness of coats	Surface preparation method

Tabulation No. 04		
<p>For ferrous surfaces:</p> <p>Sherwin Williams: Duraplate UHS Primer and Duraplate UHS Intermediate and Topcoat</p> <p>Color and gloss: manufacturer's standard light gray or other light color and gloss</p>	<p>1 or more prime coats, apply at 4 to 8 mils DFT, per coat, plus stripe coats.</p> <p>2 or more intermediate and topcoats, apply at 10 to 12 mils DFT, per coat.</p> <p>Total coat system, excluding stripe coats: 24-mil DFT, minimum 32-mil DFT, maximum</p>	<p>SSPC-SP1 followed by -</p> <p>For steel: SP10/NACE 2</p> <p>For cast-iron: NAPF 500-03-05 Blast Clean No. 4</p> <p>2 - 4 mil surface profile</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
<p>Coating materials - Option 3 100% Solids Abrasion Resistant Epoxy</p>	<p>Number and thickness of coats</p>	<p>Surface preparation method</p>
<p>For ferrous surfaces:</p> <p>Carboline Plasite 4500 S</p> <p>KCC Coatings Techni-Plus AEP 18AR</p> <p>NSP Products: NSP 120</p> <p>Color and gloss: manufacturer's standard light gray or other light color and gloss</p>	<p>2 or more base coats, apply at 10 to 16 mils DFT, per coat.</p> <p>Total coating system, excluding stripe coats: 20-mil DFT, minimum 32-mil DFT, maximum</p>	<p>SSPC-SP1 followed by -</p> <p>For steel: SP10/NACE 2</p> <p>For cast-iron: NAPF 500-03-05 Blast Clean No. 4</p> <p>2 - 4 mil surface profile</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
<p>Coating materials - Option 4 100 percent Solids Abrasion Resistant Epoxy</p>	<p>Number and thickness of coats</p>	<p>Surface preparation method</p>

Tabulation No. 04		
<p>For ferrous surfaces:</p> <p>A.W. Chesterton ARC S2</p> <p>Enviroline (International): Enviroline 225 or 376-30 or 376F-30LT</p> <p>International: Interzone 485</p> <p>KCC Corrosion: Techni-plus EN 25.5 Color and gloss: manufacturer's standard light gray or other light color and gloss</p>	<p>1 or more base coats, apply at 30 to 60 mils DFT, per coat.</p> <p>Total coating system, excluding stripe coats: 30-mil DFT, minimum 60-mil DFT, maximum</p>	<p>SSPC-SP1 followed by -</p> <p>For steel: SSPC-SP5/NACE 1 or SP10/NACE 2</p> <p>For cast-iron: NAPF 500-03-05 Blast Clean No. 4</p> <p>2 - 5 mil surface profile</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
PERFORMANCE REQUIREMENTS:		
Testing Protocol		Acceptance Criteria
Fresh/deionized water immersion test, ASTM D870:		Passes 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Dilute Harrison immersion test, Modified ASTM D870:		Passes 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D4060, CS- 17 wheel, 1,000 cycles, 1 kg load:		Epoxy: 100 milligram loss or less 100 percent Epoxy: 60 milligram or less
Direct impact, ASTM D2794		40 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, type II tester:		1000 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:		1/4 inch or less undercutting at 3000 hrs.
Cathodic disbondment, ASTM G8:		No disbondment at 120 day test

Tab IE-02.DOC

Tabulation No. 05		
Items to be coated: For potable water service, NSF 61 approved coating: <ol style="list-style-type: none"> a. Interior surfaces of exposed valves, fittings, and appurtenances located above ground. b. Interior surfaces of exposed valves, fittings, and appurtenances located in concrete vaults. Valves may be coated with fusion bonded epoxy at no additional cost to the project. c. Interior and exterior surfaces of pump bowls. The pump bowls may be coated with fusion bonded epoxy at no additional cost to the project. Coating subject to direct sunlight will need a UV resistant topcoat. d. Interior surfaces of exposed pipe, fittings, and appurtenances located in concrete vaults. e. Interior surfaces of exposed pump manifolds and mounts. f. Interior of pipe couplings. g. Interior surfaces of immersed or buried valves. Valves may be coated with fusion bonded epoxy at no additional cost to the project. h. Interior of bypass piping. i. Interior of fill line piping. j. Interior and exterior of cast iron or ductile iron pipe and fittings. May be coated with fusion bonded epoxy. k. Interior and exterior of metal fittings for turnout PVC piping and may be coated with fusion bonded epoxy at no additional cost to the project. l. Coat associated fasteners to include nuts, bolts and washers. 		
Notes: <ol style="list-style-type: none"> 1. Materials listed below require certified NSF 61 approval for contact with potable water. 2. Do not coat stainless steel, bronze, or non-metallic surfaces. 3. Do not coat mating surfaces, machine surfaces, seals, and surfaces where the coating could interfere with proper operation or fit. 4. Coat exposed machined surfaces after assembly. 		
Coating materials - Option 1 Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base Coats: Carboline: Carboguard 691(pw) PPG (Ameron): Amerlock 2(pw)	3 or more base coats, apply at 8 to 10 mils DFT, per coat, plus stripe coats. Total base coat system, excluding stripe coats: 24-mil DFT, minimum 30-mil DFT, maximum	SSPC-SP1 followed by - For steel: SSPC-SP5/NACE 1 or SP10/NACE 2 For cast-iron: NAPF 500-03-05 Blast Clean No. 4

Tabulation No. 05		
<p>Sherwin Williams: Duraplate 235 NSF(pw)</p> <p>Tnemec: Pota-Pox Series 20(pw)</p> <p>Color and gloss: manufacturer's standard color and gloss</p>		<p>2-4 mil surface profile</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
Coating materials - Option 2 100 percent Solids Epoxy	Number and thickness of coats	Surface preparation method
<p>For ferrous surfaces:</p> <p>Base coats:</p> <p>International (Enviroline) Enviroline 230(pw)</p> <p>Raven Lining Systems AquataPoxy A-6(pw)</p> <p>Color: manufacturer's standard color and gloss</p>	<p>1 or more base coats, apply at 30 to 50 mils DFT, per coat, plus stripe coats.</p> <p>Total coat system, excluding stripe coats: 30-mil DFT, minimum 50-mil DFT, maximum</p>	<p>SSPC-SP1 followed by -</p> <p>For steel: SSPC-SP5/NACE 1 or SP10/NACE 2</p> <p>For cast-iron: NAPF 500-03-05 Blast Clean No. 4</p> <p>2-4 mil surface profile</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
Coating materials - Option 3 100 percent Solids Epoxy	Number and thickness of coats	Surface preparation method
<p>For ferrous surfaces:</p> <p>Base Coats:</p> <p>Carboline Plasite 4500 S(pw)</p> <p>NSP Products: NSP 120(pw)</p> <p>Sherwin Williams Dura-Plate UHS(pw)</p>	<p>2 or more base coats, apply at 10 to 16 mils DFT, per coat.</p> <p>Total coating system, excluding stripe coats: 20-mil DFT, minimum 32-mil DFT, maximum</p>	<p>SSPC-SP1 followed by -</p> <p>For steel: SSPC-SP5/NACE 1 or SP10/NACE 2</p> <p>For cast-iron: NAPF 500-03-05 Blast Clean No. 4</p> <p>2-4 mil surface profile</p>

Tabulation No. 05	
<p>Color and gloss: manufacturer's standard color and gloss</p>	<p>Material amine blushes, multiple coat systems need to be prepared in accordance with manufacturer's instructions to apply subsequent coats.</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
PERFORMANCE REQUIREMENTS:	
Testing Protocol	Acceptance Criteria
<p>Fresh/deionized water immersion test, ASTM D870:</p>	<p>Passes 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.</p>
<p>Dilute Harrison immersion test, Modified ASTM D870:</p>	<p>Passes 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.</p>
<p>Abrasion resistance, ASTM D4060, CS- 17 wheel, 1,000 cycles, 1 kg load:</p>	<p>Epoxy: 100 milligram loss or less</p>
<p>Direct impact, ASTM D2794</p>	<p>30 inch-pounds</p>
<p>Pulloff adhesion, ASTM D4541, annex A2, type II tester:</p>	<p>1000 psi or greater</p>
<p>Cyclic testing salt fog/UV, ASTM D5894:</p>	<p>1/4 inch or less undercutting at 3000 hrs.</p>
<p>Cathodic disbondment, ASTM G8:</p>	<p>No disbondment at 120 day test</p>

Tab IE-03.DOC

Tabulation No. 06		
Items to be coated:		
<ul style="list-style-type: none"> a. Buried interior and exterior surfaces of ferrous line pipe b. Buried interior and exterior surfaces of ferrous pipe field welded joints. c. Buried exterior surfaces of ferrous piping and fittings not tabulated herein. 		
Notes:		
<ul style="list-style-type: none"> 1. Do not paint aluminum-brass, bronze, and stainless steel metalwork. 2. Do not coat seals, mating surfaces, and machined surfaces where paint could interfere with proper operation or fit. Coat exposed machined surfaces after installation. 3. Pipe bedding and trench backfill will be installed so as to avoid abrasion or other damage to the coatings. 		
Coating materials - Option 1(Interior only) - Cement-mortar lining		Surface preparation method
For ferrous surfaces: Apply in accordance with following standards: AWWA C104 or C 205, shop applied.		In accordance with AWWA C104 or AWWA C205
For girth welds and damaged areas: Apply in accordance with AWWA C602, in-place method.		In accordance with AWWA C602
Coating materials - Option 2 (Exterior and may also be used for interior lining) - Polyurethane	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Material: EC-120 or Corropipe II TX-15; as manufactured by: Madison Chemical Industries Inc., 490 McGeachie Drive, Milton, Ontario, Canada L9T 3Y5, 905-878-8863, www.madisonchemical.com Protec II; as manufactured by: ITW Futura Coatings, 130 Commerce Drive, Montgomeryville, PA 18936, www.futuracoatings.com Standard: Meets or exceeds requirements of AWWA C222 Thickness: 25-mil DFT, minimum		SSPC-SP1 followed by - For steel: SP10/NACE 2 For ductile-iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2-4 mil surface profile Follow manufacturer's surface preparation and

Tabulation No. 06	
Color: Manufacturer's standard color	application instructions to apply subsequent coats.
<p>For repair of damaged and defective polyurethane areas:</p> <p>Material: Use coating manufactures recommended repair materials.</p> <p>Thickness: Achieve thickness equal to surrounding undamaged polyurethane.</p>	<p>For damaged coated surfaces:</p> <p>SSPC-SP-1 followed by SP-10 and/or SSPC-SP-11 where abrasive blasting is impractical</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
<p>For girth weld area option 1:</p> <p>Materials: Aqua-Shield AQW; as manufactured by: Canusa-CPS, 2408 Timberloch Place, Building C-8, The Woodlands TX 77380,281-367-8866, www.canusacps.com</p> <p>Application: Follow manufacturer's recommendations and instructions to apply heat shrink sleeve.</p> <p>Repair: Repair damage or defective sleeve areas per manufacturer's instructions. Replace sleeve for areas exceeding six square inches.</p>	<p>Follow manufacturer's surface preparation and application instructions to apply sleeve and any subsequent repairs.</p>
<p>For girth weld area option 2:</p> <p>Category: Liquid applied girth weld coating, compatible and approved by the polyurethane pipe coating manufacture.</p> <p>Application: Follow manufacturer's recommendations and instructions to apply girth weld coating.</p> <p>Repair: Repair damage or defective areas per manufacturer's instructions.</p>	<p>Follow manufacturer's surface preparation and application instructions to apply girth weld coating and any subsequent repairs.</p>

Tabulation No. 07		
Items to be coated: Outdoor steel water storage tank coating options: a. Coating exterior of welded steel water storage tank option. Exterior of bolted steel water storage tank option. Coatings shall meet requirements of AWWA D103. b. Exterior surfaces of air chamber, piping and fittings. c. Exterior surfaces of the outdoor steel water piping, fitting, and valves. d. Exterior surfaces of the steel overflow piping and flap valve. e. Exterior surfaces of the steel wall manhole and hatch covers. f. Tank dome vent. g. Surfaces of accompanying metalwork to be coated and not left galvanized: Ladders, stairs, walkways, hatches, balconies, safety cages, handrail, safety railings, platforms, and catwalks. h. Coat fasteners to include nuts, bolts, washers, and anchors.		
NOTES: 1. Do not paint aluminum-brass, bronze, and stainless steel metalwork. 2. Do not coat seals and machined surfaces where paint could interfere with proper operation or fit.		
Coating materials - Option 1 Zinc Rich Epoxy/Epoxy/Polyurethane	Number and thickness of coats	Surface preparation method
Prime coat for ferrous surfaces: Carboline: Carbozinc 859 or Carbozinc 859 VOC International Paint: Catha-coat 303H PPG: Amercoat 68HS or Amercoat 68HS VOC Sherwin Williams: Zinc Clad III HS or Zinc Clad III HS 100 Tnemec: Tneme-zinc 90-97	1 or more prime coats. Apply at 3 to 5 mils DFT, per coat, plus stripe coats.	Uncoated surfaces: SSPC-SP1 followed by SSPC-SP10 For damaged coated surfaces: SSPC-SP1 followed by SSPC-SP10 and/or SSPC-SP11 where abrasive blasting is impractical
Intermediate coat for ferrous surfaces: Carboline:	1 or more intermediate coats. Apply at 6 to 8 mils DFT,	Follow manufacturer's surface preparation and application instructions to

Tabulation No. 07		
<p>Carboguard 691 PPG: Amerlock 400 or Amerlock 2 Sherwin Williams: Duraplate 235 or Macropoxy 646 Tnemec: Epoxoline Series N69 or Epoxoline Series V69</p>	<p>per coat, plus stripe coats.</p>	<p>apply subsequent coats.</p>
<p>Finish coats: Carboline: Carbothane 134 HB, HG, or VOC PPG: Amercoat 450H or Amershield VOC Sherwin Williams: Hi solids polyurethane or Hi solids polyurethane 250 Tnemec: Endura-shield 175 Color and gloss: see color schedule</p>	<p>1 or more compatible manufacturer's finish coats. Apply at 3 to 4 mils DFT, per coat. Total system, excluding stripe coats: 12 mil DFT, minimum 17 mil DFT, maximum</p>	<p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
<p>Coating materials - Option 2 Moisture-cured urethane</p>	<p>Number and thickness of coats</p>	<p>Surface preparation method</p>
<p>Prime coat for ferrous surfaces: Sherwin Williams: Corothane I Mio-zinc Wasser: MC-Miozinc 2.8 or 100</p>	<p>1 or more prime coats. Apply at 3 to 5 mils DFT, per coat, plus stripe coats.</p>	<p>Uncoated surfaces: SSPC-SP1 followed by SSPC-SP10 For damaged coated surfaces: SSPC-SP1 followed by SSPC-SP10 and/or SSPC- SP11 where abrasive blasting is impractical</p>

Tabulation No. 07		
Intermediate coat: Sherwin Williams: Corothane I Ironox B Wasser: MC Ferrox B 2.8 or 100	1 or more compatible manufacturer's finish coats. Apply at 3 to 5 mils DFT, per coat.	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Finish coats: Gloss Sherwin Williams: Corothane I Aliphatic Finish Coat Wasser: MC Shieldcoat 2.8 or 100 Color and gloss: see color schedule	2 or more compatible manufacturer's finish coats, apply at 1 to 3 mils DFT, per coat. Total system, excluding stripe coats: 8 mil DFT, minimum 16 mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
PERFORMANCE REQUIREMENTS:		
Testing Protocol	Acceptance Criteria	
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1 kg load:	Epoxy/polyurethane: 100 milligram loss or less MC urethanes: 100 milligram loss or less	
Direct impact, ASTM D2794	Epoxy/polyurethane: 30 inch pounds MC Urethanes: 100 inch pounds	
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	Epoxy polyurethane, and MC urethane: 800 psi or greater	
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs.	
QUV accelerated weathering test, ASTM D4587:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244.	

Tabulation No. 08		
Items to be coated: Outdoor steel water storage tank coating options: 1. Coating interior of welded steel water storage tank option. Interior of bolted steel water storage tank option. Coatings meet the requirements of AWWA D103. 2. Interior and exterior ferrous surfaces of tank piping, and valves in-contact with potable water. 3. Interior of air chamber tank. 4. Interior and exterior ferrous surfaces of buried tank piping and valves. 5. Interior and exterior ferrous surfaces of the tank overflow piping and flap valve (not exposed to direct sunlight). 6. Interior and exterior ferrous surfaces of the tank wall manhole and hatch covers. 7. Pipe supports. 8. Fasteners to include nuts, bolts, washers, and anchors.		
Note: 1. Materials listed below require certified NSF 61 approval for contact with potable water. 2. Do not paint aluminum-brass, bronze, and stainless steel metalwork. 3. Do not coat seals and machined surfaces where paint could interfere with proper operation or fit.		
Coating materials - Option 1 Epoxy - NSF 61	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Carboline: Carboguard 691(pw) PPG (Ameron): Amerlock 2(pw) Sherwin Williams: Duraplate 235 PW(pw) Tnemec: Pota-Pox Series 20(pw) Color: white and gloss	3 or more base coats. Apply at 8 to 10 mils DFT, per coat, plus stripe coats. Total system, excluding stripe coats: 24 mil DFT, minimum 30 mil DFT, maximum	Uncoated surfaces: SSPC-SP1 followed by SSPC-SP10 For damaged coated surfaces: SSPC-SP1 followed by SSPC-SP10 and/or SSPC-SP11 where abrasive blasting is impractical Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Tabulation No. 08		
Coating materials - Option 2 100 percent Solids Epoxy - NSF 61	Number and thickness of coats	Surface preparation method
<p>For ferrous surfaces:</p> <p>Base coats:</p> <p>Raven Lining Systems AquataPoxy A-6(pw)</p> <p>Color: manufacturer's standard white and gloss</p>	<p>1 or more base coats.</p> <p>Apply at 20 to 60 mils DFT, per coat, plus stripe coats.</p> <p>Total system, excluding stripe coats: 20 mil DFT, minimum 60 mil DFT, maximum</p>	<p>Uncoated surfaces: SSPC-SP1 followed by SSPC-SP10, 2 to 3 mil profile</p> <p>For damaged coated surfaces: SSPC-SP1 followed by SSPC-SP10 and/or SSPC- SP11 where abrasive blasting is impractical</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
Coating materials - Option 3 100 percent Solids Epoxy - NSF 61	Number and thickness of coats	Surface preparation method
<p>For ferrous surfaces:</p> <p>Base coats:</p> <p>Carboline: Plasite 4500 S(pw)</p> <p>Color: manufacturer's standard gray and gloss.</p>	<p>1 or more base coats.</p> <p>Apply at 20 to 60 mils DFT, per coat, plus stripe coats.</p> <p>Total system, excluding stripe coats: 20 mil DFT, minimum 60 mil DFT, maximum</p>	<p>Uncoated surfaces: SSPC-SP1 followed by SSPC-SP10, 3 to 4 mil profile</p> <p>For damaged coated surfaces: SSPC-SP1 followed by SSPC-SP10 and/or SSPC- SP11 where abrasive blasting is impractical</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
Coating materials - Option 4 100 percent Solids Epoxy - NSF 61	Number and thickness of coats	Surface preparation method

Tabulation No. 08		
<p>For ferrous surfaces:</p> <p>Base coats:</p> <p>NSP Specialty Products NSP 120(pw)</p> <p>Color: manufacturer's standard gray and gloss.</p>	<p>2 or more base coats.</p> <p>Apply at 10 to 15 mils DFT, per coat, plus stripe coats.</p> <p>Total system, excluding stripe coats: 20 mil DFT, minimum 30 mil DFT, maximum</p>	<p>Uncoated surfaces: SSPC-SP1 followed by SSPC-SP10, 3 to 4 mil profile</p> <p>For damaged coated surfaces: SSPC-SP1 followed by SSPC-SP10 and/or SSPC- SP11 where abrasive blasting is impractical</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats.</p>
PERFORMANCE REQUIREMENTS:		
Testing Protocol	Acceptance Criteria	
Fresh/deionized water immersion test, ASTM D870:	Passes 2 years aerated water at ambient temperature no blisters on scribed or unscribed sides.	
Dilute Harrison immersion test, Modified ASTM D870:	Passes 2 years aerated water at ambient temperature no blisters on either scribed or unscribed sides.	
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1 kg load:	100 milligram loss or less	
Direct impact, ASTM D2794	30 inch pounds	
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	1000 psi or greater	
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs.	
Cathodic disbondment, ASTM G8:	No disbondment 120 day test	

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<p>Tabulation No. 9</p>	
<p>Items to be coated:</p> <p>As an option to weld steel tanks: Ferrous surfaces of glass line bolted tanks. Coat interior and exterior surfaces, and fittings of bolted tanks.</p>	
<p>Coating materials</p>	<p>Surface preparation method</p>
<p>For ferrous surfaces:</p> <p>The glass coating system shall meet requirements of AWWA D103, An enamel process consisting of a 2 coat Powder Enamel Coating System, 2 coats and 2 burns of powder enamel, fired at temperature of 1580 degrees F including strict firing time, furnace humidity and temperature control requirements.</p> <p><u>Notes:</u></p> <ol style="list-style-type: none"> 1. Tank manufacturer shall use Continuous Casted & Enamel Capable (CCE) steel. 2. Steel plate edges including tank openings and bolt holes shall be mechanically beveled, squared and/or rounded in the shop prior to application of the enamel/glass coating system. 3. Interior and Exterior surfaces shall be glass lined with the same quality enamel material and shall be of the same thickness and color. 4. The dry film thickness of the interior and exterior coating should be minimum 7 mils DFT and should not exceed 14 mils DFT. Do not exceed dry film thickness (DFT) of 20 mils DFT. Plates with DFT over 20 mils DFT shall be rejected. <p>Color: Manufacturer's light tan or beige</p>	<p>SSPC SP-1 Solvent Cleaning followed by SSPC SP-5 Blast Cleaning to White Metal and follow manufactures recommendations for surface mil profile.</p> <p>Follow manufacturer's surface preparation and application instructions to apply subsequent coats and make repairs.</p>

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Tabulation No. 10		
Items to be coated:		
a. Coat cathodic weld nuggets.		
Coating materials	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Carboline Bitumastic 50 or equal Color: Manufacturer's standard color	2 or more heavy base coats. Follow manufacturer's instructions for dry or wet film thickness per coat.	SSPC-SP3
Approved Materials: Materials from MPI APL		

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Tabulation No. 1140		
Damaged galvanized items to be repaired: <ul style="list-style-type: none">a. Hatch covers.b. Gratings.c. Ladders.d. Handrail and safety railings.e. Platforms.f. Steel joistsg. Metal roof deck.h. Damaged galvanized surfaces not otherwise tabulated.		
Coating materials	Number and thickness of coats	Surface preparation method
Repair damaged galvanized surfaces in accordance with ASTM A780, except repair materials containing cadmium and lead are not permitted.		

Tab AE-11.DOC

Tabulation No. 1244		
Damaged stainless steel items not to be coated and to receive a uniform passivation layer: a. Stainless steel clad surfaces not otherwise tabulated herein.		
Note: Do not coat stainless steel items listed above. New stainless steel surfaces to receive uniform passivation at point of manufacture. Clean and restored uniform passivation layer of damaged, contaminated, or depassivated stainless steel surfaces by methods listed below.		
Coating materials	Number and thickness of coats	Surface testing method
Do not coat unless specifically listed elsewhere in these tabulations.		ASTM A380
Repassivation Methods and Inspection Procedures of Contaminated Stainless Steel Surfaces		
Degree of surface contamination	ASTM A380* Surface preparation method**	ASTM A380* Surface testing methods preparation method**
Locally heavy surface contaminated areas: Contaminated by free iron, oxide scale, or rust related contaminants caused by field welding or cutting.	Method 5. - "Descaling", General Method 5.3 - "Mechanical Descaling" by grinding and/or Method 6.3 - "Cleaning of Welds and Weld-Joint Areas"	Method 7.2 - "Gross Inspection" Methods 7.2.5 - "Tests for Free Iron: Gross Indications"
General surface contaminated areas: Contaminated by free iron, oxide scale, or rust related contaminants.	Method 5. - "Descaling," General Method 5.2 - "Chemical Descaling" Method 5.2.2.(1) - "Chemical Descaling" by swab or spray wetting the surfaces and/or Method 5.3 - "Mechanical Descaling" by grinding	Method 7.2 - "Gross Inspection" Method 7.2.5 - Tests for Free Iron: Gross Indication

Tabulation No. 1244		
<p>General surface contaminated areas:</p> <p>Contaminated by grease, oil, residual chemical films, or other non-free iron related contaminants.</p>	<p>Method 6.2.10 - "Water Jetting"</p> <p>and/or</p> <p>Method 6.4 - "Final Cleaning, or Passivation, or Both", wiping with a clean, solvent-moistened cloth</p>	<p>Method 7.2 - "Gross Inspection"</p> <p>Method 7.2.2 - "Wipe Tests"</p> <p>Where films are not detectable under white light conditions, use</p> <p>Method 7.3 - "Precision Inspection"</p> <p>Method 7.3.2 - "Black Light Inspection"</p>
<p>* Other ASTM A380 methods may be used instead of above specified surface preparation methods and inspection procedures.</p> <p>** Do not damage attached parts, adjacent parts, or materials by field cleaning and passivation methods of stainless steel.</p>		

Tab AE-14.DOC

3.12 COLOR SCHEDULE

- A. Color and gloss to meet one or more of following:
1. Munsell Color.
 2. FED-STD-595.
 3. Manufacturer's standard color.
- B. Gloss abbreviations:
1. G - Full Gloss.
 2. SG - Semigloss.
 3. F - Flat.
- C. Table 09 96 20A: Color Schedule.
1. Numbers listed in the "Tabulation No." column correspond to "Items to be coated" listed in Coating Tabulations.
- D. Color and gloss of finished coats to be selected and approved by the COR.

Table 09 96 20A - Color Schedule

Tabulation No.	Item Surface	Color	Color No.	Gloss
7	a. Exterior tank surfaces, piping, fittings, valves, and accompanying metal work.	Beige	Munsell 2.5Y8/4	G
	b. For lettering or stenciling of the tanks.	Blue	Munsell 7.5B7/8	G

END OF SECTION

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SECTION 26 05 02
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Complete Electrical System:

1. Payment: For the lump sum price offered in the Price Schedule. Includes:
 - a. Performing required design.
 - b. Furnishing recently certified calibrated testing equipment.
 - c. Performing testing.
 - d. Transporting and storing equipment and materials.
 - e. Modifying and relocating equipment.
 - f. Assembling, adjusting, and installing equipment.
 - g. Coating equipment and materials.
 - h. Brackets, fasteners, bolts, nuts, lock washers, and other accessories required for mounting or installing electrical equipment and materials.
 - i. Drilling holes in steel structures (other than tubular structures) as required for mounting or installing electrical equipment and materials.
 - j. Furnishing, handling, and storing spare parts for electrical equipment.
 - k. Furnishing special tools and appliances for maintenance and adjustment of equipment.
 - l. Making electrical connections; furnishing miscellaneous materials, which are required for making the connections to electrical equipment.
 - 1) Estimate the number of connections to be made to the equipment based on prior knowledge or experience with similar equipment.
 - 2) No additional compensation will be allowed in the event that actual connections exceed the number estimated at the time of bidding.
 - m. Performing wiring checkout and tests.
 - n. **Transformer enclosure.**
 - o. **Transformer foundation.**

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM)
 - 1. ASTM A123/A123M-15 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 2. ASTM A153/A153M-09 Zinc Coatings (Hot-Dip) on Iron and Steel Hardware
- B. Institute of Electrical and Electronics Engineers (IEEE)
 - 1. IEEE C2-12 National Electric Safety Code (NEC)
- C. National Electrical Installation Standards (NEIS)
 - 1. NECA 1-15 Good Workmanship in Electrical Contracting
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 70-14 National Electrical Code (NEC)

1.03 EXTRA MATERIALS

- A. Provide to Government special tools and equipment necessary to properly install, adjust, test, and check operation of electrical equipment. Furnish additional tools and equipment to properly install, adjust, and check the operation of electrical equipment.

PART 2 PRODUCTS

2.01 TRANSFORMER FOUNDATIONS

- A. See Section 03 11 10 - Concrete Forming, Section 03 20 00 - Concrete Reinforcing, and Section 03 30 00 - Cast-in-Place Concrete.

2.02 TRANSFORMER ENCLOSURES

- A. See Section 04 22 10 - Reinforced Concrete Unit Masonry Assemblies.

2.03 MATERIALS AND EQUIPMENT

- A. Conform to NFPA 70 and IEEE C2.
- B. Furnish electrical materials and equipment.
- C. Galvanize mounting brackets, bolts, nuts, and washers for major items of electrical equipment such as the outdoor unit substations and the motor control centers in accordance with ASTM A123 and ASTM A153.

- D. Provide galvanized steel or non-corrosive metal for mounting bolts, nuts, and washers for minor items of electrical equipment and lighter weight items. Do not use cadmium-plated mounting hardware.
- E. Change designs as required where Contractor-furnished electrical equipment and materials differ in size, type, ratings, or other physical properties from designs in these specifications. CO will approve changes at Contractor's expense, unless Contractor can demonstrate that changes are necessary regardless of manufacturer.
- F. Provide special tools and appliances furnished by manufacturer for maintenance and adjustment of manufacturer's electrical equipment.
- G. Use test equipment that has been calibrated within 365 days of its use with the calibration sticker clearly visible.
- H. Deliver spare parts required by this section to Government after completion of contract.

2.04 SOURCE QUALITY ASSURANCE

- A. Government will inspect the outdoor switchgear and motor control equipment at supplier's manufacturing plant during fabrication and testing. However, final acceptance will not be made until the equipment has been installed and is operational.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, assemble, and adjust equipment in accordance with this subparagraph. These specifications requirements are based on the premise that no conflict exists between the specified design, the standards, and the codes. However, in the event a conflict is discovered, inform the COR of the conflict.
 - 1. In the event of conflicting requirements, establish precedence by the following order:
 - a. This section or as directed by the COR.
 - b. The drawings included in this section.
 - c. The latest edition of "National Electric Code" of the National Fire Protection Association for electrical wiring apparatus and the adopted electrical code of the State in which the construction is located. Cooperate with any agency designated by that State to inspect the electrical installation for conformance with the applicable State code.
- B. Do not install electrical equipment until approval drawings and data for associated equipment have been approved by Government.

- C. Electrical Installations, Assembly Operations, and Adjustments: Comply with NFPA 70, IEEE C2, and NECA 1.
- D. Make electrical installations complete and ready for service.
- E. Install electrical equipment in accordance with directions furnished by manufacturer's instruction books.
- F. Make electrical wire, cable, conduit and grounding connections and furnish miscellaneous materials which are required for making these connections to equipment.
- G. Install items of electrical equipment that are required to be in a lineup so appearance is uniform, including height, depth, color, and general construction.
- H. Tighten nuts used in electrical equipment assembly with torque wrenches to torque values recommended by equipment manufacturers.
- I. Drill holes in bolted steel structures and provide fastenings required for mounting or installing electrical equipment and materials.
- J. Do not drill holes in tubular steel structures. Fasten to tubular steel structures by means of properly drilled and tapped pads or brackets welded to tubular members.
- K. Installation of Electrical Equipment includes:
 - 1. Leveling and grouting channel bases.
 - 2. Drilling holes, furnishing hardware, and assembling components to each other.
 - 3. Furnishing materials for and making connections correctly in accordance with final wiring diagrams.
 - 4. Tagging wires and cables at each end.
 - 5. Correcting errors made by the Contractor in the installation at no expense to the Government.
 - 6. Wiring and checkout of equipment in accordance with Section 26 05 90 - Wiring Checkout and Tests.
- L. Set electrical equipment installed on concrete foundations on channel bases and grout in place to provide full and even bearing.

3.02 REPAIR

- A. Repair or replace damaged devices and repair damaged painted surfaces of equipment to match original finish.
- B. Correct by repair or replacement, at the Contractor's expense, damage to or failure of part of the items of material and equipment which in the opinion of the COR was caused by faulty installation, faulty mechanical assembly, or mishandling.

3.03 FIELD QUALITY ASSURANCE

- A. Government will inspect the outdoor switchgear and motor control equipment during construction. Acceptance of equipment will be made after equipment is operational.

END OF SECTION

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SECTION 26 05 13
MEDIUM-VOLTAGE POWER CABLE SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Cost:
1. Include in the price in the Price Schedule for Complete Electrical System.

1.02 REFERENCE STANDARDS

- A. Association of Edison Illuminating Companies (AEIC)
1. AEIC CS8-13 Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV
- B. ASTM International (ASTM)
1. ASTM B8-11 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 48-09 Alternating-Current Cable Terminations 2.5 kV Through 765 kV
- D. National Electrical Manufacturers Association (NEMA)
1. ICEA S-93-639 NEMA WC74-12 5-46 KV Shielded Power cable for Use in the Transmission and Distribution of Electric Energy

1.03 PERFORMANCE REQUIREMENTS

- A. Provide ~~5/8 kilovolt~~, 15 kilovolt, and 28 kilovolt cable systems.
- B. Determine actual cable length and cable termination configurations.

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 33 26 - Electrical Drawings and Data.
- B. RSN 26 05 13-1, Approval Drawings and Data:
1. Manufacturer's catalog data.
- C. RSN 26 05 13-2, Field Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cable on reels which are sufficiently sturdy to withstand normal handling during shipping, hauling, and installation.
- B. Seal ends of cable on reels from moisture with suitable heat-shrinkable caps and mastic compounds.
- C. Do not drag cable across ground, fences, or other sharp projections during shipping or placement of cable reels at the jobsite.

PART 2 PRODUCTS

2.01 POWER CABLE

- A. Type: MV-105 single-conductor shielded.
- B. Ratings:
 - 1. Rated Voltage: ~~5/8~~ kilovolts.
 - a. Operating voltage: 4.16 kilovolts.
 - b. Frequency: 60 hertz.
 - c. Operating temperature: 105 degrees C, maximum.
 - d. Insulation level: 133 percent insulation.
 - e. Circuit configuration: ~~Delta~~Wye.
 - 2. Rated Voltage: 15 kilovolts.
 - a. Operating voltage: 13.8 kilovolts.
 - b. Frequency: 60 hertz.
 - c. Operating temperature: 105 degrees C, maximum.
 - d. Insulation level: 133 percent insulation.
 - e. Circuit configuration: Wye.
 - 3. Rated Voltage: 28 kilovolts.
 - a. Operating voltage: 24.9 kilovolts.
 - b. Frequency: 60 hertz.
 - c. Operating temperature: 105 degrees C, maximum.
 - d. Insulation level: 100 percent insulation.
 - e. Circuit configuration: Wye.

- C. Conductor:
 - 1. Stranded bare annealed copper in accordance with ASTM B8.
 - 2. Size: As shown.
- D. Insulation: Solid-dielectric EPR (ethylene-propylene rubber).
- E. Screens:
 - 1. Strand Screen: Extruded, semi-conducting EPR.
 - 2. Insulation Screen: Extruded, semi-conducting EPR strand screen applied directly over the insulation.
- F. Shield: 5 mil copper tape, coated, helically applied.
- G. Jacket: PVC (polyvinyl chloride).
- H. Suitable for conduit installation.
- I. Date of Manufacture: No more than 24 months before Notice-to-Proceed.
- J. Have AWG or circular mil designation.
- K. Conform to ICEA S-93-639, NEMA WC74 and AEIC CS8, where applicable.

2.02 CABLE TERMINATIONS

- A. Type: Kit form, heat shrinkable, suitable for outdoor use and with the cable specified. Include stress tube, ground kit, and appropriate lug.
- B. Conform to IEEE 48.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In accordance with manufacturer's instructions and recommendations, and recognized industry practice.
- B. Install cable terminations in accordance with manufacturer's instructions and recommendations.
- C. Reel Procedures:
 - 1. Remove cable from reel by turning mounted reel.
 - 2. Do not end feed from reel.
 - 3. Do not allow cable reel to rest upon reeled cable.

4. Inspect cable as removed from reel for visible defects.
- D. Do not drag cable across ground, fences, or other sharp projections.
- E. Installation in Raceways:
1. Do not exceed cable pulling tensions and bending radius recommended by manufacturer.
 2. Use lubrication in accordance with manufacturer's recommendations.
 3. Pull cable by hand, or use tensiometer or release mechanism on cable pulling equipment to ensure pulling tension remains below tensile strength of cable.
 4. Pull all cable in each conduit run at the same time.
- F. Terminate or seal cut ends of cable immediately after cutting operation. Seal ends of cable against moisture with waterproof end caps.
- G. Do not splice cables.

3.02 CONTRACTOR FIELD QUALITY TESTING

- A. Perform testing after cable terminations have been installed, but before connections have been made to bus or apparatus.
- B. Notify COR, in writing, of date, time, and cables to be tested at least 14 working days before testing. Test dates shall be mutually agreeable between the Contractor and the COR.
- C. Perform Following Tests:
1. Insulation resistance.
 2. DC high potential.
- D. Insulation Resistance Test:
1. Perform test prior to DC high potential test.
 2. Measure cable insulation resistance with megohm meter.
 3. Test voltage: 2,500 volts direct current for 1 minute.
 4. Reject cable if resistance is less than 25 megohms.
- E. D.C. High Potential:
1. Test voltage: ~~35 kilovolts or not to exceed maximum recommended~~ Recommended dc field acceptance testing value specified by the cable manufacturer.
 2. Apply voltage between conductor and metallic shield with the shield and other metallic components of the cable grounded.

3. Initially applied DC voltage shall not exceed 3 times rated AC voltage of cable.
 4. Test duration: 15 minutes or until current reading levels off and remains steady for at least three minutes.
 5. Test failure is detected by excessive leakage current tripping the internal circuit breaker of the test equipment.
- F. Record the following data on test report for each test performed and for each conductor tested:
1. Date of test.
 2. Name or names of Contractor's personnel who performed test.
 3. Name of Government inspector who witnessed test.
 4. Conductor identification.
 5. Test data for each conductor tested. Record the current magnitude at 2, 5, 10 and 15 minutes after the maximum test voltage has been reached.
 6. Result of test: Pass or fail.

END OF SECTION

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SECTION 26 16 12
PRIMARY UNIT SUBSTATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the price in the Price Schedule for Complete Electrical System.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

1. ANSI C37.46-10 High-Voltage (>1000V) Expulsion and Current-Limiting Power Class Fuses and Fuse Disconnecting Switches
2. ANSI C37.121-12 Unit Substations - Requirements
3. ANSI C57.12.55-9887 Dry-Type Transformers - Used in Unit Installations, Including Unit Substations - Conformance Standard

B. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 693-05 Recommended Practice for Seismic Design of Substations
2. IEEE C37.04-09 Rating Structure for AC High Voltage Circuit Breakers
3. IEEE C37.06-09 AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Voltages Above 1000 V
4. IEEE C37.09-07 Test Procedure for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
5. IEEE C37.20.2-15 Metal-Clad Switchgear
6. IEEE C57.12.01-15 Requirements for Dry-Type Distribution and Power Transformers
7. IEEE C57.12.91-11 Test Code for Dry-Type Distribution and Power Transformers
8. IEEE C57.13-16 Instrument Transformers

- 9. IEEE C57.94-15 Recommended Practice for Installation, Application, Operation and Maintenance of Dry-Type Distribution and Power Transformers
- 10. IEEE C57.96-13 Loading Dry-Type Distribution and Power Transformers
- 11. IEEE C62.11-12 Metal-Oxide Surge Arresters for AC Power Circuits (> 1 kV)
- C. InterNational Electrical Testing Association, Inc. (NETA)
 - 1. NETA ATS-13 Acceptance Testing Specifications
- D. National Electrical Manufacturers Association (NEMA)
 - 1. NEMA FU1-12 Low Voltage Cartridge Fuses
 - 2. NEMA TR1-13 Transformers, Regulators, and Reactors

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 33 26 - Electrical Drawings and Data.
- B. RSN 26 13 26-1, Approval Drawings and Data:
 - 1. Manufacturer's technical catalog data marked with corresponding Bill of Materials (BOM) item number.
 - 2. Layout drawings.
 - 3. Equipment data:
 - a. Total weight of switchgear assembly and additional impact load during opening operation of breaker.
 - b. Weight of removable element of circuit breaker.
 - c. Circuit breaker tripping and closing currents.
 - d. Description of bus bar insulation system.
 - 4. Equipment Nameplate list.
 - 5. Device Nameplate list.
 - 6. BOM.
- C. RSN 26 13 26-2, Schematic and Wiring Diagrams:
- D. RSN 26 16 12-3, Factory Test Notification:
 - 1. Notify COR, in writing, at least 14 days in advance of factory testing.

- a. Include factory JHA for government inspector(s) visit in accordance with Section 01 33 26 - Electrical Drawings and Data.
- E. RSN 26 13 26-4, Check Prints.
- F. RSN 26 13 26-5, Factory Test Reports:
 - 1. For design tests, certificates stating equipment has passed applicable referenced design tests are acceptable in lieu of submitting actual test reports.
- G. RSN 26 13 26-6, Field Test Reports.
- H. RSN 26 13 26-7, Final Drawings.
- I. RSN 26 13 26-8, Operation and Maintenance Instruction Book.

1.04 QUALIFICATIONS

- A. Field testing organization and personnel: As specified in NETA ATS, Section 3, except may be accredited by other than NETA.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. The entire unit substation shall be factory-assembled except for necessary shipping splits.
- B. Impact and mishandling detection devices shall be affixed to the transformer during transport. Provide record of impact recorder to the COR.
- C. Store and protect products from moisture and debris. Provide heating within enclosures as required by manufacturer.
- D. Handle, unload, and store equipment in accordance with manufacturer's instructions. Include a copy of these instructions with equipment at time of shipment.

1.06 WARRANTY

- A. Warrant outdoor unit substation in accordance with the clause at FAR 52.246-18 - Warranty of Supplies of a Complex Nature.

1.07 DESIGN REQUIREMENTS

- A. Design, manufacture, test, and deliver outdoor primary unit substation as described in this section.
 - 1. Design equipment bases in accordance with the specified seismic qualification level in accordance with IEEE 693. Use Annex M for the switchgear sections and Annex D for the transformer section.
- B. Conform to ANSI C37.121.

- C. Furnish and coordinate components of the outdoor primary unit substation including but not limited to the primary-side enclosure, transformer, secondary-side enclosure, including components as specified herein.

1.08 PROJECT CONDITIONS

- A. Completely assembled and installed switchgear assembly shall operate as specified without derating under following conditions:
 1. Elevation: 6,000 feet.
 2. Temperature range: minus 35 degrees C to 40 degrees C.
 3. Seismic qualifications: Low Qualification level in accordance with IEEE 693.
 4. Wind loading: Withstand wind up to 90 miles/hour.
 5. Seismic and wind forces do not occur simultaneously.

1.09 EXTRA MATERIALS

- A. Furnish 3 fuses of each size used for internal circuit protection.
- B. Furnish special tools required for installation and normal operation and maintenance of the unit substation in accordance with Section 01 60 00 - Product Requirements.

PART 2 PRODUCTS

2.01 PRIMARY (INCOMING) SECTION

- A. General: The primary section shall consist of a metal-clad switchgear section with bottom cable entry for incoming power and control circuits and a transition section or throat as required for connection to the transformer primary.
 1. The primary shall be on the right when facing the unit substation front.
 2. Designed for coupling with the transformer and securely connected together.
 3. Conform to IEEE C37.20.3.
- B. Switchgear assembly.
 1. Conform to IEEE C37.20.2.
 2. Type: Outdoor, dead front, with energized parts behind grounded metal barriers.

3. Ratings: See Table 26 16 12A - Switchgear Ratings.

Table 26 16 12A - Switchgear Ratings

Rating	Pumping Plant No. 1	Pumping Plant No. 2
Nominal system voltage	13.8 kV, rms	24.9 kV, rms
Maximum voltage (minimum)	15.5 kV, rms	38 kV, rms
Rated insulation level (BIL)	110 kV, peak	150 kV, peak
Continuous current	1,200 A, main bus	
Momentary current	Not less than close-and-latch capability of circuit breaker.	
Short-time current	Not less than short-time withstand rating of circuit breaker.	
Frequency	60 hertz	

4. Construction Features:

- a. Shield energized low-voltage terminals exposed by door opening with removable cover.
- b. Equip high-voltage drawer or trunion-mounted devices with automatic grounding devices.
- c. Determine number of switchgear sections from drawings, including required bus transition sections.

5. Bus: Copper.

C. Circuit breakers:

1. Conform to IEEE C37.04 and IEEE C37.06.
2. Type:
 - a. Vacuum with motor-compressed spring stored-energy mechanism.
 - b. Three-pole, single-throw, back-connected, latch-in, removable-element type.
 - c. Trip Free in all positions.
3. Ratings: See with Table 26 16 12B - Circuit Breaker Ratings.

Table 26 16 12B - Circuit Breaker Ratings

Rating	Pumping Plant No. 1	Pumping Plant No. 2
Nominal system voltage	13.8 kV, rms	24.9 kV, rms
Maximum voltage (minimum)	15.5 kV, rms	38 kV, rms
Full wave withstand (BIL)	110 kV, peak	150 kV, peak
Continuous current	1,200 A, rms	600 A, rms
Short-circuit/Short time current	2,000 A, rms	8,000 A, rms
Interrupting time- Cycles	5 cycles	5 cycles
Closing and latching capability	5,200 A, crest	20,800 A, crest

4. Construction Features and Accessories:
 - a. Locate manual closer and opener on front panel of removable element.
 - b. Closing Speed of Contacts: Independent of control voltage and operator.
 - c. Visual indications:
 - 1) On front of breaker panel.
 - 2) Circuit breaker contact position.
 - 3) Spring charge condition.
 - 4) Operation counter.
 - d. Mechanical interlocks to prevent insertion or removal of circuit breaker removable elements while circuit breaker is in closed position.
 - e. Mechanical interlocks to prevent circuit breaker from closing unless primary disconnecting devices are in fully closed contact.
 - f. Internal wiring shall be NEC 70 Type SIS, size 14 AWG min., and terminators shall be insulated ring-tongue type utilizing lock washers.
 - g. Self-coupling, separable, adjustable ground plate.
 - h. Mechanism Operated Contact (MOC) switch interface shall completely close and latch breaker contacts without stalling and with no harm to the MOC switch.
5. Control and Operational Features:
 - a. Closing and tripping power: 120 Vac.
 - b. Stored energy mechanism motor operator power: 120 Vac.
 - c. Capacitive trip device.
 - d. Breaker closing will normally be by operator pendant-connected control switch operation.
 - e. Manual close and trip for emergency operation, test, and withdrawn positions.
 - f. During closing operation, stored energy springs shall be automatically charged for tripping.
 - g. Provide manual charging of stored energy mechanism for use during power outages or testing.
 - h. Auxiliary switches with not less than 5 spare "a" contacts and 5 spare "b" contacts.
 - i. Local operation of circuit breaker from control circuit while breaker is in test position.
 - j. Initiate breaker tripping by operator control switch or protective relays.

- k. Latch breaker closed so loss of station power or control power does not cause breaker tripping.
- l. Removal of breaker element shall automatically trip breaker and release springs.
- m. In installed breaker position, stored-energy mechanism shall automatically charge following a trip operation.

2.02 TRANSFORMER SECTION

A. Construction Requirements:

- 1. Dry-type construction, self-cooled, AA rated, 3 phase, 60Hz.
- 2. Designed, manufactured, and tested in accordance with ANSI C57.12.55 and where no conflict occurs, with NEMA TR1, unless otherwise specified.
- 3. Capable of operating with loading and temperature-rise limitations of IEEE C57.96.
- 4. Primary and Secondary Windings: Copper.
- 5. Core and coil assembly encapsulated utilizing a VPE (vacuum pressure encapsulated) process.
- 6. Suitable for installation outdoors and operation under project conditions.

B. Ratings:

- 1. Capacity: 1500 kVA.
- 2. Primary Specifications: See Table 26 16 12C.

Table 26 16 12C - Transformer Rating Primary Specifications

Rating	Pumping Plant No. 1	Pumping Plant No. 2
Voltage	13.8 kV, rms	24.9 kV, rms
Connection	Delta	Delta
BIL (Line-End)	110 kV, peak	150 kV, peak
Taps	Two 2 1/2 percent FCAN and two 2 1/2 percent FCBN	

- 3. Secondary Specifications: See Table 26 16 12D.

Table 26 16 12D - Transformer Rating Secondary Specifications

Rating	Pumping Plant No. 1	Pumping Plant No. 2
Voltage	4.16 kV, rms	
Connection	Wye-Gnd	
BIL (Line-End)	60 kV, peak	60 kV, peak
BIL (Neutral-End)	60 kV, peak	60 kV, peak
Taps	None	
Neutral CT	100:5, C20	200:5, C50

- 4. Impedance: Manufacturer's standard.

5. Coil Insulation Class: 220 degrees C.
 6. Temperature Rise: 80 degrees C.
- C. Enclosure:
1. Outdoor, ventilated.
 2. Meet requirements for Category "B" outdoor enclosures as defined in ANSI C57.12.55.
- D. Base: Welded structure of heavy steel angles and channels capable of supporting the enclosure and the core-and-coil assembly.
- E. Winding Temperature Indicator:
1. Range: 25 to 250 degrees C.
 2. Digital temperature gauge powered from protection equipment uninterruptible power supply located in the associated switchgear section.
 3. Trip and alarm relays.
 4. Modbus-RTU communication interface.
- F. Connections between incoming and outgoing section busing and transformer windings to be made with flexible copper braid bus or copper bus bar through a suitable throat or transition section.
- G. Grounding:
1. Provide transformer base with two stainless steel or copper ground pads located on diagonally opposite corners. Ground pads to have two tapped holes for attaching ground leads.
 2. Ground neutral point of transformer secondary winding to grounding electrode system.

2.03 SECONDARY (OUTGOING) SECTION

- A. General: The secondary section shall consist of a metal-clad switchgear section with bottom cable entry for outgoing power and control circuits and a transition section or throat as required for connection to the transformer secondary.
1. The secondary shall be on the left when facing the unit substation front.
 2. Designed for coupling with the transformer and securely connected together.
 3. Conform to IEEE C37.20.3.
- B. Switchgear assembly:
1. Conform to IEEE C37.20.2.
 2. Type: Outdoor, dead front, with energized parts behind grounded metal barriers.

3. Ratings:
 - a. Maximum voltage: 15 kV, rms.
 - b. Lightning impulse withstand: 95 kV, peak.
 - c. Continuous current: 1200 A, main bus.
 - d. Momentary current: Not less than close-and-latch capability of circuit breaker.
 - e. Short-time current: Not less than short-time withstand rating of circuit breaker.
 - f. Frequency: 60-hertz.
4. Construction Features:
 - a. Shield energized low-voltage terminals exposed by door opening with removable cover.
 - b. Equip high-voltage drawer or trunion-mounted devices with automatic grounding devices.
 - c. Determine number of switchgear sections from drawings, including required bus transition sections.
5. Bus: Copper.

C. Circuit breakers:

1. Conform to IEEE C37.04 and IEEE C37.06.
2. Type:
 - a. Vacuum with motor-compressed spring stored-energy mechanism.
 - b. Three-pole, single-throw, back-connected, latch-in, removable-element type.
 - c. Trip Free in all positions.
3. Ratings: In accordance with Table 25 16 12E - Circuit Breaker Ratings.

Table 26 16 12E - Circuit Breaker Ratings

Rating	Pumping Plant No. 1	Pumping Plant No. 2
Nominal system voltage	4.16 kV, rms	4.16 kV, rms
Maximum voltage (minimum)	15 kV, rms	15 kV, rms
Full wave withstand (BIL)	95 kV, peak	95 kV, peak
Continuous current	1,200 A, rms	1200 A, rms
Short-circuit/Short time current	2,500 A, rms	5,000 A, rms
Interrupting time- Cycles	5 cycles	5 cycles
Closing and latching capability	6,500 A, crest	13,000 A, crest

4. Construction Features and Accessories:
 - a. Locate manual closer and opener on front panel of removable element.

- b. Closing Speed of Contacts: Independent of control voltage and operator.
 - c. Visual indications:
 - 1) On front of breaker panel.
 - 2) Circuit breaker contact position.
 - 3) Spring charge condition.
 - 4) Operation counter.
 - d. Mechanical interlocks to prevent insertion or removal of circuit breaker removable elements while circuit breaker is in closed position.
 - e. Mechanical interlocks to prevent circuit breaker from closing unless primary disconnecting devices are in fully closed contact.
 - f. Internal wiring shall be NEC Type SIS, size 14 AWG min., and terminators shall be insulated ring-tongue type utilizing lock washers.
 - g. Self-coupling, separable, adjustable ground plate.
 - h. Mechanism Operated Contact (MOC) switch interface shall completely close and latch breaker contacts without stalling and with no harm to the MOC switch.
5. Control and Operational Features:
- a. Closing and tripping power: 120 Vac.
 - b. Stored energy mechanism motor operator power: 120 Vac.
 - c. Capacitive trip device.
 - d. Breaker closing will normally be by operator pendant-connected control switch operation.
 - e. Manual close and trip for emergency operation, test, and withdrawn positions.
 - f. During closing operation, stored energy springs shall be automatically charged for tripping.
 - g. Provide manual charging of stored energy mechanism for use during power outages or testing.
 - h. Auxiliary switches with not less than 5 spare "a" contacts and 5 spare "b" contacts.
 - i. Local operation of circuit breaker from control circuit while breaker is in test position.
 - j. Initiate breaker tripping by operator control switch or protective relays.
 - k. Latch breaker closed so loss of station power or control power does not cause breaker tripping.

- l. Removal of breaker element shall automatically trip breaker and release springs.
- m. In installed breaker position, stored-energy mechanism shall automatically charge following a trip operation.

2.04 SURGE ARRESTERS

- A. Conform to IEEE C62.11.
- B. Type: Metal-oxide.
- C. Construction: Polymer housing.
- D. Station class.
- E. Protective characteristics as specified in Table 26 17 20F - Surge Arrester Protective Characteristics.

Table 26 17 20F - Surge Arrester Protective Characteristics

Pumping Plant	TOV, 1 sec.	MCOV, kV rms; not less than:	Maximum Equivalent Front-of - Wave, kV crest	Maximum Discharge Voltage, kV crest Using 8/20 Current Wave @			Maximum Switching Surge, kV crest
				5kA	20kA	40kA	
No. 1	10.9 kV	8.4 kV	101 kV	-	-	93 kV	77 kV
No. 2	19.6 kV	15.1 kV	137 kV	-	-	127 kV	105 kV

2.05 CURRENT TRANSFORMERS

- A. Conform to IEEE C57.13 and IEEE C37.04.
- B. Bushing or window type.
- C. Ratios as indicated on drawings.
- D. Accuracy Class: As indicated on drawings.

2.06 POTENTIAL TRANSFORMERS

- A. In accordance with IEEE C57.13 and IEEE C37.04.
- B. Ratings and Connection: As shown on drawings.
- C. Drawout type.

D. Fuse:

1. In accordance with ANSI C37.46.
2. Current-limiting type.
3. Sized by PT manufacturer.

2.07 PROTECTIVE RELAY

A. BE1-11t Transformer Protective Relay as manufactured by Basler Electric Company, Highland, IL; or equal, having following essential characteristics:

1. Multifunction, digital relay that monitors 3 phase, alternating-current and voltage.
2. Output relays: Trip relay, alarm relay. Output relays to be programmable.
3. Self-diagnostics failure function: Continually monitor its own functions and trip or alarm in case of failure.
4. Protective functions:
 - a. Phase instantaneous overcurrent (50).
 - b. Phase inverse time overcurrent (51).
 - c. Phase current differential (87).
 - d. Neutral current differential (87N).
 - e. Modbus RTU.
 - f. 120 Vac control input.
 - g. 5 ampere current input.
 - h. 120 Vac voltage input.
 - i. Programmable for arc flash reduction maintenance mode selector switch use.
5. Furnish maintenance/test switches for each potential transformer, current transformer, and breaker trip circuit to allow for relay and breaker functional testing.

2.08 BUS PROTECTION UNINTERRUPTIBLE POWER SUPPLY

A. Series S4K2U1500 Industrial On-Line UPS manufactured by SolaHD, Rosemont, Illinois; or equal, having the following essential characteristics:

1. Suitable for use with 120-volt, 60 Hz. control circuit.
2. Hardwire capable for permanent installation.
3. Automatic restart with battery test capability.
4. Sufficient power to provide for:
 - a. One transformer protection relay.

- b. One transformer temperature monitor.

2.09 ENCLOSURES

- A. Single lineup, self-contained, outdoor, weatherproof type with sloping roof and structural steel bases.
- B. Outdoor, weatherproof, IEEE C37.20.2: Category A.
- C. Provide weather-exposed bolted joints with neoprene gaskets.
- D. "Non-walk-in" type which provides front of each section with at least one inside door, or equivalent, and one outside weatherproof door.
- E. Inside doors to provide access to equipment cavity and may be used for mounting control and metering devices.
- F. Outside weatherproof doors:
 - 1. Provide access and protection to front of section.
 - 2. Do not mount electrical devices on outside door.
 - 3. Equip with top and bottom strikes, and center latch. Strikes and latch shall pull door securely against gasket and enclosure. Mechanism used to pull door against gasket and enclosure shall be adjustable.
 - 4. Door handle shall engage latch and strikes.
 - 5. Door handles shall be pad lockable.
- G. Slope top of outdoor equipment away from front of enclosures.
- H. Seal weatherproof doors and outdoor enclosure walls with neoprene gaskets.
- I. Equip ventilation openings with filters.
- J. Primary and secondary cable entry: Conduits from below.
- K. Low-voltage control and auxiliary power cable entry: Conduits from below.
- L. Heavy-duty galvanized connection means shall be provided to anchor the switchgear to the concrete pad.
- M. The unit substation base shall be provided with means for anchoring and installing onto a concrete pad.
- N. Enclosures shall be provided with lifting devices bolted or welded to the base structure and shall have jacking pads.
- O. Ventilations shall follow NEMA and NEC requirements for ventilated enclosures.

- P. Where enclosure joints are designed to be welded, the entire length of joint is to be welded. Skip welding will not be acceptable.

2.10 ACCESSORIES

- A. Compatible with associated electrical, mechanical, and thermal ratings of circuit breakers.
- B. Provide device to permit removing and handling breaker element by one person.
- C. UL listed, where applicable.
- D. Suitable length of control cable, with plug and receptacle, to permit test of removable breaker element while in withdrawn position, from control circuit.
- E. Control Switches:
1. Pistol-grip handle switches:
 - a. 600 volts alternating current or direct current.
 - b. 20 amperes continuous current.
 - c. Contacts: Silver plated and of self-wiping action type.
 2. Arc flash reduction maintenance mode selector switch:
 - a. Location: Primary (Incoming) Section.
 - b. Integrated with protective relay to reduce arc flash hazard during maintenance.
- F. Hand Held Pendant Pushbutton Station:
1. OPEN and CLOSE pushbuttons.
 2. Minimum 25 foot umbilical cord.
- G. Remote Racking Device:
1. Allows for open/close operation and in/out racking at a safe distance.
 2. Torque switch mechanism to stop racking motor.
 3. Powered by plug connection to 120 Vac receptacle.
 4. Hand held pendant racking control station.
 - a. Minimum 25 foot umbilical cord.
 - b. Open, Close, In, Out pushbuttons. Enable pushbutton for two-hand operation.
 - c. Permissive circuit provisions.
- H. Engraved Nameplates and Warning Signs:

1. Signs, size, engraving, and material: As indicated on standard drawing 40-D-6234.
 2. Provide nameplates and warning signs for following:
 - a. Overall switchgear assembly: Manufacturer's nameplate.
 - 1) Place manufacturer's name, trademark, or other descriptive marking on all electrical equipment.
 - 2) Provide other markings: Voltage, current, wattage, or other ratings as specified.
 - b. Each section of switchgear assembly: Designations as indicated on drawings or as follows:
 - 1) Mount nameplates for each device on a door.
 - 2) Nameplates for each device mounted within switchgear enclosure. In lieu of furnishing nameplates, Contractor may fulfill this requirement by identifying each device with device name or standard NEMA designation by a typed or computer generated permanent marking on or adjacent to device.
 - 3) High-voltage compartment. - Warning sign mounted on access door or barrier to each high-voltage compartment. Sign shall carry notation "DANGER - High-voltage compartment".
 3. No hand lettering.
- I. Enclosure Wire:
1. NEC type SIS wire.
 2. No. 14 AWG copper conductor minimum with the current transformer wiring No. 10 AWG minimum.
 3. Class K stranded.
 4. 600 volts.
- J. Fuses and Fuseholders:
1. Voltage rating: 600 volts.
 2. UL listed.
 3. Fuses:
 - a. In accordance with NEMA FU1.
 - b. Current-limiting type.
 - c. Current ratings determined by Contractor.
 - d. Suitable for 'finger-safe' type fuse holders.

4. Fuseholders:
 - a. Modular 'finger-safe' type.
 - b. Current rating: Not less than fuse size.
 - c. Furnish with nameplate identifying protected circuit.
 - d. Mount in easily accessible location within control cabinet.

- K. Space Heaters:
 1. Provide as necessary to prevent condensation.
 2. Suitable for 120 Vac service.
 3. Thermostatically controlled and be adjustable.
 4. Provide with protective covers.

- L. Terminal Blocks:
 1. Rated 600 volts, 30 amperes.
 2. Molded-block type to accommodate ring lugs one half of an inch wide (outer diameter) at terminal screws.
 3. Furnish with binding-head or washer-head screws having serrated or grooved contact surfaces or lockwashers.
 4. Molded insulating barriers between terminals.
 5. Shorting-type for current transformer wiring.
 6. Removable covers and marking strips.
 7. Provide 20 percent spare terminals on each terminal block for connections to external circuits.
 8. Provide marking strips with conductor designations typed or computer generated. No hand lettering.

- M. Terminal Connectors:
 1. Pressure-crimp-type ring connectors:
 - a. Tin-plated copper, serrated inner barrel.
 2. Pressure-crimp-type pin connectors:
 - a. Tin-platted copper.
 - b. For use only on device terminals not suitable for ring connectors.
 3. Insulation: 600 volts, nylon or vinyl.

- N. Wire Markers:
 1. Type: Self-laminating-vinyl or heat-shrink.

2. Color: White.
 3. Lettering: Machine. Do not print wire markers by hand.
- O. A continuous solid copper ground bus shall be installed through the bottom of each section, mechanically and electrically connected to the enclosure. The bus shall connect to 2 external ground pads for connection to the ground mat.
- P. Provide internal lights operated by an externally-mounted, weatherproof light switches for observing each switch blade position.
- Q. Grounding ball stud: Ball stud, catalog No. C6002102, as manufactured by Hubbell Power Systems, Inc., Website <http://www.hubbellpowersystems.com> ; or equal, having the following essential characteristics:
1. Ball and threaded stud suitable for attaching to each interrupter switch a phase buses.
 2. Provide a nonconductive, flexible cover for each ball stud.
- R. Include all hardware, including anchor bolts, cables, and connectors required to complete the unit substation.

2.11 FABRICATION

- A. General:
1. Completely wire switchgear. Tag cables going between switchgear sections.
 2. Twist hinge wiring around axis of wire instead of bending laterally.
 3. Firmly clamp wiring on hinged panels near hinged side of panels and terminate on adjacent blocks on stationary part of switchgear.
 4. Equip switchgear with wiring to terminal blocks for connection to control and relaying circuits.
 5. Coordinate location of openings for conduits from below.
 6. Mount relays so vibration caused by door closing or breaker operation will not cause false operation.
- B. Protective Relay:
1. Panel-mount on the internal door of the applicable switchgear section.
 2. Wire to instrument transformers through relay test switches.
- C. Ground Bus:
1. Install ground bus in accordance with IEEE C37.20.2. Electrically bond to enclosure.
 2. Ground bus shall be accessible from front of cubicle.

3. Provide lugs or terminals on ground bus suitable for connection to ground system with No. 4 AWG bare copper conductors.
4. Install grounding ball stud and cover on each phase bus.

D. Terminal Blocks:

1. Arrange terminal blocks to allow external cabling to be supported and to allow easy connection of incoming and outgoing cables.
2. Mount terminal blocks at least 3 inches from panel edges and other devices. Mount adjacent rows of terminal blocks with 6 inches separation minimum. Access to front of terminal blocks shall be unobstructed.
3. Provide 1 spare 12 terminal block per breaker section.
4. Machine letter designations on terminal block marking strips. Do not use hand lettering.
5. Identify vertical columns of terminal blocks with a single letter such as "A", "B", "C". Vertical columns may contain more than 12 termination points.
6. Terminate current transformer secondary wiring on short-circuiting type terminal blocks.

E. Wiring And Wiring Connections:

1. Make connections at device terminals or terminal blocks. Maximum 2 wires at terminations. Wire splices are not acceptable.
2. Support and secure wire bundles with cable tie mounting bases. Secure cable tie mounting base with 2 No. 8 screws. Mounting cable tie bases with only adhesive will not be allowed.
3. Install ring tongue pressure-crimp-type connectors for terminations at terminal blocks and electrical devices.
4. Do not terminate wire without terminal connector.

F. Wire Markers:

1. Install wire markers on conductor end.
2. Print conductor designation on first line.
3. Print conductor destination and terminal number on second line.

G. Nameplates and Warning Signs: Attach manufacturer's metal nameplates and warning signs with round head, stainless steel screws.

2.12 FINISHES

- A. Provide manufacturer's standard finish for outdoor service.

2.13 CONTRACTOR SOURCE QUALITY TESTING

- A. Inspection and Witnessing:
 - 1. Government may, at its option inspect equipment and witness factory tests.
 - 2. Notify COR, in writing, at least 14 days in advance of factory testing.
- B. Circuit Breaker:
 - 1. Factory Tests:
 - a. Design tests in accordance with IEEE C37.09 on a circuit breaker of same type, style, and model furnished.
 - b. Production tests in accordance with IEEE C37.09.
- C. Switchgear Lineup(s):
 - 1. Factory Tests: Production tests in accordance with IEEE C37.20.2.
- D. Transformer: Perform routine tests and listed design tests on transformer in accordance with IEEE C57.12.01 and performed in accordance with IEEE C57.12.91. Design tests to include:
 - 1. Insulation resistance.
 - 2. Lightning Impulse.
 - 3. Temperature rise.
 - 4. Audible sound level.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In accordance with Section 26 05 02 - Basic Electrical Materials and Methods.
- B. Install primary unit substation in location shown.
 - 1. Assemble, level, grout, and secure in position.
 - 2. Grouting: In accordance with Section 03 63 00 - Epoxy Grout.
 - 3. Ground and bond switchgear to ground mat in accordance with Section 26 05 20 - Grounding and Bonding.
- C. Install and inspect in accordance with manufacturer's recommendations and installation instructions, and IEEE C57.94.
- D. Make cable and conduit connections. Terminate incoming medium-voltage cables with terminators.

E. Adjust transformer primary taps as required to obtain proper secondary voltage.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Wiring checkout in accordance with Section 26 05 90 - Wiring Checkout and Tests.

B. Field acceptance testing in accordance with NETA ATS and IEEE C37.20.2 as applicable.

END OF SECTION

SECTION 31 23 22
PIPE TRENCH EARTHWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Common Excavation for Pipe Trenches:

1. Measurement: Made to paylines and lengths shown on drawings.
 - a. Regardless of actual widths, bottoms, and side slopes excavated, measurement will be made to paylines shown on drawings and to original ground surface.
 - b. Measurement for payment for additional excavation will be made to trench widths (W_p) shown on drawings and to depth directed by COR.
 - c. Measurement for payment will be continuous through pipe fittings.
 - d. Measurement for payment for excavation for concrete for pipe fittings that is outside the trench excavation paylines will be made to lines and dimensions shown on the drawings or to the neatlines of the concrete.
2. Payment: Cubic yard price offered in the Price Schedule.
 - a. Includes cost of labor and materials for shoring, sheeting, bracing, timbering, safety sloping, and other temporary construction; of pumping and unwatering; of removing such temporary construction where required; stockpiling excavated material for backfill; and disposal of unused or wasted excavated materials.
 - b. No direct payment will be made for excavation for pipe trenches for pipe outside the paylines shown on drawings. Include cost of excavation for pipe trenches required outside paylines in the prices offered in the Price Schedule for Common Excavation for Pipe Trenches.
 - c. Overexcavation performed beyond specified or directed paylines and backfill and compaction of backfill for such overexcavation shall be at the expense of the Contractor.
 - d. Where excavation is performed in backfill, no payment will be made for the resulting excavation, backfill, and compacting backfill.
 - e. Includes Bank Protection.

B. Rock Excavation for Pipe Trenches:

1. Measurement: Made to paylines shown on drawings and trench lengths of rock material excavated.

- a. Regardless of actual widths, bottoms, and side slopes excavated, measurement will be made to the paylines shown on drawings and to the original ground or rock surface.
 - b. Measurement for payment for additional excavation will be made to W_p and trench bottom shown on drawings and to depth directed by COR.
 - c. Measurement for payment will be continuous through pipe fittings.
 - d. Measurement for payment for excavation for concrete for pipe fittings that is outside the trench excavation paylines will be made to lines and dimensions shown on the drawings or to the neatlines of the concrete.
2. Payment: Cubic yard price offered in the Price Schedule.
- a. Includes cost of labor and materials for mechanical breaking, shoring, sheeting, bracing, timbering, safety sloping, and other temporary construction; of pumping and unwatering; of removing such temporary construction where required; stockpiling excavated material for backfill; and disposal of unused or wasted excavated materials.
 - b. No direct payment will be made for rock excavation for pipe trenches outside the W_p , depth and length listed above. Include cost of rock excavation for pipe trenches required outside payline prices offered in the Price Schedule for Rock Excavation for Pipe Trenches.
 - c. Overexcavation performed beyond specified or directed paylines and backfill and compaction of backfill for such overexcavation shall be at the expense of the Contractor.
- C. Backfill for Pipe Trenches:
1. Measurement:
 - a. Made to the excavation paylines for pipe trenches, to lengths shown on the drawings, or as directed less the volume of pipe based on the diameters (D_p) shown on drawings, regardless of actual diameters of pipe furnished.
 - b. Measurement for payment for backfill in pipe trenches for additional excavation of pipe trenches will be made to the trench widths (W_p) shown on drawings and to the depth directed by the COR.
 - c. Backfill material mounded or spread over the trench above the original ground surface will not be measured for payment as backfill in pipe trenches.
 2. Payment: Cubic yard price offered in the Price Schedule.
 - a. Includes cost of work associated with the excavation or procuring, processing, and hauling of necessary material.

- b. Material from required excavation used for backfill in pipe trenches will be paid for both as excavation when removed from original position and as backfill when placed.
- c. Where backfill material is obtained from other sources, payment will be made for backfill only. Include the cost of excavating or procuring, hauling, and processing of such material in the unit price offered in the Price Schedule for backfill in pipe trenches.
- d. No direct payment will be made for backfill in pipe trenches for pipe outside paylines shown on drawings. Include cost of backfill outside these paylines in the prices offered in the Price Schedule for Backfill for Pipe Trenches
- e. No direct payment will be made for furnishing and placing coarse concrete aggregate around air valves, blowoffs, and turnout. Include cost in the price offered in the Price Schedule for backfill in pipe trenches.
- f. No payment will be made for backfill required to fill overexcavation performed by the Contractor.
- g. No payment will be made for the removal and reconstruction of defective and nonconforming backfill compacted to an insufficient density.
- h. Includes Bank Protection.

D. Compacting Backfill in Pipe Trenches:

- 1. Measurement: Made in place to the paylines and lengths shown on drawings, and will be made only for the quantities actually compacted within the excavation paylines for pipe trenches.
 - a. The volume of pipe will be deducted based on the diameters (D_p) shown on drawings, regardless of the actual diameters of pipe furnished.
 - b. Measurement for payment for compacting backfill in pipe trenches for additional excavation of pipe trenches will be made to the trench widths (W_p) shown on drawings and to the depth directed by the COR.
- 2. Payment: Cubic yard price offered in the Price Schedule.
 - a. Includes cost of furnishing water and moistening the material.
 - b. No direct payment will be made to the Contractor for compacting backfill in pipe trenches for pipe outside the paylines shown on drawings. Include cost of compacting backfill required outside paylines in the prices offered in the Price Schedule for Compacting Backfill in Pipe Trenches.
 - c. Compacting backfill for overexcavation outside specified or directed excavation paylines will be at the expense of the Contractor.
 - d. Includes Bank Protection.

1.02 DEFINITIONS

- A. Additional Excavation: Excavation beyond specified lines as directed by the COR to remove unsuitable foundation material.
- B. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines.
- C. Rock Excavation:
 - 1. Material that cannot be ripped with a 400 horsepower or larger crawler tractor equipped with a ripper rated for hard rock with a rock tooth.
 - 2. Material that cannot be excavated with a 300 horsepower or larger hydraulic excavator, with rock teeth, in areas where it is not feasible for ripping with a crawler tractor.
- D. Excess excavated materials: Materials which are not used or processed for use as backfill material and waste materials from such processing.

1.03 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO SSHB-02 Standard Specifications for Highway Bridges, 17th Edition

1.04 PROJECT CONDITIONS

- A. Soil and rock conditions are described in Section 53 10 00 - Geology.

PART 2 PRODUCTS

2.01 MATERIALS FOR BACKFILL

- A. Use materials removed in excavating for pipe trenches or from other sources arranged for by the Contractor.
 - 1. The Government makes no guarantee that specified backfill materials are contained in or can be processed from materials excavated from pipe trenches.
- B. Do not use expansive clays in compacted backfill.
- C. Bedding and Embedment: Use one of the following as allowed on drawing 1695-D-60045:
 - 1. Screen native material or select material: Conform to gradation limits as shown on tables on drawing 1695-D-60045 or,

- 2. Controlled low strength materials in accordance with Section 31 23 70 - Controlled Low Strength Materials (CLSM) may be used in lieu of select material. CLSM is required as shown on drawing 1695-D-60045.
- D. Maximum backfill particle size within 1 foot of the outside of pipe: Conform to requirements of Table 31 23 22A - Maximum Backfill Particle Size.

Table 31 23 22A - Maximum Backfill Particle Size

Type of Pipe	Maximum Particle Size, inches
Fiberglass, PVC, metallic pipe with dielectric coating, or metallic pipe encased in polyethylene	3/4
Coal-tar enamel-coated and -wrapped or plastic tape-coated steel line pipe with an approved bonded coatings	1-1/2
Polyethylene Pipe: Diameter up to 4 inches Diameter 6 inch to 8 inch Diameter 10 inch to 16 inch Diameter greater than 16 inch	1/2 3/4 1 1 1/2
Other pipe	3

- E. Maximum backfill particle size beyond 1 foot of outside of pipe: 1/2 lift height.
- F. Particle size of material placed in compacted backfill, maximum: 3 inches.
- G. Particle size of material placed in uncompacted backfill, maximum: 5 inches.
- H. Backfill placed where pipelines cross under open irrigation ditches and other watercourses: Silty or clayey material with a plasticity index of 8 or more.

2.02 WARNING TAPE

- A. Polyethylene tape.
- B. Thickness: 4 mils.
- C. Magnetically detectable.
- D. Width, Minimum: 6 inches.
- E. Color: Blue with silver lettering.

- F. Legend repeated at least every 3 feet: “CAUTION: WATERLINE BURIED BELOW - FOR MORE INFORMATION CONTACT THE NAVAJO TRIBAL UTILITY AUTHORITY”.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform operations so that land can be restored to original conditions.

3.02 EXCAVATION

- A. Do not excavate pipe or keep pipe trench open more than 300 feet ahead or 100 feet when groundwater is present of pipelaying, backfilling, or compacting backfill operations, unless approved by COR.
1. Backfill and Compacting Operations:
 - a. Shall not fall behind pipelaying and excavation operations,
 - b. Allow CLSM to obtain required strength in accordance with Section 31 23 70 - Controlled Low Strength Materials (CLSM).
 - c. At the end of each shift:
 - 1) One hundred feet of pipe trench, maximum, is open ahead of pipelaying and,
 - 2) Backfill is within 100 feet of pipelaying.
 - 3) For trenches left open overnight,
 - a) Cap exposed end of the pipeline.
 - b) Fence open trench with temporary safety fence in accordance with Section 01 56 32 - Temporary Safety Fence.
 2. If backfilling and compacting fall behind pipelaying operations, stop excavation and pipelaying operations. Do not proceed until directed by the COR.
- B. Excavate pipe trenches for pipelines, delivery installations, and pipeline accessories to lines, grades, and dimensions shown on drawings.
- C. Finish bottom of trench accurately to lines and grades shown on drawings.
- D. Perform excavation in the dry.
- E. Do not excavate in frozen materials without written approval of the COR.
- F. Place wildlife escape ramps and crossovers every 1,320 feet.

1. Place escape ramps and crossovers every 500 feet where active grazing is taking place or in Wildlife Specially Designated Areas.
2. Crossovers:
 - a. Ten foot wide, minimum.
 - b. Not fenced.
3. Maintain existing livestock and wildlife trails as a crossover.

G. Slope end of open trench with 3:1 Slope at end of work day.

3.03 ADDITIONAL EXCAVATION

A. Perform additional excavation in trench bottom for pipe foundations as shown on drawings and other additional excavation beyond specified lines, as directed by the COR.

3.04 OVEREXCAVATION

- A. When foundation material is overexcavated beyond specified or directed lines, fill the overexcavation with backfill materials and compact in accordance with Section 31 23 02 - Compacting Earth Materials.
- B. If foundation material is overexcavated by being disturbed or loosened during excavation, compact material in place or remove and replace with backfill material and compact in accordance with Section 31 23 02 - Compacting Earth Materials.

3.05 STOCKPILING

A. Stockpile excavated materials which meet or will be processed to meet material requirements for backfill in pipe trenches until processed or used as backfill material.

3.06 BEDDING AND EMBEDMENT

- A. Place to lines shown on drawings or as directed by the COR.
- B. Place CLSM in accordance with Section 31 23 70 - Controlled Low Strength Material (CLSM) and as shown on drawings.
- C. Use CLSM in open cut road crossings.
- D. Use CLSM for utility crossings and extend 10 feet on each side of crossing.
- E. Do not drop directly on pipe.
- F. If bedding is used, place bedding material below bottom of pipe before pipe is laid. Grade bedding material parallel to bottom of pipe.
- G. Place to widths and depths shown on drawings.

- H. Place at same elevation on both sides of pipe to prevent unequal loading and displacement of pipe. Elevation difference on sides of pipe shall not exceed 6 inches.

3.07 BACKFILL PLACEMENT

- A. Install warning tape over center of pipe at least 18 inches below ground and at least 18 inches above pipe.
- B. Place backfill in pipe trenches to lines shown on drawings, or as directed by the COR.
- C. Do not place material in backfill when either the material or the surfaces on which the backfill is to be placed are frozen.
- D. Place backfill for overexcavation performed outside specified or directed paylines for excavation for pipe trenches in the same manner as specified for adjacent backfill or embedment.
- E. Do not drop backfill directly on pipe.
- F. Place backfill carefully and spread in uniform layers so that spaces about rocks and clods will be filled.
- G. Place backfill in lifts:
 - 1. Backfill to be compacted: In accordance with Section 31 23 02 - Compacting Earth Materials.
 - 2. Maximum lift height of other backfill: 1 foot.
- H. Place backfill to the same elevation on both sides of the pipe to prevent unequal loading and displacement of pipe. Elevation difference of backfill on sides of pipe shall not exceed 6 inches.
- I. Backfill above compacted backfill may be placed as soon as compacting of backfill is completed.
 - 1. Placing of this backfill shall be delayed at locations designated by the COR for compacted backfill sample collection for testing.
- J. Place backfill over pipe as approved by the COR, if backfilling operations are interrupted for more than 24 hours.

3.08 COMPACTING BACKFILL

- A. Compact backfill in pipe trenches in layers having about the same top elevation on both sides of the pipe to prevent unequal loading and displacement of the pipe.
- B. Compact backfill as specified in Section 31 23 02 - Compacting Earth Materials.

- C. Location of Compacted Backfill:
1. As shown on drawings.
 2. For air valve and blowoff foundations.
 3. On outside of horizontal curves for a minimum of restrained pipe length.
 4. Where pipeline cross under roadways and driveways.
 5. Where utility pipelines cross pipeline:
 - a. To horizontal centerline of pipeline crossing lateral pipeline and to dimensions and slopes.
 6. At pipe bends, encasements, and collars including collar-type blocking.
 7. Around valve boxes and pipe erected vertically for air valves.
 8. Where additional excavation for pipe trenches is directed by COR to remove foundation material or other material, compact backfill within paylines for this work.
 9. Backfill at tees with horizontal outlets as shown on drawings.
- D. When tests indicate insufficient density of compacted backfill about pipe:
1. Remove backfill above compacted backfill.
 2. Compact backfill until proper density is obtained
 3. Replace backfill above compacted backfill
 4. This work shall be at the Contractor's expense.

3.09 PROTECTION

- A. Government reserves the right to direct the Contractor to place a sufficient amount of backfill material over compacted backfill within 72 hours after compacting of backfill has been completed.
- B. Place uncompacted backfill to a minimum depth of 3 feet or compact backfill to a minimum depth of 2 feet above top of pipe before allowing construction equipment to travel over pipe.
1. After these minimum earth covers are in place, the maximum equipment loading allowed over the pipe shall be HS-20 loading (16,000 pound wheel load) in accordance with AASHTO SSHB.
 2. If construction equipment that exerts a larger wheel load is proposed to be used, submit construction equipment loadings to the COR for analysis and determination of required backfill depths or other protective measures.

3.10 DISPOSAL

- A. Dispose of excess excavated materials in accordance with Section 31 23 39 - Disposal of Excavated Materials.

END OF SECTION

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SECTION 33 11 10
PIPELINE GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Line Pipe:

1. Measurement: Length along pipe centerline between ends of pipe in place. Continuous through fittings, and road crossings with no allowance for lap at joints.
 - a. Measurement for line pipe will begin downstream of Pumping Plant No. 1 yard (1695-D-60028) and end upstream of Regulating Tank No. 2 (1695-D-60044).
 - b. Stations shown on plan and profile drawings are break points between various bid items for providing line pipe.
 - c. Includes
 - 1) Coating Line Pipe and Fittings.
 - 2) Pipe Crossings.
2. Payment: Applicable linear foot price offered in the Price Schedule for various sizes and classes of line pipe.
 - a. Includes cost of furnishing materials; providing pipe; fittings, providing bedding and embedment; providing utility markers; providing concrete, cement, and reinforcement steel in encasements, blocking, and collars not included elsewhere.
 - b. If after award of contract, the next larger size of pipe is required to meet the inside diameter requirement of this section, fittings and associated valves must be the same as the larger pipe size.
 - c. Payment for larger size pipe, valves, and fittings will be made at the unit price offered in the Price Schedule for this section denoted size and not for the larger size.

B. Filling and Testing Water:

1. Measurement: Volume of Water for filling and testing.
 - a. Only water used as directed by the COR will be included.
 - b. Quantity will be measured in tanks or tank trucks of predetermined capacity or by means of water meters.
 - c. Types of water meters used for measuring water for subject to COR's approval.

2. Payment: M (1,000) gallons price offered in the Price Schedule.
- C. Repair Kit:
1. Payment: Lump sum price offered in Price Schedule.

1.02 DEFINITIONS

- A. Line Pipe Stationing:
1. Sta 22249+52.72 to Sta 22608+47.06.
 2. Sta 22610+23.06 to Sta 23092+42.55.
- B. Pipe sizes and classes: Designated on plan and profile drawings by an alphanumeric symbol.
1. PVC and HDPE pipe:
 - a. Symbol identifies pipe diameter and dimension ratio as follows:
 - 1) First number in the symbol indicates nominal diameter in inches.
 - 2) Alphanumeric indicates dimension ratio as defined in AWWA C900, AWWA C905 and AWWA C906.
 - 3) Number in parenthesis is the hydrostatic head measured to centerline of pipe.
 - 4) A symbol of 24DR25 means the pipe is 24 inches in diameter with a dimension ratio (DR) of 25.
 - ~~2. Metallic and Fiberglass pipe:~~
 3. Symbol ~~Pipe Designation is defined identifies pipe diameter and dimension ratio~~ as follows:
 - 1) First number in the symbol indicates nominal diameter in inches.
 - 2) The alphabetic character represents the cover class of pipe where; $A < 5 \text{ ft.}$, $5 \text{ ft.} < B < 10 \text{ ft.}$, ~~and~~ $10 \text{ ft.} < C < 15 \text{ ft.}$ ~~and~~ $15 \text{ ft.} < D < 20 \text{ ft.}$
 - 3) Second number in the symbol is the hydrostatic head measured to centerline of pipe.
 - 4) A symbol of 24C600 means the pipe is 24 inches in diameter with a cover between 10 and 15 feet and a hydrostatic head of 600 feet at the center line of pipe.
 4. Unless specific reference is made to outside diameter of pipe, pipe diameters shown on drawings and used in this section are inside diameters.
 5. Ductile Iron Pipe (DI):
 - a. Symbol identifies pipe as follows:
 - 1) First number indicates nominal diameter in inches.

- 2) Nominal diameter nomenclature DIOD for ductile iron outside diameter.
 - 3) The next number is the pipe pressure class in psi.
 - 4) A symbol of 24DIOD250 means the nominal diameter of the pipe is 24 inches with a ductile iron outside diameter nomenclature. The pressure class is 250 psi.
6. Steel Pipe:
- a. Symbol identifies the pipe as follows:
 - 1) First number is the nominal diameter in inches.
 - 2) The second number is the steel pipe wall thickness in inches.
 - 3) A symbol of 24 inches - 0.125 inches means the nominal diameter for the pipe is 24 inches and the steel pipe wall thickness is 0.125 inches.
7. Pipe designations shown on drawings and in this section establish minimum requirements for pipe types allowed.

Table 33 11 10A- Symbol Pipe Equivalentents

Symbol Pipe Designation	PVC	HDPE	Steel	Ductile Iron
24B50	24DR32.5	30DR32.5	N/A	N/A
24D50	24DR25	30DR32.5	N/A	N/A
24B75	24DR32.5	30DR32.5	N/A	N/A
24B100	24DR32.5	30DR32.5	N/A	N/A
24B125	24DR32.5	30DR32.5	N/A	N/A
24B150	24DR32.5	30DR26	N/A	N/A
24B175	24DR32.5	30DR26	N/A	N/A
24C175	24DR32.5	30DR26	N/A	N/A
24D175	24DR32.5	30DR26	N/A	N/A
24B200	24DR32.5	30DR21	N/A	N/A
24C200	24DR32.5	30DR21	N/A	N/A
24B225	24DR32.5	30DR21	N/A	N/A
24C225	24DR32.5	30DR21	N/A	N/A
24B250	24DR32.5	30DR19	N/A	N/A
24C250	24DR32.5	30DR19	N/A	N/A
24B275	24DR32.5	30DR17	N/A	N/A
24B300	24DR25	30DR15.5	N/A	N/A
24C300	24DR25	30DR15.5	N/A	N/A
24D300	24DR25	30DR15.5	N/A	N/A
24B325	24DR25	30DR13.5	N/A	N/A
24C325	24DR25	30DR13.5	N/A	N/A
24B350	24DR25	30DR13.5	N/A	N/A
24C350	24DR25	30DR13.5	N/A	N/A

Table 33 11 10A- Symbol Pipe Equivalents

Symbol Pipe Designation	PVC	HDPE	Steel	Ductile Iron
24B375	24DR25	30DR11	N/A	N/A
24C375	24DR25	30DR11	N/A	N/A
24B400	24DR21	30DR11	N/A	N/A
24C400	24DR21	30DR11	N/A	N/A
24D400	24DR21	30DR11	N/A	N/A
24B425	24DR21	30DR11	N/A	N/A
24C425	24DR21	30DR11	N/A	N/A
24B450	24DR21	30DR11	N/A	N/A
24C450	24DR21	30DR11	N/A	N/A
24B475	24DR18	30DR9	N/A	N/A
24C475	24DR18	30DR9	N/A	N/A
24D475	24DR18	30DR9	N/A	N/A
24B500	24DR18	30DR9	N/A	N/A
24C500	24DR18	30DR9	N/A	N/A
24D500	24DR18	30DR9	N/A	N/A
24B525	24DR18	30DR9	N/A	N/A
24C525	24DR18	30DR9	N/A	N/A
24D525	24DR18	30DR9	N/A	N/A
24C540	24DR18	30DR9	N/A	N/A
24B550	N/A	30DR9	24 inches - 0.103 inches	24DIOD250
24B575	N/A	30DR9	24 inches - 0.125 inches	24DIOD250
24B600	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24C600	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24D600	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24B625	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24C625	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24B650	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24C650	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24C675	N/A	N/A	24 inches - 0.125 inches	24DIOD300
24D675	N/A	N/A	24 inches - 0.125 inches	24DIOD300
Fiberglass pipe: Submit in accordance with Section 33 11 19 - Fiberglass Pipe.				

Table 33 11 10A- Symbol Pipe Equivalents

Symbol Pipe Designation	PVC	HDPE	Steel	Ductile Iron
N/A indicates that the particular pipe option is not allowed.				

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

- | | | |
|----|--------------------|---|
| 1. | ASTM C150/C150M-13 | Portland Cement |
| 2. | ASTM F2164-13 | Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure |

B. American Water Works Association (AWWA)

- | | | |
|----|--------------|---|
| 1. | AWWA C205-12 | Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 in. (100 mm) and Larger - Shop Applied |
| 2. | AWWA C207-13 | Steel Pipe Flanges for Waterworks Service Sizes 4 In. Through 144 in. (100 mm Through 3,600mm) |
| 3. | AWWA C600-10 | Installation of Ductile Iron Water Mains and Their Appurtenances |
| 4. | AWWA C604-11 | Installation of Steel Water Pipe 4 in. (100mm) and Larger |
| 5. | AWWA C605-13 | Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings |
| 6. | AWWA C900-07 | Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution |
| 7. | AWWA C905-10 | Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches through 48 Inches (350 mm Through 1,200 mm) for Water Transmission and Distribution |
| 8. | AWWA C906-15 | Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks |
| 9. | AWWA C950-13 | Fiberglass Pressure Pipe |

- C. International Organization for Standardization (ISO)
 - 1. ISO 9001-15 Quality Management
- D. National Sanitation Foundation (NSF)
 - 1. NSF Standard 61-13 Drinking Water System Components - Health Effects

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals:
- B. RSN 33 11 10-1, Qualifications:
 - 1. Resumes and references of line pipe manufacturers.
 - 2. Pipe fuser certifications, if needed, for equipment to be used.
- C. RSN 33 11 10-2, Pipelaying Diagrams:
 - 1. For each type of pipe furnished.
 - 2. Show position and marking of pipe sections.
 - 3. Include centerline and invert stationing and elevations at horizontal and vertical changes in alignment, and subgrade elevation for each pipe fitting.
- D. RSN 33 11 10-3, Filling and Testing Plan:
 - 1. Proposed rate, time, and procedure for:
 - a. Cleaning.
 - b. Filling.
 - c. Field and pressure testing.
 - d. Draining pipeline.
 - 2. Method of disposing of water drained from pipeline.
- E. RSN 33 11 10-4, Floatation Prevention Plan:
 - 1. Show location and describe method of preventing pipe from floating.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Place pipe in storage as directed by COR. Within 150 miles from site, as designated by COR.

1.06 REPAIR KIT

- A. Furnish 1 repair kit for each type and size of pipe used.

- B. Repair kit:
 - 1. One standard length of pipe and 2 couplings.
 - 2. At highest loading and pressure rating for each type of pipe used.

1.07 QUALIFICATIONS

- A. Pipe manufacturer:
 - 1. Certified in accordance with ISO 9001 or similar nationally certified quality program as approved by COR.
 - 2. At least 10 years of successful experience producing products as specified.
 - 3. Provide references for at least 3 completed projects with proposed pipe products between 18-inch and 36 inch diameter.
- B. Welding procedures and welders in accordance with AWS D1.1 as applicable
- C. Pipelaying Workers: Skilled and experienced in laying pipe with type of pipe and joint being furnished.

PART 2 PRODUCTS

2.01 PIPE CROSSINGS

- A. See Section 33 11 50 - Pipe Crossings at Existing Utility Pipelines.

2.02 GENERAL

- A. Confirm elevations and locations shown on drawings with COR prior to ordering pipeline materials.

2.03 PIPE OPTIONS

- A. Listed in Table 33 11 10A-Symbol Pipe Equivalents and following sections:
 - 1. 33 11 12 - Steel Line Pipe,
 - 2. 33 11 13 - Ductile Iron Pipe,
 - 3. 33 11 16 - PVC Pressure Pipe,
 - 4. 33 11 18 - HDPE Pressure Pipe,
 - 5. 33 11 19 - Fiberglass Pipe.
- B. Materials and chemicals that may come into contact with drinking water certified by NSF 61.

2.04 PIPE ACCESSORIES

- A. Two Inch Diameter Air Valve Assemblies: See Section 33 12 10 - Valves and Equipment for Line Pipe Installations.
- B. Four Inch Diameter Blowoff Assemblies: See Section 33 12 10 - Valves and Equipment for Line Pipe Installations.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform cleaning, filling and testing after backfill has been placed to finished grade or as approved by COR.
- B. Surveyor licensed in the State of New Mexico shall be on site during excavation and pipelaying.
- C. Protect pipe from contamination, damage, and the elements during storage on site by covering it with a tarp as directed by the COR.

3.02 INSTALLATION

- A. Install pipe in accordance with appropriate Section for pipe option installed.
- B. Lower pipe into the trench and place pipe in position such that no soil gets inside the pipe and pipe is not damaged.
- C. Keep openings to installed pipe closed with watertight plugs during work stoppage, including end of work day, breaks, work delays.
- D. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipelines closed.
- E. If pipe is flooded during construction, clear floodwater by draining and flushing with water, or other approved method, until pipe is clean.
- F. Lubricant:
 - 1. Keep clean.
 - 2. Apply with dedicated, clean applicator brushes.
- G. Concrete in encasements, blocking and collars: Section 03 30 00 - Cast-in-Place Concrete.

H. Wash Crossings:

1. Pipe joints to be fused or restrained from beginning to end of Wash Crossing stationing. See Section 35 42 35 - Bank Protection and drawings for locations.

3.03 FIELD EXAMINATION

A. Flush pipe before filling.

1. Flush foreign material from pipeline prior to testing.
2. Flush using a minimum velocity of 3 feet per second toward low points in reach.
3. Flush at least 3 pipe volumes until the water is clean as approved by COR.
4. Dispose of flush water in accordance with permits in Section 01 57 30 - Water Pollution Control.
5. Operate valves several times during flushing period.

3.04 FILLING PIPELINE

- A. Provide water for filling and testing pipeline in accordance with Section 01 51 00 - Temporary Utilities.
- B. Pipeline fill rate, maximum: 2 cubic feet per second.
- C. Maintain pipeline completely filled for at least 72 hours before testing.

3.05 CONTRACTOR FIELD QUALITY TESTING

A. Leak testing pipeline:

1. Notify the COR at least 7 days before applying pressure to pipeline.
2. Do not start leak testing when snow or standing water is on the ground. Suspend testing as directed by the COR if precipitation accumulates on the ground.
3. Furnish pumps, power, pressure gages, air valves at each end of line and calibrated flow meters for testing.
4. Comply with applicable test standard except as noted below:
 - a. AWWA C605 for PVC.
 - b. ASTM F2164 for HDPE.
5. Test pipeline with hydrostatic pressure equal to:
 - a. 420 feet elevation downstream of Pre-manufactured Pump Station No. 1.
 - b. 460 feet elevation downstream of Pre-manufactured Pump Station No. 2.
6. Prior to starting test, maintain pressure in pipe for 24 hours.
7. Test for 96 hours or as approved by COR.
8. If leakage is detected, halt test. Identify and repair leaks.

9. Repeat test until acceptance criteria is achieved.
10. Drain pipe using both gravity flow and sump pump at blowoffs or as approved by COR.
11. Repeat field examination as detailed above.
12. Seal openings to pipe as approved by COR.

END OF SECTION

SECTION 33 11 12
STEEL LINE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the prices offered in the Price Schedule for Line Pipe.

1.02 DEFINITIONS

- A. Steel Line Pipe: See Section 33 11 10 - Pipeline General Requirements.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM A139/A139M-04 Electric-Fusion (Arc) - Welded Steel Pipe (NPS 4 and Over)
2. ASTM A283/A283M-13 Low and Intermediate Tensile Strength Carbon Steel Plates
3. ASTM A1011/A1011M-14 Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Allow and High-Strength Low-Allow with Improved Formability
4. ASTM A1018/A1018M-08a Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability
5. ASTM E165/E165M-12 Liquid Penetrant Examination for General Industry

B. American Water Works Association (AWWA)

1. AWWA C200-12 Steel Water Pipe - 6 In (150 mm) and Larger
2. AWWA C205-07 Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In (100 mm) and Larger - Shop Applied
3. AWWA C206-11 Field Welding of Steel Water Pipe

- | | | |
|----|--------------|---|
| 4. | AWWA C207-13 | Steel Pipe Flanges for Waterworks Service,
Sizes 4 In Through 144 In. (100 mm
Through 3,600 mm) |
| 5. | AWWA C604-11 | Installation of Buried Steel Water Pipe 4 In.
(100 mm) and Larger |

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
- B. RSN 33 11 12-1, Shop Drawings:
 - 1. Show fitting fabrication details.
 - 2. Show exact dimensions of joints, and proposed restraint.
- C. RSN 33 11 12-2, Ventilation Plan:
 - 1. Method for ventilating the inside of pipe when placing mortar lining.

1.05 QUALIFICATIONS

- A. Qualify welding procedures and welders in accordance with the code under which welding is specified to be accomplished.
- B. **See 33 11 10 - Pipeline General Requirements.**

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prevent damage during loading, transporting, unloading, laying, and at final storage location.
 - 1. Supply:
 - a. Padded bolsters curved to fit under outside of pipe.
 - b. Heavy padding under ties during transportation and storage.
- B. Tightly close open ends of shop-applied, cement-mortar-lined pipe with plastic wrap for protection of cement-mortar lining during shipment.
 - 1. Plastic Wrap:
 - a. At least 2 thicknesses of 6 mil sheet polyethylene plastic.
 - b. Remain on pipe until installation.
- C. Support and store pipe above ground surface. Do not allow bells and spigots to contact each other or the ground.
- D. Government will inspect pipe once it is delivered.

- E. Repair damage to lining or coating as directed if, in the opinion of the COR, a satisfactory repair can be made; otherwise, replace damaged section at the expense of the Contractor.

PART 2 PRODUCTS

2.01 STEEL LINE PIPE

- A. Steel Line Pipe:
1. Electric fusion (arc) welded helical-seam steel pipe: ASTM A139, grade C, D, or E.
 2. Fabricated in accordance with AWWA C200 Except:
 - a. Steel Plate: ASTM A283, grade C or D.
 - b. Steel Sheet: ASTM A1011, designation SS, grade 40, 45, or 50; or ASTM A1018, designation SS, grade 40.
- B. Pipe Diameter: To inside of lining.
- C. Minimum Steel Wall Thickness of Pipe:
1. As shown in Table 33 11 10A- Symbol Pipe Equivalents or as otherwise shown on the drawings.
 2. Alternate yield stress steel with the resulting minimum steel wall thickness is allowed with government approval.
- D. Prepare pipe ends for field welding **where welded joints will be installed.**

2.02 FITTINGS

- A. Flanges:
1. AWWA C207.
 - a. Class: Working pressure meets or exceeds head class of attached pipe.
- B. Flange Gaskets:
1. Model No. 19, manufactured by Garlock Sealing Technologies, 1666 Division Street, Palmyra NY 14522; or equal, having following essential characteristics:
 - a. Full flat face-type.
 - b. For AWWA C207 flanged joints.
 - c. For cold water service.
- C. Flange Bolts:
1. AWWA C207.

D. Tapers (or Adaptors):

1. Lengths: As shown on drawings.
2. Ends: Fit type of joint in adjacent pipeline.

2.03 LININGS AND COATINGS

- A. Coating and lining in accordance with Section 09 96 20 - Coatings.
- B. Do not field apply mortar lining without COR approval.

2.04 CONTRACTOR SOURCE QUALITY TESTING

A. Steel Pipe and Fittings:

1. Hydrostatic Test for Pipe and Fittings: Perform shop hydrostatic test on pipe which stresses steel to 75 percent of minimum yield point of the steel.
2. Hold pressure long enough to allow a thorough inspection of welded joints.
3. Repair leaks by rewelding and retesting of joints.
4. Hydrostatic Test for Pipe:
 - a. Test sections prior to forming bell and spigot joints.
 - b. Repair defects and retest section before applying lining and coating.
 - c. The Government may witness the hydrostatic testing and calibration of the pressure gauges. Notify the Government 30 days prior to performing the hydrostatic test.
5. Hydrostatic Test for Fittings:
 - a. Fittings fabricated from tested steel pipe do not require hydrostatic testing if girth butt welds are complete penetration welds.
 - b. Perform dye penetrant test on welds in accordance with ASTM E165.
 - c. Chip, flame gouge, or grind to sound metal defects in welds as disclosed by the dye penetrant or hydrostatic tests. Reweld and retest the resulting cavities.

B. Joint Testing:

1. Assemble one joint for each pipe diameter to check the bell and spigot to check fit prior to coating or lining.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Excavate and backfill pipe trench in accordance with Section 31 23 22 - Pipe Trench Earthwork.

1. Grade pipe trenches to provide uniform slope along the bottom of pipe.
 2. At joints involving bells or collars, excavate holes at the joint of ample size to prevent bells or collars from coming in contact with the subgrade.
 3. Lower the pipe into the trench and place pipe in position such that no soil gets inside the pipe and pipe is not damaged.
- B. Install the steel pipe to line and grade as shown on drawings.
1. On grades exceeding 10 percent, lay pipe uphill.
- C. Joints for Pipe with Gasketed Joints:
1. Before Assembling Pipe Joints:
 - a. Clean gasket, bell, especially the groove, and the spigot with a rag, brush, or paper towel to remove any dirt or foreign material.
 - b. Use only gaskets which are designed for and supplied with the pipe.
 - c. Insert gaskets in accordance with AWWA C604 or as approved by COR.
 - d. Lubricate spigot end of pipe as recommended by the manufacturer.
 2. Joining Pipe:
 - a. In accordance with AWWA C604.
 - b. Verify inside joint gap meets manufacturer's tolerances as the work progresses.
 - c. Do not encase flanged joints in concrete.
- D. Joints for Pipe with Welded Joints:
1. In accordance with AWWA C206.
 2. Perform dye penetrant test on butt welds in accordance with ASTM E165.
 3. Double Lap Weld Joints:
 - a. Provide joint with a full fillet weld and a seal weld.
 - b. Air test double lap welds in accordance with AWWA C206.
- E. Changes in Alignment and Grade:
1. Where shown on the drawings, makes changes in alignment and grade with miter bends.
 2. Make other changes in alignment and grade by providing small deflections between adjacent pipe. Do not exceed manufacturer's deflection tolerances.
- F. Thrust Restraint:
1. Restrained joints, or
 - a. Minimum restrained joint length as shown on drawing 1695-D-60049.

2. Miter bends with blocking, or
3. Other methods of restraint, as proposed by the contractor, may be used as approved by the COR.

G. Closure Sections:

1. Use closure sections where necessary as determined by the Contractor, subject to the approval of the COR.

H. Schedule works so that at no time will pipe remain in the trench more than 7 days before backfill is placed to original ground surface or to other specified backfill limits shown on the drawings.

3.02 TOLERANCES

A. Lay pipe to lines and grades shown on drawings or established by the COR to the following tolerances:

1. Total departure from established alignment and grade, maximum: 1 inch.

3.03 JOINT LINING AND COATING

A. Field joints for pipe with shop applied cement-mortar lining.

1. Line field joints with cement-mortar in accordance with AWWA C205.
2. Coat exterior joints as specified in Section 09 96 20 - Coatings.
3. Do not backfill field joints until coating is approved by the COR.

B. Apply shrink sleeves to field joints in accordance with Section 09 96 20 - Coatings.

3.04 BACKFILL

A. Backfill pipe in accordance with Section 31 23 22 - Pipe Trench Earthwork.

1. Place backfill about pipe carefully to avoid lateral displacement of the pipe and damage to joints.
2. In certain pipeline reaches, where determined necessary by the COR to prevent the possibility of flotation, do not lay more than 300 linear feet of pipe ahead of backfilling operations.
3. If pipelaying operations are interrupted for more than 24 hours, cover pipe laid in the trench with backfill.

B. Keep internal supports in place until backfill has been placed and compacted above the bottom of the pipe to a minimum height of 0.7 times the diameter.

END OF SECTION

SECTION 33 11 13
DUCTILE IRON PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the price in the Price Schedule for Line Pipe.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME B18.2.1-12 Square, Hex, Heavy Hex, And Askew Head Bolts And Hex, Heavy Hex, Hex Flange, Lobed Head, And Lag Screws (Inch Series)

B. ASTM International (ASTM)

1. ASTM A283/A283M-13 Low and Intermediate Tensile Strength Carbon Steel Plates
2. ASTM A1011/A1011M-14 Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
3. ASTM A1018/A1018M-15 Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
4. ASTM E165/E165M-12 Liquid Penetrant Examination for General Industry

C. American Welding Society, Inc. (AWS)

1. AWS D1.1/D1.1M-15 Structural Welding Code - Steel

D. American Water Works Association (AWWA)

1. AWWA C110-12 Ductile-Iron and Gray-Iron Fittings for Water
2. AWWA C111-12 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

3. AWWA C151-09 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
 4. AWWA C153-11 Ductile-Iron Compact Fittings for Water Service
 5. AWWA C600-10 Installation of Ductile-Iron Mains and Their Appurtenances
- E. Federal Specifications (FED-STD)
1. FED-STD FF-N-836E Nut: Square, Hexagon, Cap, Slotted, Castle Knurled, Welding and Single Ball Seat

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
- B. RSN 33 11 13-1, Shop Drawings:
 1. Show fitting fabrication, connection, and thrust restraint details.
 2. Show exact dimensions of joints, and diameter of rubber gasket including tolerances, other major dimensions, proposed restraint.

1.04 QUALIFICATIONS

- A. See 33 11 10 - Pipeline General Requirements.
- B. Qualify welding procedures and welders in accordance with AWS D1.1.
- C. Pipelaying Workers: Skilled and experienced in laying pipe with type of pipe and joint being furnished.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prevent damage to pipe and fittings during loading, transporting, unloading, storing, and laying.
- B. Transport pipe and fittings on padded bolsters curved to fit the outside of the pipes. Use heavy padding under ties.
- C. Support and store pipe above ground surface. Do not allow bells and spigots to contact each other or the ground.
- D. Replace or repair, as approved by the COR, any pipe that is damaged during shipment, storage, or installation at the Contractor's expense.

PART 2 PRODUCTS

2.01 PIPE

- A. Ductile Iron Pipe: AWWA C151.
 - 1. Nominal laying length: 20 feet.
- B. For allowable pipe size and classes refer to Section 33 11 10 - Pipeline General Requirements.
- C. Rubber Gaskets: AWWA C111.
 - 1. Lubricant:
 - a. Recommended by pipe manufacturer.
 - b. Approved for potable water use.
- D. Coatings and Linings in accordance with Section 09 96 20 - Coatings.

2.02 FITTINGS

- A. Tees, bends, and connections at structures and encasements: As shown on drawings.
- B. Fittings: Steel or ductile iron.
 - 1. Steel Fittings:
 - a. Steel for fittings: ASTM A283, grade C, D or E, ASTM A1011, designation SS, grade 40, 45 or 50, ASTM A1018, designation SS, grade 40 or designation HSLAS-F, grade 50.
 - b. Minimum steel wall thickness: 0.25 inches or thickness required to meet pipe classification shown on the plan and profile, whichever is greater.
 - c. Pipe Diameter: Pipe inside diameter measured to the inside of the lining shall not be less than the nominal diameter shown on the drawings.
 - d. Welding:
 - 1) AWS D1.1.
 - 2) Lifting eyes and other handling devices: Made part of fitting before lining and coating are applied.
 - 3) Temporary or permanent welding for convenience of the Contractor: Not permitted on areas where welding will damage lining and coating.
 - e. Bolts and nuts: ASME B18.2.1 and FED-STD FF-N-836.
 - f. Coating and lining in accordance with Section 09 96 20 - Coatings.

- g. Tees:
 - 1) Tees as shown on drawings.
 - 2) Tee lengths, minimum: As shown on drawings or as required for blocking.
 - h. Joints between fittings and ductile iron pipe:
 - 1) Rubber gasket joints.
 - 2) Joint dimensions and tolerances: Same as pipe manufacturer's joint design.
 - i. Miter Bends: Fabricate steel bends as shown on drawings.
 - j. Closure Section Joints: Sleeve Coupling.
2. Ductile Iron Fittings:
- a. AWWA C110 or AWWA C153.
 - 1) Match pipe pressure class.
 - 2) Flanges: AWWA C110 or AWWA C153.
 - 3) Bolts: AWWA C110 or AWWA C153.
 - 4) Gaskets: AWWA C110 or AWWA C153.
 - b. Coatings and lining: Refer to Section 09 96 20 - Coatings. Cement mortar lining to be double thickness as defined by AWWA C104.
3. Joints between fittings and ductile iron pipe:
- a. Rubber gasket joints.
 - b. Joint dimensions and tolerances: Same as pipe manufacturer's joint design.

2.03 CONCRETE

- A. Concrete in Encasements, Blocking and Collars: Section 03 33 00 - Cast-in-Place Concrete.
- B. Other methods of restraint may be used as approved by the COR.

2.04 CONTRACTOR SOURCE QUALITY TESTING

- A. Ductile Iron Pipe: AWWA C151.

B. Steel Fittings:

1. Testing:

a. Hydrostatic test fittings fabricated from steel plate.

- 1) Perform shop hydrostatic test on pipe which stresses steel to 75 percent of minimum yield point of the steel.
- 2) Hold pressure long enough to allow inspection of welded joints.
- 3) Repair leaks by re-welding and retesting of joints.

b. Fittings fabricated from tested steel pipe do not require hydrostatic testing if girth butt welds are complete penetration welds.

- 1) Girth weld test: Dye penetrant test welds in accordance with ASTM E165.
- 2) Weld defect repair. Chip, flame gouge, or grind to sound metal; re-weld; and test the repaired weld.

C. Ductile Iron Fittings:

1. Test in accordance with AWWA C110 or AWWA C153.

2.05 SOURCE QUALITY ASSURANCE

A. Approval for Shipment:

1. Pipe and fitting approval will be determined by inspection, during and after manufacture.
2. Notify the Technical Service Center, Attn: 86-68140, and COR at least 14 days before manufacturing pipe and fittings and 3 days before shipping pipe and fittings.
3. The Government may inspect pipe units and fittings and approve for shipment those which have been manufactured and tested in accordance with this section, unless the Contractor is notified in writing.
4. Further inspection of pipe units and fittings will be in accordance with the clause entitled "Inspection of Construction".

PART 3 EXECUTION

3.01 LAYING PIPE

A. Excavate pipe trench in accordance with Section 31 23 22 - Pipe Trench Earthwork.

1. Grade pipe trenches to provide uniform slope along bottom of pipe.
2. At joints involving bells or collars, provide holes at joint of ample size to prevent bells or collars from coming in contact with subgrade.

- B. Keep pipe trenches free of water during pipelaying operations.
- C. Lower pipe into the trench and place pipe in position such that no soil gets inside the pipe and pipe is not damaged.
- D. On grades exceeding 10 percent, lay pipe uphill.
- E. When pipelaying is not in progress, keep ends of pipelines closed.
- F. Joining Pipe:
 - 1. Before assembling pipe joints, clean parts with a rag, brush, or paper towel to remove dirt or foreign material.
 - 2. Assemble push-on or mechanical joints in accordance with AWWA C111 and the manufacturer's recommendations.
 - 3. If adjustment of the position of a length of pipe is required after installation, remove and relay the length of pipe as for a new pipe.
 - 4. Maintain pipe firmly in final position.
- G. Changes in Alignment and Grade:
 - 1. Where shown on drawings, make changes in alignment and grade with miter bends as shown on drawings, or
 - 2. Make changes in alignment and grade by providing deflections at joints.
 - a. Maximum deflection angle between adjacent pipe sections as shown in Table 31 11 13B - Maximum Deflection Angle Between Adjacent Pipe Sections.

Table 31 11 13B. - Maximum Deflection Angle Between Adjacent Pipe Sections

Push-on Joint	
Pipe Size, inches	Deflection Angle, degrees*
24	3

* Or manufacturers recommendation whichever is less.

- H. Thrust Restraint:
 - 1. Joint Restraint Products: AWWA C600.
 - 2. Coat in accordance with Section 09 96 20 - Coatings.
 - 3. Other methods of restraint, as proposed by the Contractor, may be used as approved by the COR. Address cathodic protection.
- I. Connections at Structures and Encasements:

1. Where ductile iron pipe adjoins a concrete structure or is fully encased in concrete, except at concrete collars and air valve and blowoff encasements provide flexible joint.
 2. Maximum distance from pipe joint to concrete face: $D/2$ inches.
- J. Connections to Other Types of Pipe:
1. Use rubber gasket joints to make connections between ductile iron pipe and other types of pipe.
- K. Backfill pipe in accordance with Section 31 23 22 - Pipe Trench Earthwork.
- L. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipelines closed.

3.02 TOLERANCES

- A. Lay pipe to lines and grades shown on drawings or established by the COR to the following tolerances:
1. Departure from and return to established alignment and grade, maximum: $1/16$ inch per foot of pipe.
 2. Total departure from established alignment and grade, maximum: 1 inch.

3.03 PIPE DEFLECTION

- A. Allowable vertical pipe diameter deflection after backfilling is complete.
1. Decrease, maximum: 2 percent of nominal pipe diameter.
 2. Elongation, maximum: 3 percent of nominal pipe diameter.
- B. Within 2 weeks after backfilling is completed, take measurements of internal diameters.
- C. Measurement Frequency:
1. One pipe unit out of 3 for the first 30 units laid and 1 pipe unit out of 10 thereafter.
 2. In areas of deep burial or where special problems are encountered, the frequency of measurements may be increased at the discretion of the COR.
- D. Measurements:
1. Measure vertical and horizontal diameter at approximate midpoint of pipe unit.
 2. Record pipe deflections and station where measurements were taken.
 3. Mark inside of pipe so that future comparisons can be made.
- E. If a pipe unit deflection exceeds the allowable.

1. Take measurements in adjacent pipe units to determine extent of excessive deflection.
2. Provide deflection data to the COR.
3. Additional direction will be provided after deflection data is analyzed.

END OF SECTION

SECTION 33 11 16
PVC PRESSURE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the price in the Price Schedule for Line Pipe.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM A36/A36M-14 Carbon Structural Steel
2. ASTM A283/A283M-13 Low and Intermediate Tensile Strength Carbon Steel Plates
3. ASTM E165/E165M-12 Liquid Penetrant Examination for General Industry
4. ASTM F1674-11 Joint Restraint Products for Use with PVC Pipe

B. American Welding Society (AWS)

1. AWS D1.1/D1.1M-15 Structural Welding Code - Steel

C. American Water Works Association (AWWA)

1. AWWA C110-12 Ductile-Iron and Gray-Iron Fittings
2. AWWA C153-11 Ductile-Iron Compact Fittings
3. AWWA C208-12 Dimensions for Fabricated Steel Water Pipe Fittings
4. AWWA C223-13 Fabricated Steel and Stainless Steel Tapping Sleeves
5. AWWA C605-13 Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
6. AWWA C800-14 Underground Service Line Valves and Fittings

7. AWWA C905-10 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. Through 48 in. (350 mm Through 1,200 mm), for Water Transmission and Distribution

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
- B. RSN 33 11 16-1, Shop Drawings:
1. Show fitting fabrication details. Include: miter bend fabrication details (angles, leg lengths), restrained lengths, inside pipe diameters.
 2. Dimensions of joints, diameter of rubber gasket including tolerances, other major dimensions, proposed restraint, and location which include station and elevation.
 3. Connections details to other pipe types.
- C. RSN 33 11 16-2, Pipe Manufacture Certification:
1. Pipe and miter bends meet AWWA C905.
 2. Saddle and Sleeve product data.
- D. RSN 33 11 16-3, Test Results:
1. Manufacturer's steel fitting test results.

1.04 QUALIFICATIONS

- A. See 33 11 10 - Pipeline General Requirements.
- ~~B. Qualify welding procedures and welders in accordance with AWS D1.1.~~
- ~~C. Pipe laying workers: Skilled and experienced in laying pipe with type of joint being furnished.~~

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ship pipe after receiving COR approval of pipe manufacture per submittal.
- B. Prevent damage to PVC pipe and fittings during loading, transporting, unloading, storing, and laying.
- C. Transport coated fittings with padded bolsters between the pipes. Use heavy padding under ties.

- D. Provide sun protection for PVC pipe that is stored outside.
 - 1. At a minimum, wrap pipe in an adequately fastened opaque covering.
 - a. In warm climates, allow air circulation through and around the pipe by puncturing or cutting the covering in the area of the pipe ends.
- E. Support and store pipe above ground surface. Do not allow bells and spigots to contact each other or the ground.

PART 2 PRODUCTS

2.01 PIPE

- A. PVC Pressure Pipe: AWWA C905, elastomeric joint only.
 - 1. Nominal laying length: 20 feet.
 - 2. PVC pipe dimension ratios (DR) shown on the plan and profile drawings are based on AWWA Cast Iron (CI) sizes for diameters.
- B. Rubber Gaskets: Manufactured and tested in accordance with AWWA C905.
 - 1. Petroleum-resistant gaskets: Use in pipe joints in accordance with Section 33 05 21 - Bored Utility Crossings.
 - 2. Lubricant: Approved for potable water use.

2.02 FITTINGS

- A. Tees, adaptors, couplings, bends, and connections at structures and encasements: As shown on drawings.
- B. Fittings: Steel or ductile iron.
- C. Steel Fittings:
 - 1. Steel for fittings: ASTM A283, grade C or D or ASTM A36.
 - 2. Minimum steel wall thickness: 10 gauge or greater.
 - 3. Welding:
 - a. AWS D1.1.
 - b. Temporary or permanent welding for convenience of the Contractor: Not permitted on areas where welding will damage fusion-epoxy lining and coating.
 - c. Lifting eyes and other handling devices: Made part of fitting before lining and coating are applied.
 - 4. Coatings and Linings: In accordance with Section 09 96 02 - Coatings.

5. Joints between fittings and PVC pressure pipe:
 - a. Rubber gasket joints.
 - b. Joint dimensions and tolerances: Same as PVC pipe manufacturer's joint design.
 - c. Joint Restraint Products: ASTM F1674.
 6. In accordance with AWWA C208.
- D. Ductile Iron Fittings:
1. AWWA C110 or AWWA C153.
 2. Coatings and Linings: In accordance with Section 09 96 02 - Coatings.
 3. Joints between fittings and PVC pressure pipe:
 - a. Rubber gasket joints.
 - b. Joint dimensions and tolerances: Same as PVC pipe manufacturer's joint design.
 4. Joint Restraint Products: ASTM F1674:
 - a. Between pipe sections:
 - 1) Megalug Series 2800, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716, <http://www.ebaa.com> or equivalent.
 - b. Between pipe and fittings:
 - 1) Megalug Series 2500, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716, <http://www.ebaa.com> or equivalent.
- E. Tapping Saddles:
1. AWWA C800.
 2. Provide threaded outlet to match remaining 2 inch air valve assembly.
 3. NSF/ANSI 61 Compliant.
- F. Tapping Sleeves:
1. AWWA C223.
 2. Provide tapping flange to match remaining 4 inch blowoff assembly.
 3. NSF/ANSI 61 Compliant.
- 2.03 CONCRETE**
- A. Concrete in encasements, blocking and collars in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.04 CONTRACTOR SOURCE QUALITY TESTING

A. Steel Fittings:

1. Testing:
 - a. Hydrostatic test fittings fabricated from steel plate.
 - 1) Hydrostatic pressure: Sufficient to stress steel to 75 percent of minimum yield point of steel.
 - 2) Hold pressure long enough to allow inspection of welded joints.
 - 3) Repair leaks by rewelding and retesting of joints.
 - b. Fittings fabricated from tested steel pipe do not require hydrostatic testing if girth butt welds are complete penetration welds.
 - 1) Girth weld test: Dye penetrant test welds in accordance with ASTM E165.
 - 2) Repair weld defect: Chip, flame gouge, or grind to sound metal; reweld resulting cavities; and retest.

B. Ductile Iron Fittings: Test in accordance with AWWA C110 ~~or and~~ AWWA C153.

PART 3 EXECUTION

3.01 LAYING PIPE

- A. Keep pipe trenches free of water during pipelaying operations.
- B. Excavate pipe trench in accordance with Section 31 23 22 - Pipe Trench Earthwork.
 1. Grade pipe trenches to provide uniform slope along bottom of pipe.
 2. At joints involving bells or collars, provide holes at joint of ample size to prevent bells or collars from coming in contact with subgrade.
 3. Lower pipe into the trench and place pipe in position such that no soil gets inside the pipe and pipe is not damaged.
- C. On grades exceeding 10 percent, lay pipe uphill.
- D. Before Assembling Pipe Joints:
 1. Clean gasket, bell, and spigot with a rag, brush, or paper towel to remove any foreign material.
 2. Apply lubricant as specified by pipe manufacturer:
 - a. Use only lubricant supplied by the pipe manufacturer.
 - b. Lubricate spigot end of pipe as recommended by the manufacturer.

- c. Do not lubricate either the gasket or gasket groove in bells where gaskets are field installed.
- d. Lubricate factory-installed, nonremovable-type gaskets as recommended by the pipe manufacturer.

E. Joining Pipe:

1. Join pipe in accordance with AWWA C605 or as directed by COR.
2. Align spigot to bell, and insert spigot into bell until spigot contacts gasket uniformly.
3. Apply firm, steady pressure either by hand or by using bar and block until spigot easily slips through gasket.
 - a. Mechanical equipment such as come-alongs may also be used to join pipe.
 - b. Do not damage pipe during joint assembly.
4. Push spigot until reference mark on spigot end is flush with bell end.
 - a. Spigot end of pipe: Marked by manufacturer to indicate proper depth of insertion.
5. Do not swing or "stab" the joint. Do not suspend pipe and swing into the bell.
6. If adjustment of the position of a length of pipe is required after installation, remove and relay the length of pipe as for a new pipe.

F. Changes in Alignment and Grade:

1. Where shown as miter bends on drawings, make changes in alignment and grade with steel or ductile-iron miter bends.
2. Cathodically protect metallic miter bends and/or metallic restraint joints.
3. Make other changes in alignment and grade by providing deflections at joints.
 - a. Maximum deflection: 1 degree or deflection recommended by pipe manufacturer, whichever is less.
4. Longitudinal bending of pipe to obtain deflection: Not permitted.
5. Other methods of providing curves in pipelines may be submitted; and if approved, use these methods to install curves at no additional cost to the Government.
 - a. Methods of providing curves in pipelines which incorporate rubber gasket joints encased in concrete will not be approved.

G. Connections Between PVC Pressure Pipe and Other Types of Pipe:

1. Use rubber gasketed mechanical joints to make connections between PVC pressure pipe and other types of pipe.

- H. Schedule work so that at no time will pipe remain in the trench more than 7 days before backfill is placed to original ground surface or to other specified backfill limits shown on drawings.
- I. Thrust Restraint:
 - 1. Joint restraint products or other restraint method at miter bends as shown on drawing 1695-D-60049.
 - a. Other methods of restraint may be used as approved by COR.
 - b. Coat in accordance with Section 09 96 20 - Coatings.
- J. Backfill pipe in accordance with Section 31 23 22 - Pipe Trench Earthwork.
 - 1. Place backfill about pipe carefully to avoid lateral displacement of the pipe and damage to joints.
 - 2. In certain pipeline reaches, where determined necessary by the COR to prevent the possibility of flotation, do not lay more than 300 linear feet of pipe ahead of backfilling operations.
 - 3. If pipelaying operations are interrupted for more than 24 hours, cover pipe laid in the trench with backfill.

3.02 TOLERANCES

- A. Lay pipe to lines and grades shown on drawings or established by the COR to the following tolerances:
 - 1. Departure from and return to established alignment and grade, maximum: 1/16 inch per foot of pipe.
 - 2. Total departure from established alignment and grade, maximum: 1 inch.

3.03 PIPE DEFLECTION

- A. Allowable vertical pipe diameter deflection after backfilling is complete:
 - 1. Decrease, maximum: 5 percent of nominal pipe diameter.
 - 2. Elongation, maximum: 3 percent of nominal pipe diameter.
- B. Within 2 weeks after backfilling is completed, take measurements of internal diameters.
- C. Measurement Frequency:
 - 1. One pipe unit out of 3 for the first 30 units laid and 1 pipe unit out of 10 thereafter.
 - 2. In areas of deep burial or where special problems are encountered, the frequency of measurements may be increased at the discretion of the COR.

- D. Measurements:
1. Measure vertical and horizontal diameter at approximate midpoint of pipe unit.
 2. Record pipe deflections and station where measurements were taken.
 3. Mark inside of pipe so that future comparisons can be made.
- E. If a pipe unit deflection exceeds the allowable:
1. Take measurements in adjacent pipe units to determine extent of excessive deflection.
 2. Provide deflection data to the COR.
 3. Additional direction will be provided to the Contractor after deflection data is analyzed.

END OF SECTION

SECTION 33 11 18
HDPE PRESSURE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the price in the Price Schedule for Line Pipe.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME B16.1-10 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
2. ASME B16.5-13 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B. ASTM International (ASTM)

1. ASTM A36/A36M-14 Carbon Structural Steel
2. ASTM A283/A283M-13 Low and Intermediate Tensile Strength Carbon Steel Plates
3. ASTM D2513-14 Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
4. ASTM D3350-14 Polyethylene Plastics Pipe and Fittings
5. ASTM E165/E165M-12 Liquid Penetrant Examination for General Industry
6. ASTM F714-13 Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
7. ASTM F2206-14 Fabricated Fittings of Butt-Fused Polyethylene (PE)
8. ASTM F2620-13 Heat Fusion Joining of Polyethylene Pipe and Fittings
9. ASTM F2634-15 Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method

C. American Welding Society (AWS)

1. AWS D1.1/D1.1M-15 Structural Welding Code - Steel

- D. American Water Works Association (AWWA)
1. AWWA C600-10 Installation of Ductile Iron Water Mains and Their Appurtenances
 2. AWWA C906-15 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks
 - ~~3. AWS D1.1/D1.1M-15 Structural Welding Code—Steel~~
- E. Plastic Pipe Institute (PPI)
1. TR-33-12 Generic Butt Fusion Joint Procedure for Field Joint of Polyethylene Pipe

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
- B. RSN 33 11 18-1, Heat Fusion Joint Operator Qualifications:
1. Certifications from manufacturer.
 2. Inspection results.
 3. Date of Certification.
- C. RSN 33 11 18-2, Shop Drawings:
1. Show fitting fabrication details such as dimensions and location which includes station and elevation.
 2. Connections details to other pipe types.
- D. RSN 33 11 18-3, Certification:
1. Pipe meets AWWA C906.
 2. Test reports correlated to shipping bills.
- E. RSN 33 11 18-4, Fusion Procedures:
1. Fusion temperature.
 2. Interface pressure.
 3. Cooling time.
 4. Record of pipe size and DR being joined and each joints fusion temperature, interface pressure and cooling time.

1.04 QUALIFICATIONS

- A. Heat Fusion Joint Machine Operator:
1. Certified by machine manufacturer or representative.
 2. Trained on specific fusion machine and bonding procedure and shall:
 - a. Perform 1 pipe-to-pipe bond and,
 - b. One pipe-to-fitting bond on each machine to be used.
 - c. Bonds made as part of operator certification shall be:
 - 1) Visually inspected and tested in accordance with PPI and ASTM standards.
 3. Qualification remain in effect for 6 months from date of qualification.
 - a. Ability to be revoked by certifying entity.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prevent damage to pipe and fittings during loading, transporting, unloading, storing, and laying.
- B. Transport pipe and fittings with padded bolsters. Use heavy padding under ties.
- C. Support and store pipe above ground surface.

PART 2 PRODUCTS

2.01 PIPE

- A. HDPE Pressure Pipe: AWWA C906, except;
1. PE material:
 - a. Standard PE code designation: PE 4710.
 - b. Minimum cell Classification, ASTM D3350: PE 445574C, or E.
 2. Each production lot of pipe shall be tested for melt index, density, percent carbon, dimensions and ring tensile strength.
 3. Approved for potable water in accordance with NSF Standard 61.
 4. Not less than 4 permanent co-extruded, equally spaced, blue color stripes in outside surface of pipe.

2.02 FITTINGS

- A. Adaptors, couplings, bends, and connections at structures and encasements: Fabricated from HDPE unless otherwise specified, or as shown on drawings.

B. Metal Back-up Flange:

1. Material: Ductile iron, Class 150, ASME B16.1 or ASME B16.5, coat in accordance with Section 09 96 02 - Coatings.

C. Steel Fittings:

1. Steel for Fittings: ASTM A283, grade C or D; or ASTM A36.
2. Minimum Steel Wall Thickness: 10 gauge or greater.
3. Welding:
 - a. AWS D1.1.
 - b. Temporary or permanent welding for convenience of Contractor: Not permitted on areas where welding will damage fusion-epoxy lining and coating.
 - c. Lifting eyes and other handling devices: Made part of fitting before lining and coating are applied.
4. Coatings and Linings:
 - a. Fusion epoxy or coal-tar epoxy paint in accordance with Section 09 96 02 - Coatings.

D. HDPE Pipe Fittings:

1. Molded fittings constructed of HDPE PE 4710 in accordance with ASTM F714 and ASTM F2206.
2. Made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings;
 - a. Rated for internal pressure service at least equal to full service pressure rating of mating pipe.
 - b. Tested in accordance with AWWA C906.
3. HDPE flange and mechanical joint adaptors shall be rated to at least the same pressure as mating pipe.
4. Polyethylene flange or mechanical joint adapters made with sufficient through-bore to be clamped in a butt fusion-joining machine without use of a stub-end holder, as per pipe manufacturer's instructions.
5. HDPE fabricated mechanical adapters shall have steel stiffeners.

2.03 CONCRETE

- A. Concrete in encasements, blocking and collars: Section 03 30 00 - Cast-in-Place Concrete.

2.04 CONTRACTOR SOURCE QUALITY TESTING

A. HDPE Pipe and Fittings:

1. General: AWWA C906 testing of HDPE pipe and fittings and ASTM F2634 testing of HDPE factory test fusions.
 - a. Completed and documented by qualified personnel.
 - b. Government reserves right to:
 - 1) Observe testing while in process and to receive testing documentation.
 - 2) Inspect materials both during and after manufacture.
 - c. Testing reports shall have unique identifiers with shipping bills to verify that pieces shipped belong to same as those tested.
2. Test in accordance with AWWA C906 and/or ASTM F714.
 - a. Perform 1 butt fusion in accordance with ASTM F2620 and PPI Technical Report TR-33 on each run of pipe and from each batch of material feedstock.
 - 1) Test using Tensile Impact Test in accordance with ASTM F2634 prior to shipping pipe.
 - b. Joints exhibiting yield point lower than unfused pipe or that fails in a brittle mode is considered unacceptable.
 - c. Unacceptable test result, Government may reject pipe manufactured in same run and from same batch of material feedstock represented by unacceptable test. Manufacturer may, at own expense, supply additional testing to COR.
 - d. Acceptable test results do not:
 - 1) Mean that pipe from pipe run or material feedstock batch will be acceptable.
 - 2) Relieve pipe manufacturer or supplier from liability for defects in material or workmanship of pipe discovered during installation or warranty period.
3. HDPE pipe out-of-roundness tolerances shall not exceed maximum allowances in ASTM D2513, Table 2.
 - a. HDPE pipe ovality: plus or minus 3 percent at pipe manufacturing facility.

B. HDPE Fittings:

1. Test at least 1 piece for every 50 fabricated; in the event that the number of pieces fabricated is not a multiple of 50, test at least 1 additional piece to ensure that over 2 percent of pieces fabricated are tested.

2. Government reserves right to require up to 2 percent of HDPE fittings shipped to job site be tested in accordance with AWWA C906 at no additional cost to Government.
- C. Steel Fittings:
1. Hydrostatic test fittings fabricated from steel plate.
 - a. Hydrostatic test for pipe and fittings: Stresses steel to 75 percent of minimum yield point of steel.
 - b. Inspect welded joints during test.
 - c. Repair leaks by rewelding and retesting of joints.
 2. Girth Weld Test:
 - a. Testing not required if girth butt welds are complete penetration welds.
 - b. Dye penetrant test **welds** in accordance with ASTM E165.
 - c. Weld defect repair: Chip, flame gouge, or grind to sound metal; reweld and retest weld.

PART 3 EXECUTION

3.01 LAYING PIPE

- A. Excavate pipe trench in accordance with Section 31 23 22 - Pipe Trench Earthwork.
1. Grade pipe trenches to provide uniform slope along bottom of pipe.
 2. At joints involving flanges, provide holes at joint to prevent flanges from coming in contact with subgrade.
- B. Joining Pipe:
1. HDPE pipe butt fusions: In accordance with PPI Technical Report TR-33 (TR-33-12) and ASTM F2620.
 2. Pipe may be joined above ground and then lowered into position, provided pipe is supported and handled in a manner that prevents damage.
 3. Connections between HDPE pressure pipe and other types of pipe: as shown on drawings.
 4. Tied Joint Restraint System:
 - a. Clean surfaces of pipe and fittings to receive tied joint restraint system.
 - b. In accordance with AWWA C600.
 - c. Install joint restraint system so joints are mechanically locked together to prevent joint separation.

5. Saddle Fittings: Fusion weld saddle fittings to pipe in accordance with ASTM F2620.
6. Polyethylene Pipe Fusion Machine Data Loggers:
 - a. Used during joint fusions.
 - b. Record:
 - 1) Joint temperature,
 - 2) Pressure,
 - 3) Time.
 - c. Supply data on fusion joints upon request of COR.
7. Thermal Contraction and Expansion of HDPE Pipe:
 - a. COR may unbolt flange at transition between HDPE and steel to check for tensile or compressive loading due to thermal contraction of the HDPE pipe.
 - b. Excessive tension or excessive compression of flange shall be cause for Contractor to excavate HDPE pipe, lengthen or shorten and re-bury at own cost.

C. Changes in Alignment and Grade:

1. Where shown as miter bends on drawings, make changes in alignment and grade with miter bends or submit proposal to COR for approval.
2. Make other changes in alignment and grade by bending pipe.
 - a. Minimum cold (field) bend radius shown in Table 33 11 18A - Minimum Cold Bending Radius.

Table 33 11 18A - Minimum Cold Bending Radius

Pipe DR	Minimum Cold Bending Radius
≤ 9	20 times pipe OD
>9 to 13.5	25 times pipe OD
>13.5 to 21	27 times Pipe OD
>21	30 times pipe OD
Fitting or flange present or to be installed in bend	100 times pipe OD

- D. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipelines closed.
- E. Closure sections:
 - 1. Last fusion joint for HDPE pipe to HDPE pipe closure sections:
 - a. Make during the coolest part of the day.
 - b. Air temperature, maximum: 65 degrees F.
- F. Pipe will remain in the trench no more than 7 days before backfill is placed to original ground surface or to other specified backfill limits shown on drawings.
- G. Backfill pipe in accordance with Section 31 23 22 - Pipe Trench Earthwork.

3.02 TOLERANCES

- A. Lay pipe to lines and grades shown on drawings or established by the COR to the following tolerances:
 - 1. Departure from and return to established alignment and grade, maximum: 1/16 inch per foot of pipe.
 - 2. Total departure from established alignment and grade, maximum: 1 inch.

3.03 CONTRACTOR FIELD QUALITY TESTING

- A. Fusion Quality Testing on Polyethylene pipe:
 - 1. Frequency:
 - a. Minimum: 1 per crew per week or at request of COR.
 - b. Maximum: 10 percent of welds.
 - c. Additional testing may be required during changes in:
 - 1) Weather.
 - 2) Fusion machine.
 - 3) Fusion crew.
 - 2. Procedure:
 - a. Cool trial fusion, then.
 - 1) Cut out test coupons.
 - 2) Test using Tensile Impact Method accordance with ASTM F2634.
 - 3. Rejection of Fusion Joints:
 - a. Exhibits a yield point lower than unfused pipe or,
 - b. Fails in brittle mode.
 - c. Field fusions represented by trial fusion shall be rejected.

- 1) Make corrections at Contractor expense and re-make rejected fusions.
- B. Test field welds on steel pipe and fittings using ultrasonic or radiographic method in accordance with AWS D1.1.

END OF SECTION

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SECTION 33 11 19
FIBERGLASS PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the price in the Price Schedule for Line Pipe.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME B18.2.1-10 Square and Hex Bolts and Screws, Inch Series

B. ASTM International (ASTM)

1. ASTM A36/A36M-12 Carbon Structural Steel
2. ASTM A283/A283M-12a Low and Intermediate Tensile Strength Carbon Steel Plates
3. ASTM D3517-11 Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe
4. ASTM D4161-01(2010) Fiberglass (Glass-Fiber-Reinforcing Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
5. **ASTM D5686-11** **Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe Fittings**
6. ASTM F477-10 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
7. ASTM E165-12 Liquid Penetrant Examination

C. American Water Works Association (AWWA)

1. AWWA C110-12 Ductile-Iron and Gray-Iron Fittings for Water
2. AWWA C153-11 Ductile-Iron Compact Fittings for Water Service
3. AWWA C950-13 Fiberglass Pressure Pipe
4. AWWA M45-05 Fiberglass Pipe Design

- D. American Welding Society, Inc. (AWS)
 - 1. AWS D1.1/D1.1M-08 Structural Welding Code - Steel
 - 2. AWS D1.4/D1.4M-11 Structural Welding Code Reinforcing Steel
- E. Federal Specifications (FED-STD)
 - 1. FED-STD FF-N-836E Nut, Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat, February 14, 1994
- F. International Organization for Standardization
 - 1. ISO 9001-08 Quality Management Systems - Requirements

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals.
- B. RSN 33 11 19-1, Shop Drawings:
 - 1. Show fitting fabrication details.
 - 2. Show exact dimensions of joints, and diameter of rubber gasket including tolerances, and other major dimensions.
- C. RSN 33 11 19-2, Joint Repair Plan:
 - 1. Proposed equipment, materials, and procedures for repairing leaks in pipe joints.
- D. RSN 33 11 19-3, Qualifications:
 - 1. Pipe manufacturer:
 - a. ISO 9001 or similar nationally certified quality program certification.
 - b. At least 10 years of successful experience producing products as specified.
 - c. References for at least 3 completed projects with fiberglass pressure pipe 24 inches or greater.

1.04 QUALIFICATIONS

- A. See 33 11 10 - Pipeline General Requirements.
- ~~B. Pipe manufacturer:~~
 - ~~1. Certified in accordance with ISO 9001 or similar nationally certified quality program as approved by COR.~~
 - ~~2. At least 10 years of successful experience producing products as specified.~~
 - ~~3. Provide references for at least 3 completed projects.~~

~~C. Welding procedures and welders in accordance with AWS D1.1.~~

~~D. Pipelaying Workers: Skilled and experienced in laying pipe with type of joint being furnished.~~

1.05 DELIVERY, STORAGE AND HANDLING

- A. Prevent damage to pipe and fittings during loading, transporting, unloading, storage, and installation.
- B. Package, handle, and ship in accordance with manufacturer's recommendations.
- C. Transport pipe and fittings on padded bolsters either curved to fit the outside of the pipe or using triangular chocks. Use heavy padding under ties.
- D. Support and store pipe above ground surface. Do not allow bells, couplings or spigots to contact each other or the ground.
- E. Use manufacturer's instructions for handling of pipe.
- F. Replace or repair, as approved by the COR, pipe that is damaged during shipment, storage, or installation at the Contractor's expense.

PART 2 PRODUCTS

2.01 PIPE

- A. Fiberglass Pipe: In accordance with AWWA C950 and ASTM D3517.
 - 1. Pressure pipe utilizing either a continuous filament wound process or centrifugally cast process with:
 - a. Type 1: glass fiber-reinforced thermosetting polyester resin mortar.
 - b. Liner 1: reinforced thermoset liner.
 - c. Grade 1: polyester resin surface layer - reinforced.
 - d. Class: see Table 33 11 10A - Symbol Pipe Equivalents for required line pipe sizes and pressure classes.
 - e. Pipe Stiffness: 18 psi minimum.
- B. Design pipe for the maximum sustained working pressure and the surge pressure.
 - 1. The maximum sustained and surge pressures are considered the same and are defined by the head classes shown on pipeline plan and profile drawings.
- C. Elastomeric Sealing Gaskets: Manufactured and tested in accordance with ASTM F477.

2.02 FITTINGS

- A. Tees, bends, adapters, and connections at structures and encasements: As shown on drawings.
- B. Fittings: Fabricated from **fiberglass**, steel or ductile iron.
1. Fiberglass Fittings: In accordance with AWWA M45, ~~and~~ AWWA C950, and **ASTM D5685, except that fiberglass fittings shall be hydrostatically factory tested.**
 - a. Installed in accordance with manufacture's recommendations.
 2. Steel Fittings:
 - a. Steel for Fittings: ASTM A283, grade C or D or ASTM A36.
 - b. Minimum steel wall thickness: 0.25 inches or thickness required to meet pipe classification shown on the plan and profile, whichever is greater.
 - c. Pipe Diameter: Pipe inside diameter measured to the inside of the lining shall not be less than the nominal diameter shown on the drawings.
 - d. Welding:
 - 1) AWS D1.1.
 - 2) Lifting eyes and other handling devices: Made part of fitting before lining and coating are applied.
 - 3) Temporary or permanent welding for convenience of the Contractor: Not permitted on areas where welding will damage fusion-epoxy lining and coating.
 - e. Bolts and Nuts: ASME B18.2.1 and FED-STD FF-N-836.
 - f. Coating and lining in accordance with Section 09 96 20 - Coatings.
 - g. Tees:
 - 1) Tees as shown on drawings.
 - 2) Tee lengths, minimum: As shown on drawings or as required for blocking.
 - h. Miter bends: Fabricate steel bends as shown on drawings.
 - i. Closure Section Joints: Sleeve coupling.
 - ~~j. Joints between steel fittings and Fiberglass pipe: Metal outlet nozzle for blowoff and air valve only.~~
 - ~~1) Laminate overlay encasing a metal key ring around the metal piping blowoff outlet nozzle.~~
 3. Ductile Iron Fittings:
 - a. AWWA C110 or AWWA C153.

- 1) Match pipe pressure class.
 - 2) Flanges: AWWA C110 or AWWA C153.
 - 3) Bolts: AWWA C110 or AWWA C153.
 - 4) Gaskets: AWWA C110 or AWWA C153.
- b. Coatings and lining:
- 1) Refer to Section 09 96 20 - Coatings.
- c. Plan, profile and restraint system shown on drawings shall require modification if ductile iron fittings are used.
- d. Submit plan, profile, restraint system, details and connections for COR review and approval.
- e. **Joints between fittings and ductile iron pipe.**
- 1) **Rubber gasket joints.**
 - 2) **Joint dimensions and tolerances: Same as pipe manufacturer's joint design.**

2.03 FABRICATION

- A. Fiberglass fittings and couplings shall be designed, manufactured, and tested in accordance with AWWA C950, ASTM D3517, ~~and~~ ASTM D4161, **and ASTM D5685, except that fiberglass fittings shall be hydrostatically factory tested.**
- B. Fiberglass fittings should resist the same loading conditions as the adjacent pipe.
- ~~C. Steel Fittings:~~
- ~~1. Tees:~~
 - ~~a. Tees for blowoffs and air valves as shown on drawings.~~
 - ~~b. Tee length, minimum: As shown on drawings or as required for blocking.~~

2.04 CONCRETE

- A. Concrete in Encasements, Blocking and Collars: Section 03 33 00 - Cast-in-Place Concrete.
- B. Other methods of restraint may be used as approved by the COR.
- C. Plan, profile and restraint system shown on drawings require modification if alternate methods are used.

2.05 CONTRACTOR SOURCE QUALITY TESTING

- A. Fiberglass Pipe:
1. Test in accordance with AWWA C950 and ASTM D3517.

B. Fiberglass Fittings: Pipe outlets for air valves, blowoffs and tapers (or adaptors) as shown on drawings.

1. Pipe Outlets for air valves and blowoffs:

- a. Hydrostatic test in accordance with AWWA C950, ~~ASTM D3517, and ASTM D4161, and ASTM D5685~~ except that fiberglass fittings shall be hydrostatically factory tested.
- b. Use a fiberglass reinforcement collar connection for blowoffs.
- ~~c. Place metal piping securely in fiberglass laminated overlay outlet pipe.~~
- ~~d. Welding in accordance with AWS D1.4.~~

C. Steel Fittings, testing:

1. Hydrostatic test fittings fabricated from steel plate.

- a. Perform shop hydrostatic test on pipe which stresses steel to 75 percent of minimum yield point of the steel.
- b. Hold pressure long enough to allow thorough inspection of welded joints.
- c. Repair leaks by re-welding and retesting of joints.

2. Fittings fabricated from tested steel pipe do not require hydrostatic testing if girth butt welds are complete penetration welds.

- a. Girth weld test: Dye penetrant test ~~welds~~ in accordance with ASTM E165.
- b. Weld defect repair. Chip, flame gouge, or grind to sound metal; re-weld; and test the repaired weld.

D. Ductile Iron Fittings:

1. ~~Test in accordance with~~ AWWA C110 or AWWA C153.

~~2. Coatings and lining: Refer to Section 09-96-20 Coatings.~~

~~3. For straight fittings.~~

~~4. Plan, profile and restraint system shown on drawings shall require modification if ductile iron fittings are used.~~

~~E. Joints between fittings and ductile iron pipe.~~

~~1. Rubber gasket joints.~~

~~2. Joint dimensions and tolerances: Same as pipe manufacturer's joint design.~~

~~2.06 SOURCE QUALITY ASSURANCE~~

~~A. Approval for Shipment:~~

- ~~1. Pipe and fitting approval, will be determined by inspection, during and after manufacture.~~

- ~~2. Notify the Technical Service Center, Attn: 86-68140; and the COR at least 14 days before manufacturing pipe and fittings and 3 days before shipping pipe and/or fittings.~~
- ~~3. The Government will inspect pipe and fittings and will approve for shipment of those which have been manufactured and tested in accordance with these specifications.~~
- ~~4. Further inspection of pipe units and fittings will be in accordance with the clause at FAR 52.246-12 "Inspection of Construction".~~

PART 3 EXECUTION

3.01 LAYING PIPE

- A. Excavate pipe trench in accordance with Section 31 23 22 - Pipe Trench Earthwork.
 1. Grade pipe trenches to provide uniform slope along bottom of pipe.
 2. At joints involving bells or collars, provide holes at joint of ample size to prevent bells or collars from coming in contact with subgrade.
- B. Keep pipe trenches free of water during pipelaying operations.
- C. Lower pipe into the trench and place pipe in position such that no soil gets inside the pipe and pipe is not damaged.
- D. On grades exceeding 10 percent, lay pipe uphill.
- E. When pipelaying is not in progress, keep ends of pipelines closed.
- F. Joining Pipe:
 1. Follow manufacturer's recommendations for installation.
 2. Inspect pipe end and/or coupling, elastomeric gasket, and sealing surfaces for damage.
 3. Before assembling pipe joints, clean gasket, bell or coupling, especially the groove, and the spigot with a rag, brush, or paper towel to remove dirt or foreign material.
 4. Placing Elastomeric Gasket:
 - a. Spigot Groove Method:
 - 1) Follow manufacturer's recommended practices for gasket installation.
 - 2) Apply manufacturer's approved joint lubricant to spigot interior and elastomeric gasket.

- 3) After placing elastomeric gasket in spigot groove, equalize elastomeric gasket cross section by inserting a tool such as a large screwdriver under the elastomeric gasket and moving it around the periphery of the pipe spigot.
- b. Coupling Groove Method:
 - 1) Follow manufacturer's recommended practices for gasket installation. Typically this method is factory installed.
5. Fit pipe units together, spigot to bell or coupling, and draw the joints together so that the bells or couplings and spigots are fully engaged.
6. Do not swing or "stab" the joint and do not suspend the pipe and swing it into the bell or coupling.
7. Fit pipe units together in a manner to avoid twisting or otherwise displacing or damaging the elastomeric gasket.
8. When using gaskets of circular cross section, after pipe units have been joined, insert a feeler gauge between the pipe bell and pipe spigot and move it around the periphery of the pipe to determine that the position of the elastomeric gasket is correct and there are no fish-mouth problems. If adjustment of the position of a length of pipe is required after installation, remove and relay the length of pipe as for a new pipe.
9. Maintain pipe securely in final position.

G. Changes in Alignment and Grade:

1. Make changes in alignment and grade with miter bends.
2. Make minor changes in alignment and grade by pulling pipe joints.
 - a. Pull rubber gasket coupling or bell and spigot joint.
 - b. ~~A total pull of 0.5 degree joint deflection may be permitted. When pipe joint is pulled, use a full 20 foot length of pipe on each side.~~
 - c. Maximum deflection:
 - 1) ~~1 degree or deflection~~ As recommended by pipe manufacturer, whichever is less for pipe head class less than or equal to 450 feet.
 - 2) ~~0.75 degree or deflection~~ recommended by pipe manufacturer, whichever is less for pipe head class equal to or greater than 475 feet.
3. Lay ends of each section of pipe on the theoretical centerline of the curve and to the grade shown on the drawings within the laying tolerances prescribed above.

H. Thrust Restraint:

1. Restrained joint couplings in combination with concrete blocking, encasements and collars.

- a. Concrete in encasements, blocking and collars in accordance with Section 03 33 00 - Cast-in-Place Concrete.
 2. Joint restraint couplings to lengths shown on drawing 1695-D-60049:
 - a. Double bell with rubber gaskets and locking rods.
 3. Alternate methods of coupling restraint may be used if approved by the COR.
- I. Closure Sections:
1. Use closure sections where necessary as determined by the Contractor, subject to the approval of the COR.
 2. Follow manufacturer's recommendations.
- J. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipelines closed.

3.02 TOLERANCES

- A. Lay pipe to lines and grades shown on the drawings or established by the COR to the following tolerances:
1. Total departure from established alignment and grade, maximum: 1 inch.

3.03 BACKFILL

- A. Backfill pipe in accordance with Section 31 23 22 - Pipe Trench Earthwork.
1. Place backfill about pipe carefully to avoid lateral displacement of the pipe and damage to joints.
 2. In certain pipeline reaches, where determined necessary by the COR to prevent the possibility of flotation, do not lay more than 300 linear feet of pipe ahead of backfilling operations.
 3. If pipelaying operations are interrupted for more than 24 hours, cover pipe laid in the trench with backfill.

3.04 PIPE DEFLECTION

- A. Allowable vertical pipe diameter deflection after backfilling is complete.
1. Decrease, maximum: 3 percent of nominal pipe diameter.
 2. Elongation, maximum: 1.5 percent of nominal pipe diameter as measured when backfill reaches pipe crown.
- B. Within 2 weeks after backfilling is completed, take measurements of internal diameters.
- C. Measurement Frequency:
1. Midpoint of pipe section at approximate 50 feet intervals for the first 500 feet of backfilled pipe, and once every 200 feet intervals thereafter.

2. In areas of deep burial or where special problems are encountered, the frequency of measurements may be increased at the discretion of COR.
- D. Measurements:
1. Measure vertical and horizontal diameter at approximate midpoint of pipe unit.
 2. Record pipe deflections and station where measurements were taken.
 3. If a pipe deflection exceeds the allowable:
 - a. Take measurements at midpoint of pipe unit upstream and downstream at approximate 50 foot intervals to determine extend of excessive deflection.
 - b. Provide measurements to COR.
 4. Mark inside of pipe so that future comparisons can be made.
- E. If a pipe unit deflection exceeds the allowable.
1. Take measurements in adjacent pipe units to determine extent of excessive deflection.
 2. Provide deflection data to COR.
- F. Additional direction will be provided after deflection data is analyzed.
1. Take corrective action that including removing and replacing pipe that exceeds allowable deflection tolerance.

END OF SECTION

SECTION 33 12 10
VALVES AND EQUIPMENT FOR LINE PIPE INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Class 150B Two Inch Diameter Air Valve Assemblies:
1. Measurement: Number of air valve assemblies installed.
 2. Payment: Unit price offered in Price Schedule. Includes:
 - a. Precast Concrete Manhole and Coarse Aggregate.
 - b. Two Inch Air Valve.
 - c. Barrier Posts.
 - d. Air Valve Equipment Supports.
 - e. Miscellaneous metal fittings.
 - f. Coatings.
- B. Class 250B Two Inch Diameter Air Valve Assemblies:
1. Measurement: Number of air valve assemblies installed.
 2. Payment: Unit price offered in Price Schedule. Includes:
 - a. Precast Concrete Manhole and Coarse Aggregate.
 - b. Two Inch Air Valve.
 - c. Barrier Posts.
 - d. Air Valve Equipment Supports.
 - e. Miscellaneous metal fittings.
 - f. Coatings.
- C. Class 150B Four Inch Diameter Blowoffs:
1. Measurement: Number of blowoff assemblies installed.
 2. Payment: Unit price offered in the Price Schedule. Includes:
 - a. Coarse Aggregate.
 - b. Meter Box.
 - c. Valve Box.
 - d. Four inch Ball Valve.
 - e. Automatic Ball Drip Valve.

- f. Miscellaneous metal fittings.
- g. Coatings.

D. Class 250B Four Inch Diameter Blowoffs:

- 1. Measurement: Number of blowoff assemblies installed.
- 2. Payment: Unit price offered in the Price Schedule. Includes:
 - a. Coarse Aggregate.
 - b. Meter Box.
 - c. Valve Box.
 - d. Four inch Ball Valve.
 - e. Automatic Ball Drip Valve.
 - f. Miscellaneous metal fittings.
 - g. Coatings.

E. Cost:

- 1. Include valves and equipment in the price in the Price Schedule for NAPI Turnout. Includes:
 - a. Six inch butterfly valve.
 - b. Four inch butterfly valve.
 - c. Valve box.
 - d. Flanges and gaskets.
 - e. Miscellaneous metal fittings.

1.02 DEFINITIONS

A. Valves and Equipment for Line Pipe Installations.

- 1. NAPI Turnout.
- 2. Blowoffs per drawing 1695-D-60048.
- 3. Air Valve Assemblies per drawings 1695-D-60046.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

- 1. ASME B16.1-10 Gray Iron Pipe Flanges and Flanged Fittings:
Classes 25, 125, and 250
- 2. ASME B16.5-13 Pipe Flanges and Flanged Fittings: NPS 1/2
Through NPS 24 Metric/Inch Standard

B. American Water Works Association (AWWA)

1. AWWA C207-13 Steel Pipe Flanges for Waterworks Service, Sizes 4 In Through 144 In. (100 mm Through 3,600 mm)
2. AWWA C504-15 Rubber-Seated Butterfly Valves
3. AWWA C507-15 Ball Valves, 6 In. Through 48 In. (150 mm Through 1,500 mm)

1.04 SUBMITTALS

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

1. General:
 - a. Submit data that demonstrates equipment provided meets requirements.
 - b. Submit data giving manufacturer's name, type, model, size, and construction and performance characteristics of equipment.
 - c. Mark proposed catalog sheet item which allows data to be legibly reproduced.

B. RSN 33 12 10-1, Commercial Product Data.

1. Butterfly valves for buried or submerged service.
 - a. Products data for butterfly valves including hydrostatic pressure testing certification. Include pressures used in testing valves.
2. Valve boxes for buried valves.
3. Air valves.
4. Ball valves.
5. Automatic ball drip valve.

C. RSN 33 12 10-2, Service Manuals.

1. For items in RSN 33 12 10-1.

PART 2 PRODUCTS

2.01 PRECAST MANHOLE AND AGGREGATE

- A. See Section 03 48 00 - Precast Concrete Structures.

2.02 BARRIER POSTS AND AIR VALVE EQUIPMENT SUPPORTS

- A. See Section 05 50 00 - Metal Fabrications.

2.03 NAPI TURNOUT

- A. See Section 33 12 05 - NAPI Turnout.

2.04 MISCELLANEOUS METAL FITTING

- A. See Section 33 32 95 - Metal Piping for Line Pipe Installations.

2.05 EQUIPMENT

- A. Manually Operated Butterfly Valves:

1. General:
 - a. AWWA C504, Class 150B or 250B. Class of valve to suit the pressure class at the line pipe locations.
 - b. Bubbletight at rated pressure in either direction and suitable for operation after long periods of inactivity.
 - c. Axis of valve leaf: Horizontal when valve is in installed position except where shown on drawings.
2. Provide valve body flanges for connection to ASME B16.1, Class 125 or 250 or AWWA Class D, E, or F flanges as necessary.
3. Valve seat: Located either in valve body mating with a stainless steel seating surface located on valve disc; or in valve disc mating with a stainless steel seating surface located in valve body. Fully rubber lined bonded seat in body type seats are unacceptable.
4. Manual operators. Provide:
 - a. Manually-operated butterfly valves with a worm-gear or traveling nut type manual operator in accordance with AWWA C504.
 - b. Operators that open and close the valves under maximum unbalanced pressure conditions. Design for a maximum unbalanced pressure of adjoining pipe pressure.
 - c. Gears of self-locking type, holds valve in all positions without fluttering or creeping.
 - d. Rim pull and component strength: AWWA C504.
5. Buried butterfly valves. Provide:
 - a. Valve boxes.
 - b. Two inch square-nut operator.
 - c. Two steel tee-handle wrenches, each with a length of 8 feet.
 - d. Worm-gear or traveling nut type manual operator in accordance with AWWA C504.

- e. Gears of the self-locking type, holds valve in all positions without fluttering or creeping.
- f. Ensure rim pull and component strength meets AWWA C504.

B. Four inch Ball Valve:

1. AWWA C507, class 150 or 300. Class of valve to suit the pressure class at the line pipe locations.
2. Flanged connection to ASME B16.1, Class 125 or 250 or AWWA Class D or E flanges as necessary.
3. Suitable for buried service.
4. Valve boxes.
5. Two inch square nut operator.
6. Manually-operated with a worm-gear or a traveling nut type manual operator.
7. Gears of the self-locking type, holds valve in all positions without fluttering or creeping.
8. Bubble tight at rated pressure in either direction and suitable for operation after long periods of inactivity.

C. Automatic Ball Drip Valve:

1. Threaded end.
2. Automatic draining, ball check.
3. Minimum 300 psig.
4. Provide dielectric insulating union as necessary to prevent galvanic corrosion between dissimilar metals.

D. Two inch Air Valve:

1. Val-Matic model 201C manufactured by Val-Matic Valve and Manufacturing Corporation, 8448 West 45th street, Lyons, IL 60534; Dezurik Model 145C manufactured by Valve and Primer Corporation, 1420 South Wright Boulevard, Schaumburg, IL 60193-4599; Crispin Model AL21 Air and Vacuum Valve manufactured by Multiplex Manufacturing Company, 600 Fowler Avenue, Berwick, PA 18603; or equal, having the following essential characteristics:
 - a. Combination air-inlet and air-release type actuated by a float.
 - b. Remains open for filling line until water has displaced air at point of attachment of valve assembly after which it closes.
 - c. Opens when pressure in pipeline drops sufficiently to create a vacuum.
 - d. Releases trapped air when the pipeline is under pressure.

- e. Furnish with 2 petcocks for valve; one at the top to permit checking the effectiveness of air valve, and one at bottom to allow valve to be drained.
- f. Stainless steel internal parts such as guides, bushings, and screws.
- g. Stainless steel floats.
- h. Float-pivot supports: Brass, bronze, stainless steel, or cast iron.
- i. Cold water pressure rating for the body: Minimum of 300 pounds per square inch.
- j. Inlet connection: Internally threaded NPT.

E. Valve Box:

- 1. Model 6855 series, manufactured by Tyler Pipe, PO Box 2027, Tyler TX 75710; or equal, having the following essential characteristics:
 - a. 5-1/4 inch minimum inside diameter cast iron, composite, or PVC valve boxes for valves 4 inches in diameter and larger.
 - b. Two piece or 3 piece and slip type.
 - c. Cast iron collar with lid marked "WATER".
 - 1) Drop lid.
 - 2) Lock lid.
 - d. Base and adequate extension items to extend from valve nut operator to ground surface. Extension items may be PVC or metal.
 - e. Concrete medallion flush mounted with ~~grounded~~ surface except at blowoff locations. Refer to Detail A, drawing 1695-D-60050.

F. Meter Box:

- 1. Model VB-MAX-H, manufactured by Rain Bird, 6991 East Southpoint Road, Tucson, AZ 85756; or equal having the following essential characteristics:
 - a. Lockable lid.
 - b. Approximate dimensions of 40 inches by 27 inches by 18 inches.

G. Flanges:

- 1. Slip-on ring type, flat faced: AWWA C207 or ASME B16.5.
- 2. Flat face with a finish suitable for full face gasket for flanged joints.

H. Flange gaskets:

- 1. Model No. 19, manufactured by Garlock Sealing Technologies, 1666 Division Street, Palmyra NY 14522; or equal, having following essential characteristics:
 - a. Full flat face-type.

- b. For AWWA C207 flanged joints.
 - c. For cold water service.
 2. Correct flange face gasket surface finish.
 3. Spiral or concentric serrated grooved flange face gasket surface finishes suitable for flat gasket material provided and operating pressures.
- I. Miscellaneous metal fittings:
 1. Provide fittings for attaching valves and other appurtenances as shown on drawings.
- J. Valve Insulation Jacket for Air Valve Installations:
 1. Manufactured by ThermaXX LLC, 16 Hamilton Street, West Haven CT 06516; or equal, having the following essential characteristics:
 - a. Insulation material should be adequate to prevent freezing from generally accepted temperatures at location being installed.
 - b. Non-asbestos.
 - c. Hydrophobic.

2.06 CONTRACTOR SOURCE QUALITY TESTING

- A. Shop test AWWA butterfly valves in accordance with AWWA C504 for butterfly valves and AWWA C507 for ball valves.
 1. Leak test valves at manufacturer's facility or an alternate facility approved by COR.
 2. Tests may be Government witnessed. Notify Government 30 days prior to testing valves.
 3. Test valves during same trip for Government from each manufacturer.
 4. Prior to shop leakage test and in presence of Government, verify that when valve is fully closed, valve indicator shall indicate closed.
 5. If indicator is not in closed position (exactly at closed), remove operator from valve, fully close valve, reinstall operator so that it indicates "CLOSED".
 6. Shop leakage test:
 - a. Test valves and their seats for leaks with water in 100 percent closed position for timed period of 5 minutes with a pressure equal to rated design pressure. Valves shall be drip tight with no leakage.
 - b. Upstream position of valve shall be visible to Government.
 - c. Spray or high velocity leakage will not be acceptable.

- d. If valve leaks, adjust until valve is drip tight with no leakage. Adjustments may include adjusting valve stops, seats, actuators, etc.
 - e. If a valve is not drip tight (any leakage), valve will not be acceptable.
- B. After adjustments are made, inspect again valve indicator and corrected.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Class 150B and 250B Two Inch Diameter Air Valve Assemblies: As shown on drawing 1695-D-60046.
- B. Class 150B and 250B Four Inch Diameter Blowoffs: As shown on drawing 1695-D-60048.
- C. NAPI Turnout: As shown on drawing 1695-D-60050.
- D. Install valves and equipment to line and grade as shown on drawings.
- E. Install valves complete and lubricated in accordance with the manufacturer's instructions.
- F. Valves with flanged connections: Bolt holes to straddle vertical centerline when in installed position.

3.02 CONTRACTOR FIELD QUALITY TESTING

- A. After each valve has been completely installed, test valve in pipeline by opening and closing valve through full range of operation 3 times.
- B. Make changes or adjustments until operation is approved by COR, and valves are bubbletight and do not leak water past seats.
- C. Provide means for inspecting area downstream of the valve during testing by Government.

3.03 COATINGS

- A. In accordance with Section 09 96 20 - Coatings.

END OF SECTION

SECTION 52 00 00
DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

- A. Inform the CO of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction.
- B. In accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction, in case of discrepancies, written specifications take precedence over drawings unless otherwise specified.

1.02 PROJECT CONDITIONS

- A. Where there are differences as determined by the CO between details and dimensions shown on drawings and details and dimensions of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.03 SPECIFICATION DRAWINGS

- A. Some drawings show details of fabrication or other details and specifications which are not a part of work under this contract. Disregard specifications and details shown on these drawings which are not applicable to work under this contract.
- B. Reference drawings referred to on specification drawings and not considered necessary for contract purposes are not included in specifications.
- C. Parts of work for which dimensions are not shown have been drawn to scale as nearly to final dimensions as possible before purchase of machinery or equipment and development of final general and detailed designs.

1.04 TYPICAL DRAWINGS

- A. Typical drawings show installations and details of construction which are similar to or approximate to those that are part of work under these specifications. Dimensions and details shown on typical drawings may vary from those shown on construction drawings to be furnished after award of contract.
- B. Use typical drawings for bidding purposes only.

1.05 INFORMATION DRAWINGS

- A. Drawings marked "For Information Only" in the drawing list are included to show existing features about which knowledge is required to perform work under this contract. These drawings do not show work to be performed under this contract.
- B. If there are differences as determined by the CO between details and dimensions shown on these drawings and those of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.06 STANDARD DRAWINGS

- A. Standard drawings may show details which are not a part of work under this contract. Disregard details shown on these drawings which are not applicable to work under this contract.

1.07 LIST OF DRAWINGS

- A. Drawings listed in Table 52 00 00A - List of Drawings are made a part of Section C - Description/Specifications.

1.08 DRAWING NUMBERS IN NUMERICAL ORDER

- A. Specification drawings are listed in numerical order in Table 52 00 00B - Drawings in Numerical Order.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
General:		
1	1695-529-401	General Map
2	1695-529-60068	Cutter Lateral Reach 22B - Location Map
3	1695-529-60077	Reach 22B Staging Area
Civil:		
4	1695-D-60005	Pumping Plant No. 1 Site Plan - Plan
5	1695-D-60006	Pumping Plant No. 1 Site Plan - Sections Thru Yard and Sections
6	1695-D-60007	Pumping Plant No. 2 Site Plan - Plan
7	1695-D-60008	Pumping Plant No. 2 Site Plan - Sections Thru Yard and Sections
8	1695-D-60009	Regulating Tank No. 2 Site Plan - Plan
9	1695-D-60010	Regulating Tank No. 2 Site Plan - Sections Thru Yard and Detail
10	1695-D-60021	Regulating Tank No. 2 Overflow Apron - Concrete Outline and Reinforcement Design
11	1695-D-60022	Pumping Plant No. 1 and No. 2 - Switchgear Transformer Foundations and Enclosures - Plans and Sections
12	1695-D-60023	Pumping Plant No. 1 and No. 2 - Steel Pipe Encasements - Concrete Outline and Reinforcement Design
13	1695-D-60027	Line Pipe - Sheet Key General Notes Road Details - Sheet 1 of 18
14	1695-D-60028	Line Pipe - Plan and Profile - Beginning to Sta. 22300+00 - Sheet 2 of 18
15	1695-D-60029	Line Pipe - Plan and Profile - Sta. 22300+00 to Sta. 22350+00 - Sheet 3 of 18

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
16	1695-D-60030	Line Pipe - Plan and Profile - Sta. 22350+00 to Sta. 22400+00 - Sheet 4 of 18
17	1695-D-60031	Line Pipe - Plan and Profile - Sta. 22400+00 to Sta. 22450+00 - Sheet 5 of 18
18	1695-D-60032	Line Pipe - Plan and Profile - Sta. 22450+00 to Sta. 22500+00 - Sheet 6 of 18
19	1695-D-60033	Line Pipe - Plan and Profile - Sta. 22500+00 to Sta. 22550+00 - Sheet 7 of 18
20	1695-D-60034	Line Pipe - Plan and Profile - Sta. 22550+00 to Sta. 22600+00 - Sheet 8 of 18
21	1695-D-60035	Line Pipe - Plan and Profile - Sta. 22600+00 to Sta. 22650+00 - Sheet 9 of 18
22	1695-D-60036	Line Pipe - Plan and Profile - Sta. 22650+00 to Sta. 22700+00 - Sheet 10 of 18
23	1695-D-60037	Line Pipe - Plan and Profile - Sta. 22700+00 to Sta. 22750+00 - Sheet 11 of 18
24	1695-D-60038	Line Pipe - Plan and Profile - Sta. 22750+00 to Sta. 22800+00 - Sheet 12 of 18
25	1695-D-60039	Line Pipe - Plan and Profile - Sta. 22800+00 to Sta. 22850+00 - Sheet 13 of 18
26	1695-D-60040	Line Pipe - Plan and Profile - Sta. 22850+00 to Sta. 22900+00 - Sheet 14 of 18
27	1695-D-60041	Line Pipe - Plan and Profile - Sta. 22900+00 to Sta. 22950+00 - Sheet 15 of 18
28	1695-D-60042	Line Pipe - Plan and Profile - Sta. 22950+00 to Sta. 23000+00 - Sheet 16 of 18
29	1695-D-60043	Line Pipe - Plan and Profile - Sta. 23000+00 to Sta. 23050+00 - Sheet 17 of 18
30	1695-D-60044	Line Pipe - Plan and Profile - Sta. 23050+00 to End - Sheet 18 of 18

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
31	1695-D-60045	Line Pipe - Pipe Trench Installation - Sections and Details
32	1695-D-60046	Line Pipe - 2 inch Air Valve - Plan, Sections, and Details - Sheet 1 of 2
33	1695-D-60047	Line Pipe - 2 inch Air Valve Installation - Air Valve Data Table - Sheet 2 of 2
34	1695-D-60048	Line Pipe - Blowoffs - Sections and Details
35	1695-D-60049	Line Pipe - Miter Bend Thrust Restraint - Data Tables
36	1695-D-60050	Line Pipe - Plans, Sections, and Details - NAPI Turnout
37	1695-D-60051	Line Pipe - Bore and Jack - Sta. 22251+30 Sta. 22283+50 - Sheet 1 of 2
38	1695-D-60052	Line Pipe - Bore and Jack - Sta. 22415+40 Sta. 22938+50 - Sheet 2 of 2
38A	1695-D-60064	Line Pipe - Road to Pumping Plant 2 - Plan and Profile, Sheet 1 of 2
39	1695-D-60053	Line Pipe - Road to Pumping Plant 2 - Plan and Profile, Sheet 2 of 2
40	1695-D-60054	Line Pipe - Regulating Tank No. 2 Overflow Channel - Plan, Profile, and Section
41	1695-D-60055	Line Pipe - Wash Crossing - Sta. 22276+75 to Sta. 22279+25 - Sheet 1 of 9
42	1695-D-60056	Line Pipe - Wash Crossing - Sta. 22343+25 to Sta. 22344+50 - Sheet 2 of 9
43	1695-D-60057	Line Pipe - Wash Crossing - Sta. 22443+50 to Sta. 22450+50 - Sheet 3 of 9
44	1695-D-60058	Line Pipe - Wash Crossing - Sta. 22490+00 to Sta. 22491+00 - Sheet 4 of 9
45	1695-D-60059	Line Pipe - Wash Crossing - Sta. 22523+25 to Sta. 22525+25 - Sheet 5 of 9
46	1695-D-60060	Line Pipe - Wash Crossing - Sta. 22583+00 to Sta. 22585+75 - Sheet 6 of 9

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
47	1695-D-60061	Line Pipe - Wash Crossing - Sta. 22659+50 to Sta. 22660+50 - Sheet 7 of 9
48	1695-D-60062	Line Pipe - Wash Crossing - Sta. 22674+00 to Sta. 22675+00 - Sheet 8 of 9
49	1695-D-60063	Line Pipe - Wash Crossing - Sta. 22717+00 to Sta. 22721+00 - Sheet 9 of 9
Structural:		
50	1695-D-60011	Pumping Plant No. 1 and No. 2 - Air Chamber Building No. 1 and No. 2 - Architectural Floor Plans and Schedules
51	1695-D-60012	Pumping Plant No. 1 and No. 2 - Air Chamber Building No. 1 and No. 2 - Architectural Building Sections and Elevations
52	1695-D-60013	Pumping Plant No. 1 and No. 2 - Air Chamber Building No. 1 and No. 2 - Architectural Roof Plans, Sections, and Details
53	1695-D-60014	Pumping Plant No. 1 and No. 2 - Air Chamber Building No. 1 and No. 2 - Architectural Details
54	1695-D-60015	Pumping Plant No. 1 and No. 2 - Air Chamber Building No. 1 and No. 2 - Concrete Outline and Reinforcement Design Foundations
55	1695-D-60016	Pumping Plant No. 1 and No. 2 - Air Chamber Building No. 1 and No. 2 - Masonry Design Details
56	1695-D-60017	Pumping Plant No. 1 - Air Chamber Building No. 1 - Masonry Design - Plan and Sections
57	1695-D-60018	Pumping Plant No. 2 - Air Chamber Building No. 2 - Masonry Design - Plan and Sections
58	1695-D-60019	Pumping Plant No. 1 and No. 2 - Air Chamber Building No. 1 and No. 2 Structural Steel - Roof Framing Plan, Sections, and Details
59	1695-D-60020	Pumping Plant No. 2 - Regulating Tank No. 1 Overflow Apron - Concrete Outline and Reinforcement Design
Mechanical:		
60	1695-D-60065	Pumping Plant No. 1 - Steel Pipe - Plan and Detail - Sheet 1

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
61	1695-D-60066	Pumping Plant No. 1 - Steel Pipe - Section and Detail - Sheet 2
62	1695-D-60067	Pumping Plant No. 1 - Steel Pipe - Plan and Detail - Sheet 1
63	1695-D-60068	Pumping Plant No. 2 - Steel Pipe - Section and Detail - Sheet 2
64	1695-D-60069	Pumping Plant No. 2 - Regulating Tank No. 12 - Plan, Sections, and Detail - Sheet 1
65	1695-D-60070	Pumping Plant No. 2 - Regulating Tank No. 1 - Sections and Details - Sheet 2
66	1695-D-60071	Regulating Tank No. 2 - Regulating Tank No. 2 and Steel Pipe - Plan, Section, and Detail - Sheet 1
67	1695-D-60072	Regulating Tank No. 2 - Regulating Tank No. 2 and Steel Pipe - Sections and Details - Sheet 2
68	1695-D-60073	Regulating Tank No. 2 - Regulating Tank No. 2 - Sections and Details - Sheet 3
69	1695-D-60075	Pumping Plant Nos. 1 and 2 and Regulating Tank No. 2 - Steel Pipe - Section and Details - Sheet 4
70	1695-D-60076	Pumping Plant Nos. 1 and 2 and Regulating Tank No. 2 - Steel Pipe - Miscellaneous Details - Sheet 1
71	1695-D-60077	Pumping Plant Nos. 1 and 2 and Regulating Tank No. 2 - Miscellaneous Details - Sheet 2
72	1695-D-60078	Pumping Plant No. 1 and No. 2 - Air Chamber - Plan and Sections - Sheet 1
73	1695-D-60079	Pumping Plant No. 1 and No. 2 - Air Chamber - Section and Details - Sheet 2
74	1695-D-60111	Pumping Plant No. 1 and No. 2 - Air Chamber Buildings No. 1 and No. 2 - HVAC - Floor Plan and Schedules
Electrical:		
75	1695-D-60095	SCADA System - Cutter Lateral SCADA Systems Integration Overview

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
76	1695-D-60096	SCADA System - SCADA Network, Security, and Telephone Systems Overview
77	1695-D-60097	SCADA System - SCADA and Security Equipment Cabinets Layouts
78	1695-D-60098	SCADA System - Pole-mounted Cable Splicing Assembly - Plan, Section and Detail
79	1695-D-60103	Cathodic Protection - Tank #1 Galvanic Anode Cathodic Protection - Plan and Section
80	1695-D-60104	Cathodic Protection - Tank #2 Galvanic Anode Cathodic Protection - Plan
81	1695-D-60105	Cathodic Protection - Tank #2 Galvanic Anode Cathodic Protection - Section
82	1695-D-60106	Cathodic Protection - Tank Galvanic Anode Cathodic Protection - Details
83	1695-D-60107	Cathodic Protection - Galvanic Anode Cathodic Protection Anode Bed - Plan and Detail
84	1695-D-60108	Cathodic Protection - Galvanic Anode Cathodic Protection Test Stations and Cable Trench - Details
85	1695-D-60109	Cathodic Protection - Cathodic Protection Bonding and Cable I.D. - Details
86	1695-D-60203	Pumping Plant No. 1 & No. 2 - Symbols and Abbreviations - Piping & Instrumentation Diagram
87	1695-D-60204	Pumping Plant No. 1 - Reach 22A & Pumping Plant No. 1 - Piping & Instrumentation Diagram
88	1695-D-60205	Pumping Plant No. 1 - Pumping Plant No. 1 Units 1 & 2 - Piping & Instrumentation Diagram
89	1695-D-60206	Pumping Plant No. 1 - Pumping Plant No. 1 Units 3 & 4 - Piping & Instrumentation Diagram
90	1695-D-60207	Pumping Plant No. 1 - Pumping Plant No. 1 Air Chamber - Piping & Instrumentation Diagram
91	1695-D-60208	Pumping Plant No. 2 - Regulating Tank No. 1 - Piping & Instrumentation Diagram

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
92	1695-D-60209	Pumping Plant No. 2 - Pumping Plant No. 2 Units 1 & 2 - Piping & Instrumentation Diagram
93	1695-D-60210	Pumping Plant No. 2 - Pumping Plant No. 2 Units 3 & 4 - Piping & Instrumentation Diagram
94	1695-D-60211	Pumping Plant No. 2 - Pumping Plant No. 2 Air Chamber - Piping & Instrumentation Diagram
95	1695-D-60212	NAPI Turnout & Regulating Tank No. 2 - Piping & Instrumentation Diagram
96	1695-D-60213	NAPI Turnout - NAPI Turnout Electrical - Photovoltaic DC Schematic Diagram
97	1695-D-60214	Regulating Tank No. 2 - Regulating Tank No. 2 Electrical - Photovoltaic DC Schematic Diagram
98	1695-D-60215	Pumping Plant No. 1 - Single Line Diagram
99	1695-D-60216	Pumping Plant No. 1 - Pump Unit Controls - Schematic Diagram
100	1695-D-60217	Pumping Plant No. 2 - Single Line Diagram
101	1695-D-60218	Pumping Plant No. 2 - Pump Unit Controls - Schematic Diagram
102	1695-D-60219	Pumping Plant No. 1 - Site Grounding Plan
103	1695-D-60220	Pumping Plant No. 1 - Site Subsurface Conduit Plan
104	1695-D-60221	Pumping Plant No. 1 - Air Chamber Building - Conduit Plan & Section
105	1695-D-60222	Pumping Plant No. 1 - Air Chamber Building - Lighting Plan & Sections
106	1695-D-60223	Pumping Plant No. 2 - Site Grounding Plan
107	1695-D-60224	Pumping Plant No. 2 - Site Subsurface Conduit Plan
108	1695-D-60225	Pumping Plant No. 2 - Air Chamber Building - Conduit Plan & Sections
109	1695-D-60226	Pumping Plant No. 2 - Air Chamber Building - Lighting Plan & Sections

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
110	1695-D-60227	NAPI Turnout Electrical - Site Plan & Sections
111	1695-D-60228	Regulating Tank No. 2 Electrical - Site Plan & Sections
Information Drawings:		
112	1695-D-339	Sta. 22200+00 to End - Plan and Profile
113	1695-D-348	Forebay Tank Drain Pipe - Plan and Profile
114	1695-D-360	Flowmeter Vault - Precast Concrete Structures - Plans and Section
115	1695-D-361	Flow Contro Valve Vault - Concrete Outline and Reinforcement Design - Plan and Sections
116	1695-D-368	Steel Pipe - Plan, Details, and Section
117	1695-D-371	Plan, Sections, and Details - 47,000 Gallon Steel Water Storage Tank
Standard:		
118	40-D-4334	Electrical Installation - Typical Grounding Details - Sheet 1 of 2
119	40-D-4335	Electrical Installation - Typical Grounding Details - Sheet 2 of 2
120	40-D-4753	Electrical Installation - Typical Grounding Details for Switchyards and Substations
121	40-D-5246	Buildings - Method of Building Forms for Successive Lifts
122	40-D-5247	Buildings - Joints in Concrete Structures
123	40-D-6234	Standard Nameplates
124	40-D-6263	General Notes and Minimum Requirements for Detailing Reinforcement
125	40-D-6551	Pressure Pipe - Trench Installation - Select Material
126	40-D-6552	Pressure Pipe Trench Installation - Soil-Cement Slurry - 12 inch or Larger Pipe
127	40-D-7012	General Concrete Outline Notes

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
128	40-D-7016	Chain Link Fencing - Chain Link Fencing Requirements - Soil Installation
129	40-D-7018	Flange Support
130	40-D-7022	Geology for Design & Specifications - Standard Descriptors and Descriptive Criteria for Rock
131	40-D-7023	Geology for Design & Specifications - Standard Descriptors and Descriptive Criteria for Discontinuities
132	40-D-7102	Standard and Typical Designs - Government Drawing Format - Drawing Border, Sample Title Block and Signature Lines
133	40-D-60002	Standard and Typical Designs - Miscellaneous Metalwork - Typical Guard Posts - Non-Security Application
134	103-D-347	Unified Soil Classification Including Identification and Description
135	104-D-254	Electrical Standards - Box Termination
136	104-D-757	Pumping Plant - Electrical Installations - Designations and Symbols
137	104-D-1165	Design Data Typical - Powerplant Pumping Plant - Electrical Installation - Main Control CSA - Panel 7R - Wiring Diagram

Table 52 00 00B - Drawings in Numerical Order	
1695-D	
1695-D-339	113
1695-D-348	114
1695-D-360	115
1695-D-361	116
1695-D-368	117
1695-D-371	118
1695-D-60005	4
1695-D-60006	5
1695-D-60007	6
1695-D-60008	7
1695-D-60009	8

Table 52 00 00B - Drawings in Numerical Order	
1695-D-60010	9
1695-D-60011	51
1695-D-60012	52
1695-D-60013	53
1695-D-60014	54
1695-D-60015	55
1695-D-60016	56
1695-D-60017	57
1695-D-60018	58
1695-D-60019	59
1695-D-60020	60
1695-D-60021	10
1695-D-60022	11
1695-D-60023	12
1695-D-60027	13
1695-D-60028	14
1695-D-60029	15
1695-D-60030	16
1695-D-60031	17
1695-D-60032	18
1695-D-60033	19
1695-D-60034	20
1695-D-60035	21
1695-D-60036	22
1695-D-60037	23
1695-D-60038	24
1695-D-60039	25
1695-D-60040	26
1695-D-60041	27
1695-D-60042	28
1695-D-60043	29
1695-D-60044	30
1695-D-60045	31
1695-D-60046	32
1695-D-60047	33
1695-D-60048	34
1695-D-60049	35
1695-D-60050	36
1695-D-60051	37
1695-D-60052	38
1695-D-60064	38A

Table 52 00 00B - Drawings in Numerical Order	
1695-D-60053	40
1695-D-60054	41
1695-D-60055	42
1695-D-60056	43
1695-D-60057	44
1695-D-60058	45
1695-D-60059	46
1695-D-60060	47
1695-D-60061	48
1695-D-60062	49
1695-D-60063	50
1695-D-60065	61
1695-D-60066	62
1695-D-60067	63
1695-D-60068	64
1695-D-60069	65
1695-D-60070	66
1695-D-60071	67
1695-D-60072	68
1695-D-60073	69
1695-D-60075	70
1695-D-60076	71
1695-D-60077	72
1695-D-60078	73
1695-D-60079	74
1695-D-60095	76
1695-D-60096	77
1695-D-60097	78
1695-D-60098	79
1695-D-60103	80
1695-D-60104	81
1695-D-60105	82
1695-D-60106	83
1695-D-60107	84
1695-D-60108	85
1695-D-60109	86
1695-D-60111	75
1695-D-60203	87
1695-D-60204	88
1695-D-60205	89
1695-D-60206	90

Table 52 00 00B - Drawings in Numerical Order	
1695-D-60207	91
1695-D-60208	92
1695-D-60209	93
1695-D-60210	94
1695-D-60211	95
1695-D-60212	96
1695-D-60213	97
1695-D-60214	98
1695-D-60215	99
1695-D-60216	100
1695-D-60217	101
1695-D-60218	102
1695-D-60219	103
1695-D-60220	104
1695-D-60221	105
1695-D-60222	106
1695-D-60223	107
1695-D-60224	108
1695-D-60225	109
1695-D-60226	110
1695-D-60227	111
1695-D-60228	112
1659-529	
1695-529-401	1
1695-529-60068	2
1695-529-60077	3
40-D	
40-D-4334	119
40-D-4335	120
40-D-4753	121
40-D-5246	122
40-D-5247	123
40-D-60002	134
40-D-6234	124
40-D-6263	125
40-D-6551	126
40-D-6552	127
40-D-7012	128
40-D-7016	129
40-D-7018	130
40-D-7022	131

Table 52 00 00B - Drawings in Numerical Order	
40-D-7023	132
40-D-7102	133
103-D	
103-D-347	135
104-D	
104-D-254	136
104-D-757	137
104-D-1165	138

END OF SECTION

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TANK DATA			
TANK DESIGNATION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TOTAL VOLUME (gal)
Forebay Tank	20.08	22	51,900

CONTROL POINTS			
POINT	STATION	OFFSET ⁻¹	ELEVATION
CP-1	22247+44.72	45.00	5816.0
CP-2	22249+44.72	45.00	5816.0
CP-3	22248+33.68	48.00	5814.5
CP-4	22249+44.72	50.23	5813.4
CP-5	22249+50.11	45.00	5813.3
CP-6	22249+50.31	-65.00	5812.2
CP-7	22247+95.63	77.20	5816.7
CP-8	22247+83.92	49.00	5814.0
CP-9	22247+47.72	49.78	5813.6
CP-10	22247+39.79	45.00	5813.5
CP-11	22247+39.59	-65.00	5812.4

⁻¹ Offset (±) is relative to the Reach 22B alignment direction of flow. A positive (+) offset refers to the right side of the alignment looking downstream and a negative (-) offset refers to the left side of the alignment looking downstream.

GENERAL NOTES

All vertical elevations are based on NAVD1988 vertical datum.

Horizontal datum is shown in New Mexico State Coordinate System, West Zone (NAD83). A grid factor of 0.999620438002 was used.

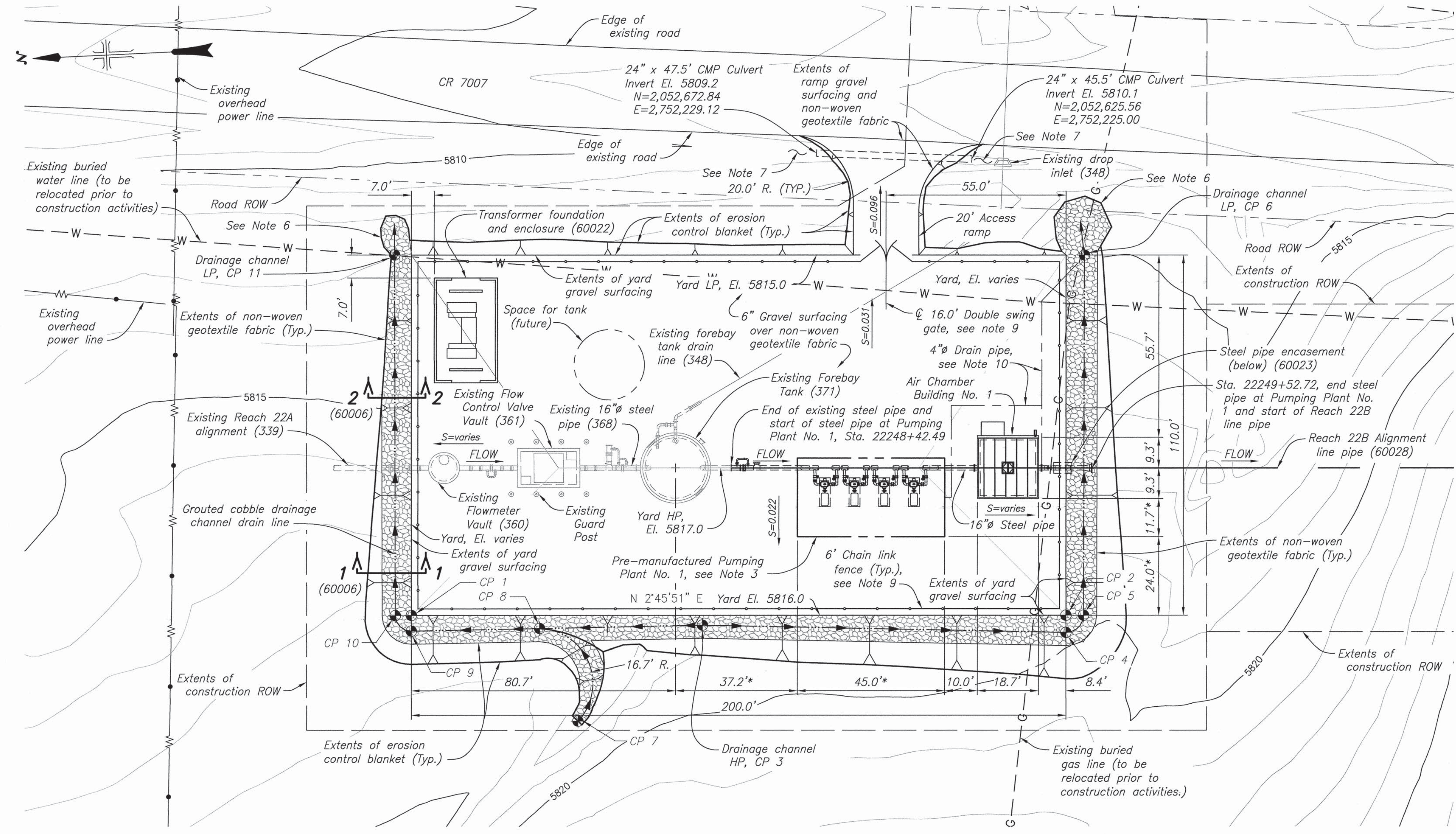
* Indicates dimensions or elevations to be determined by the Contractor or field verified prior to construction.

(Future) Indicates items to be constructed at a later date and under a different contract.

- NOTES**
- For Structural Design Data, see (60017).
 - For Reach 22B alignment location and details, see (60028).
 - Pre-manufactured pumping plant is conceptual and shall be Contractor-designed. See Specifications for pre-manufactured pumping plant design requirements. Contour intervals are 1.0 ft.
 - Permanent cut slopes required for the construction of the site shall be 2:1 maximum, and permanent placement slopes required for the construction of this site shall be 2:1 minimum.
 - Extend the non-woven geotextile fabric and grouted cobble as directed by the COR at drainage channel low points. Transition the drainage channel slope to tie into existing grade.
 - Locally adjust the drainage grading upstream and downstream of the CMP culvert as directed by the COR. Provide a 0.5-ft elevation offset between top of gravel and the finished concrete elevations for any vault, building, tank, or equipment foundation.
 - Locally adjust the finished gravel surfacing elevations around the Pumping Plant No. 1 site as directed by the COR.
 - For chain link fencing and double swing gate details, see 40-D-7016.
 - Drain piping for Pumping Plant No. 1 and Air Chamber Building No. 1 shall drain to daylight as directed by the COR. For piping details refer to Foundation and Building Drainage Piping, Specifications Section 22 13 16.

REFERENCE DRAWINGS

GENERAL	1695-529-401
GENERAL MAP	1695-529-2228
LOCATION MAP	1695-529-2228
HYDRAULIC EQUIPMENT	1695-D-60065
STEEL PIPE	1695-D-60065
WATER CONVEYANCE	1695-D-60027
LINE PIPE	1695-D-60027
AIR CHAMBER BUILDING NO. 1	1695-D-60011
ARCHITECTURAL	1695-D-60011
STRUCTURAL	1695-D-60017



PLAN
SCALE OF FEET

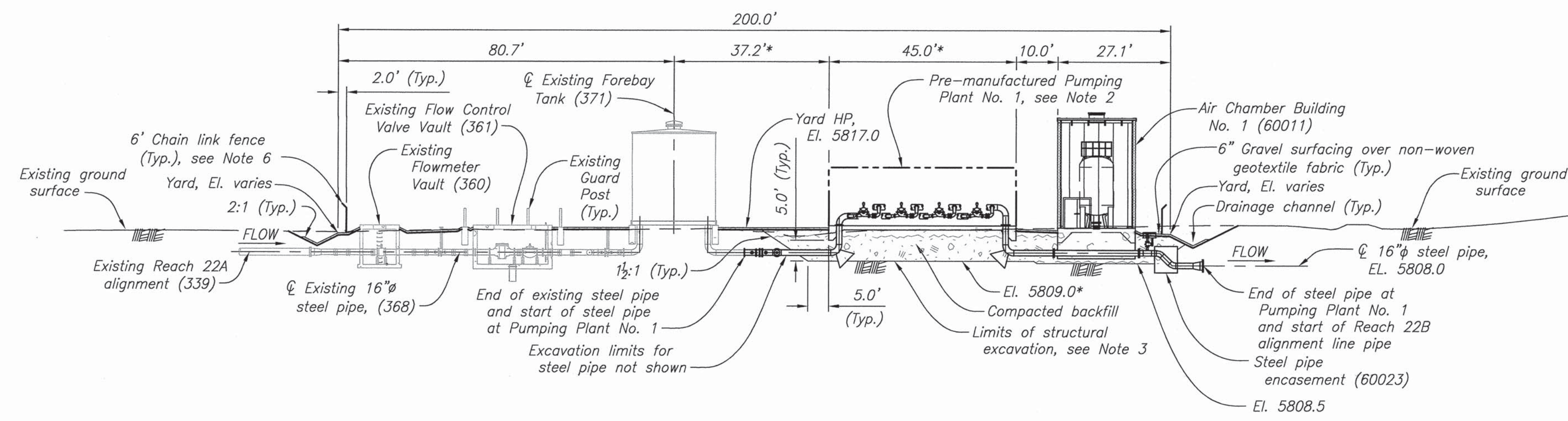
DATE AND TIME PLOTTED: JULY 7, 2016 12:15
 PLOTTED BY: BMMOTTERLOO
 CAD SYSTEM: AutoCAD File: 1695-D-60005 - PPT SITE PLAN PL1.DWG
 1695-D-60005 - PPT SITE PLAN PL1.DWG

ALWAYS THINK SAFETY
 U.S. DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 NAVAJO GALLUP WATER SUPPLY PROJECT - NEW MEXICO
CUTTER LATERAL - REACH 22B
PUMPING PLANT NO. 1

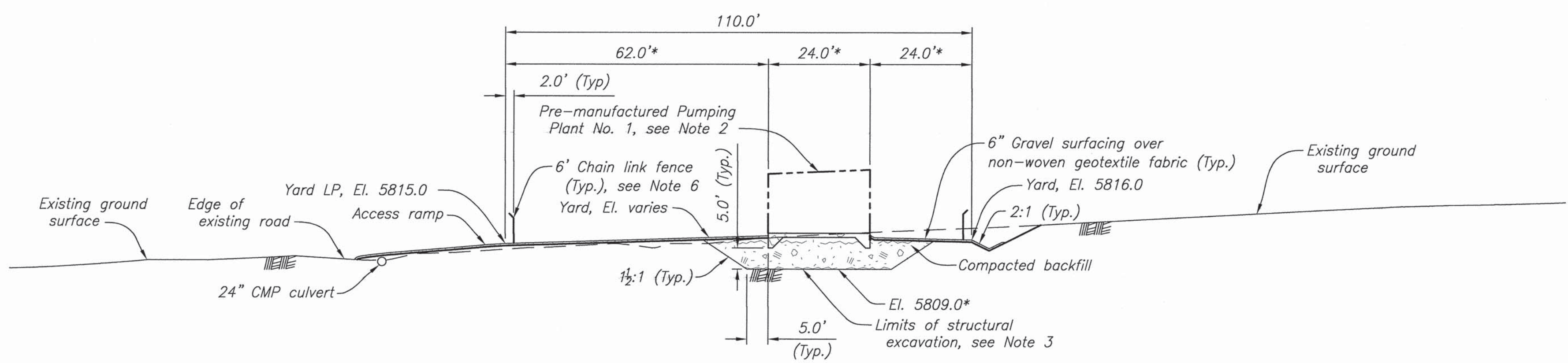
REVISED PLAN VIEW FOR TRANSFORMER FOUNDATION AND ENCLOSURE AND REVISED NOTE 6
 1
 B. D. VanOtterloo, P.E.
 B. D. VanOtterloo, P.E.

DESIGNED: B. D. VanOtterloo
 DRAWN: Justin L. Dorrough
 CHECKED: Kevin O'Shea, P.E.
 TECH. APPR.: Alfred I. Bernstein
 APPROVED: Alfred I. Bernstein
 PEER REVIEWER - Alfred I. Bernstein
 DENVER, CO 2016-03-31

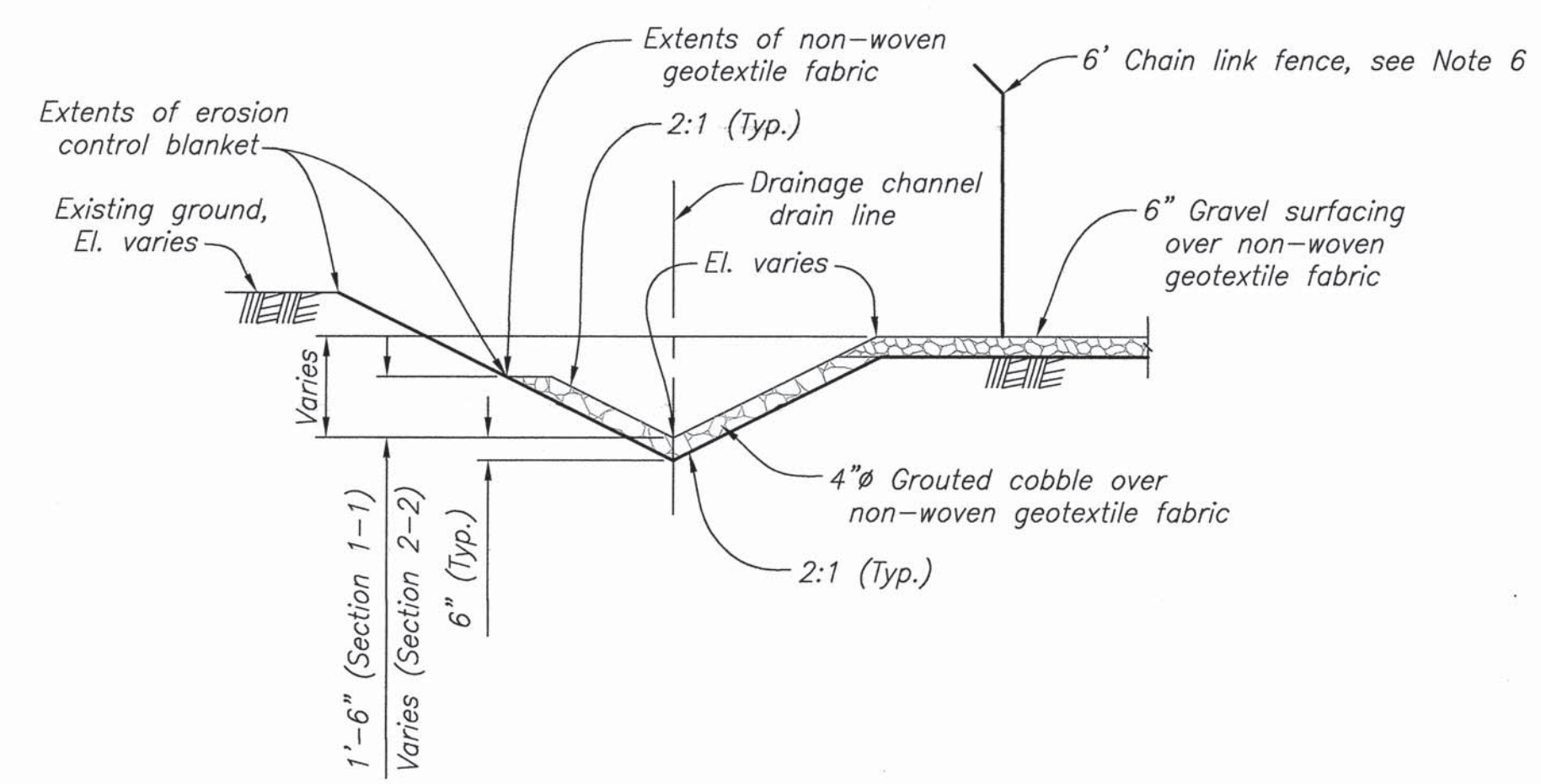
PUMPING PLANT NO. 1
SITE PLAN
 PLAN
1695-D-60005
 SHEET 1



LONGITUDINAL SECTION THRU YARD (60005)
SCALE OF FEET



TRANSVERSE SECTION THRU YARD (60005)
SCALE OF FEET



SECTION 1-1 (60005) (AS SHOWN AND AS NOTED)
SECTION 2-2 (60005) (SIMILAR AND AS NOTED)
(NOT TO SCALE)

NOTES

- For General Notes, see (60005).
- Pre-manufactured pumping plant is conceptual and shall be Contractor-designed. See Specifications for pre-manufactured pumping plant design requirements.
- Excavate 5 feet below and 5 feet beyond the extents of the pumping plant building foundation and air chamber building foundation bearing surfaces. Compact the excavation pit bottom surface and backfill the excavated area with suitable native material per the Specifications.
- Permanent cut slopes required for the construction of the site shall be 2:1 maximum, and permanent placement slopes required for the construction of this site shall be 2:1 minimum.
- Locally adjust the finished gravel surfacing elevations around the Pumping Plant No. 1 site as directed by the COR. Provide a 0.5-ft elevation offset between top of gravel and the finished concrete elevations for any vault, building, tank, or equipment foundation.
- For chain link fencing and double swing gate details, see 40-D-7016.

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
NAVAJO GALLUP WATER SUPPLY PROJECT - NEW MEXICO

CUTTER LATERAL - REACH 22B
PUMPING PLANT NO. 1

REVISED TRANSVERSE SECTION THRU YARD AND
REVISED NOTE 5.
REV NO 1
2016-07-07 5:41 PM B. D. VANOTTERLOO, P.E.
B. D. VANOTTERLOO, P.E.

B. D. VanOtterloo
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PEER REVIEWER - Alfred I. Bernstein
DENVER, CO 2016-03-31

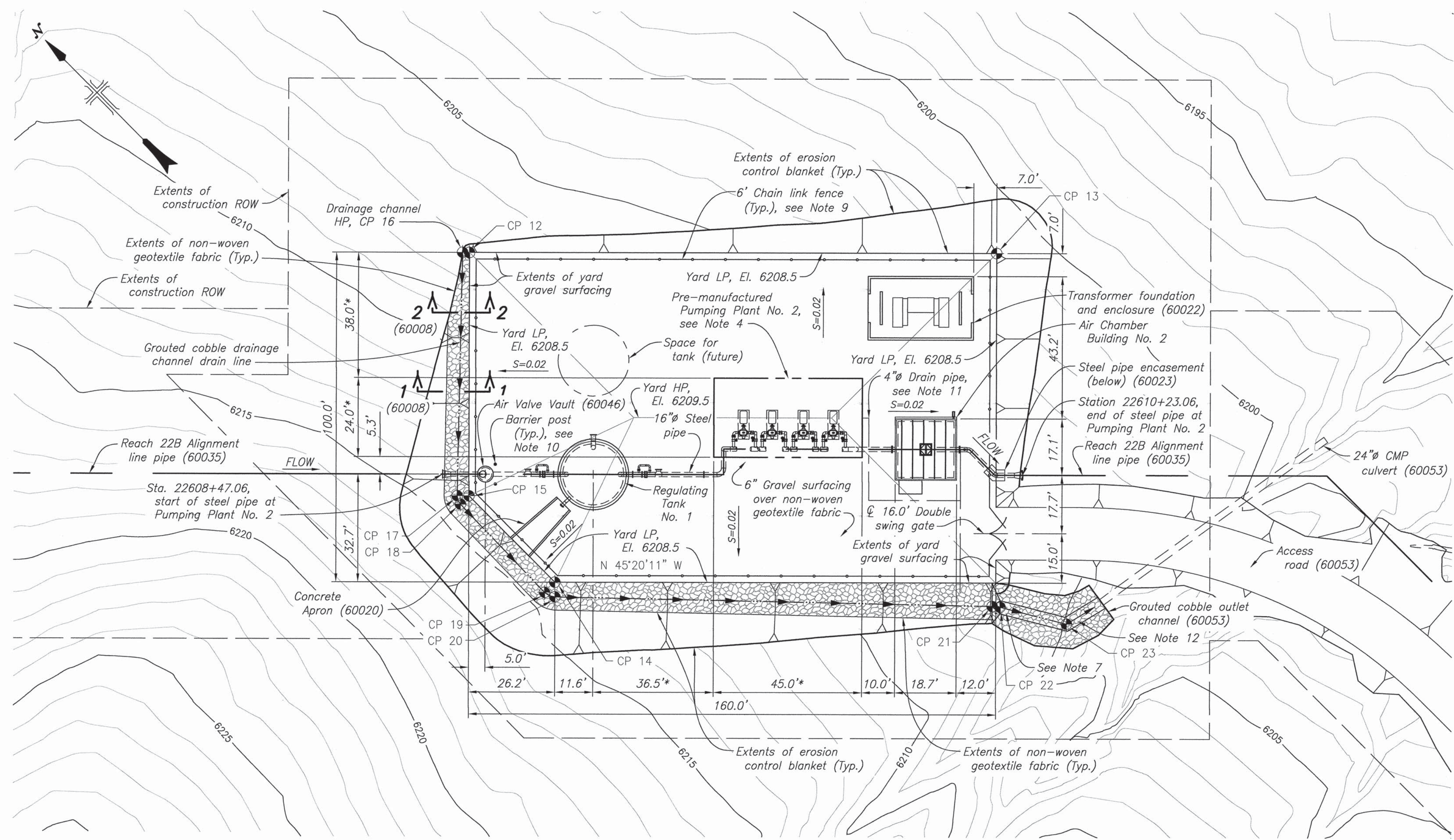
PUMPING PLANT NO. 1
SITE PLAN
SECTIONS THRU YARD
AND SECTIONS

1695-D-60006

SHEET 1

DATE AND TIME PLOTTED
JULY 7, 2016 12:36
PLOTTED BY
BMANOTTERLOO

CAD SYSTEM
AutoCAD Rev. 20.09
CAD FILENAME
1695-D-60006 - P01 SITE SECTIONS R18W16



PLAN
SCALE OF FEET
0 20 40 60

TANK DATA			
TANK DESIGNATION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TOTAL VOLUME (gal)
Regulating Tank No. 1	20	25	58,800

CONTROL POINTS			
POINT	STATION	OFFSET ⁻¹	ELEVATION
CP-12	22608+55.06	-67.25	6208.5
CP-13	22610+15.06	-67.25	6208.5
CP-14	22608+81.23	32.75	6208.5
CP-15	22608+55.06	6.58	6208.5
CP-16	22608+52.98	-67.25	6208.0
CP-17	22608+51.49	6.58	6207.6
CP-18	22608+52.48	9.13	6207.5
CP-19	22608+78.12	35.82	6206.8
CP-20	22608+81.23	37.19	6206.7
CP-21	22610+13.94	39.82	6205.5
CP-22	22610+16.36	40.05	6205.4
CP-23	22610+36.54	45.14	6202.5

⁻¹ Offset (±) is relative to the Reach 22B alignment direction of flow. A positive (+) offset refers to the right side of the alignment looking downstream and a negative (-) offset refers to the left side of the alignment looking downstream.

NOTES

- For General Notes, see (60005).
- For Structural Design Data, see (60017).
- For Reach 22B alignment location and details, see (60035).
- Pre-manufactured pumping plant is conceptual and shall be Contractor-designed. See Specifications for pumping plant design requirements.
- Contour intervals are 1.0 ft.
- Permanent cut slopes required for the construction of the site shall be 2:1 maximum, and permanent placement slopes required for the construction of this site shall be 2:1 minimum.
- For trapezoidal Outlet Channel Section, see (60053). Transition the drainage channel slope to tie into the outlet channel as directed by the COR.
- Locally adjust the finished gravel surfacing elevations around the Pumping Plant No. 2 site as directed by the COR. Provide a 0.5-ft elevation offset between top of gravel and the finished concrete elevations for any vault, building, tank, or equipment foundation.
- For chain link fencing and double swing gate details, see 40-D-7016.
- For barrier post details, see (60046). Locate barrier post around the Air Valve Vault per the direction of the COR.
- Drain piping for Pumping Plant No. 2 and Air Chamber Building No. 2 shall drain to daylight as directed by the COR. For piping details refer to Foundation and Building Drainage Piping, Specifications Section 22 13 16.
- Transition the outlet channel into the culvert as directed by the COR.

REFERENCE DRAWINGS

GENERAL	-----	1695-529-401
GENERAL MAP	-----	1695-529-2201
LOCATION MAP	-----	1695-529-2200
HYDRAULIC EQUIPMENT	-----	1695-D-60067
STEEL PIPE	-----	1695-D-60069
STORAGE TANK	-----	1695-D-60069
WATER CONVEYANCE	-----	1695-D-60027
LINE PIPE	-----	1695-D-60027
AIR CHAMBER BUILDING NO. 2	-----	1695-D-60011
ARCHITECTURAL	-----	1695-D-60011
STRUCTURAL	-----	1695-D-60018

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 BUREAU OF RECLAMATION
 NAVAJO GALLUP WATER SUPPLY PROJECT - NEW MEXICO
CUTTER LATERAL - REACH 22B
PUMPING PLANT NO. 2

REVISED PLAN VIEW FOR TRANSFORMER FOUNDATION AND ENCLOSURE AND REVISIONS
 B. D. VanOtterloo, P.E.
 B. D. VanOtterloo, P.E.
 1

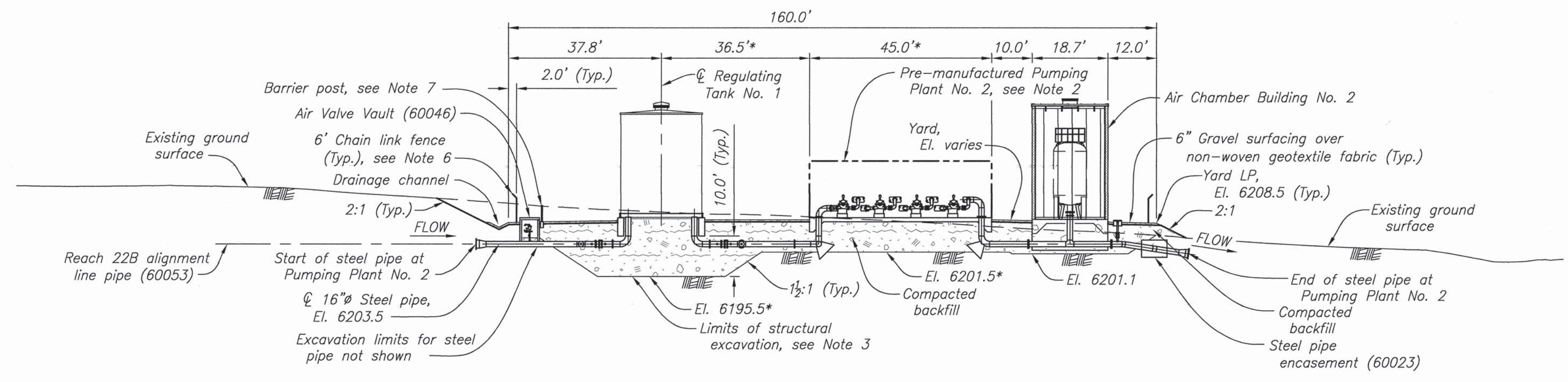
B. D. VanOtterloo
 DESIGNED
 B. D. VanOtterloo
 DRAWN
 Justin L. Dorough
 CHECKED
 Kevin O'Shea, P.E.
 TECH. APPR.
 Alfred I. Bernstein
 APPROVED
 ADMIN APPROVAL - Alfred I. Bernstein
 DENVER, CO 2016-03-31

PUMPING PLANT NO. 2
SITE PLAN

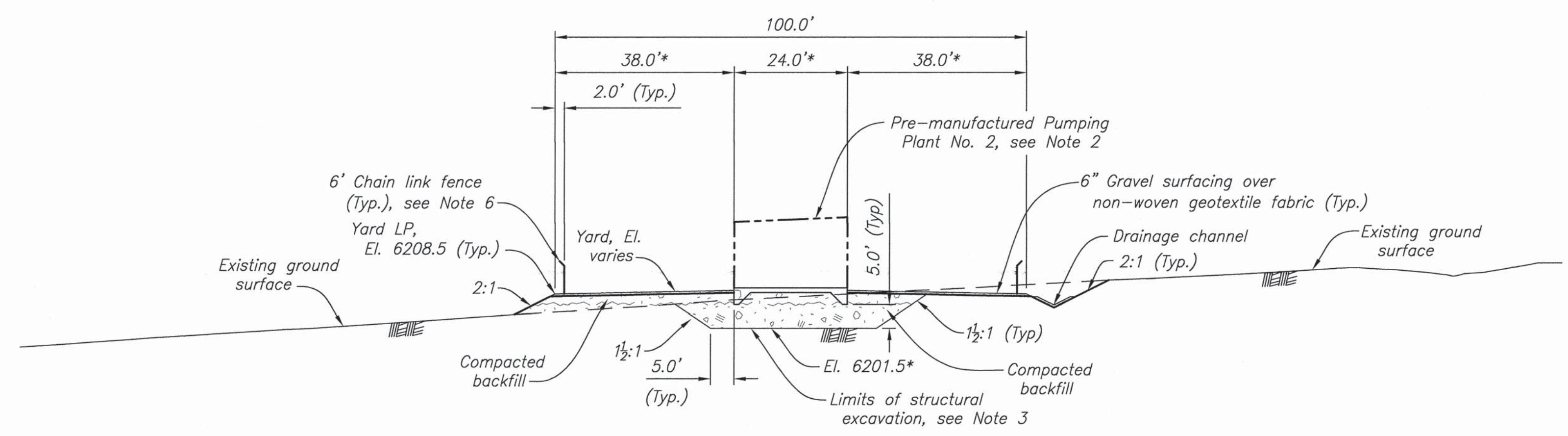
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1695-D-60007
SHEET 1

DATE AND TIME PLOTTED
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 PLOTTED BY
 B.VANOTTERLOO

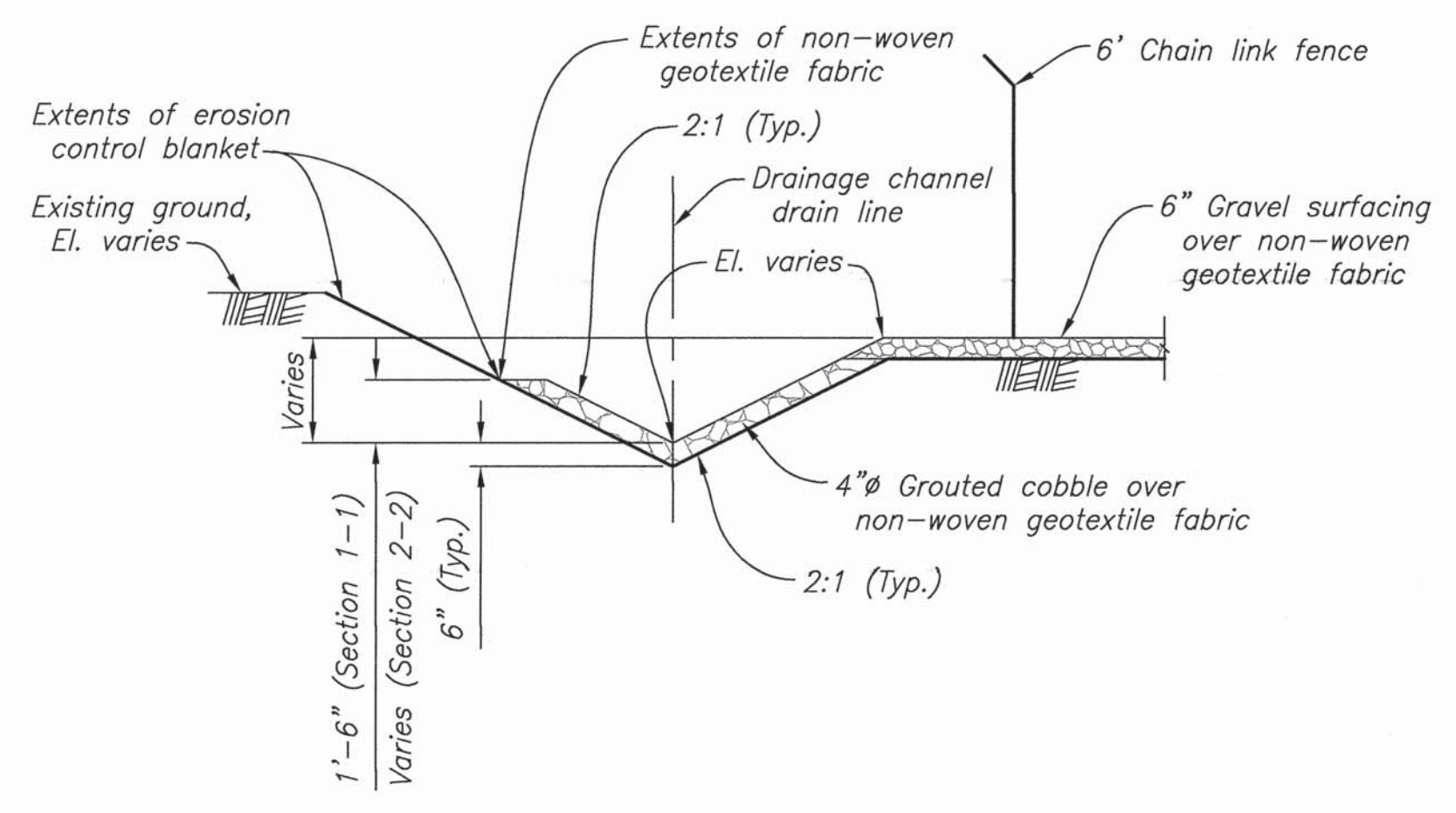
CAD SYSTEM
 AutoCAD Rev. 20.08
 CAD FILENAME
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LONGITUDINAL SECTION THRU YARD (60007)
SCALE OF FEET



TRANSVERSE SECTION THRU YARD (60007)
SCALE OF FEET



SECTION 1-1 (60007) (AS SHOWN AND AS NOTED)
SECTION 2-2 (60007) (SIMILAR AND AS NOTED)
(NOT TO SCALE)

NOTES

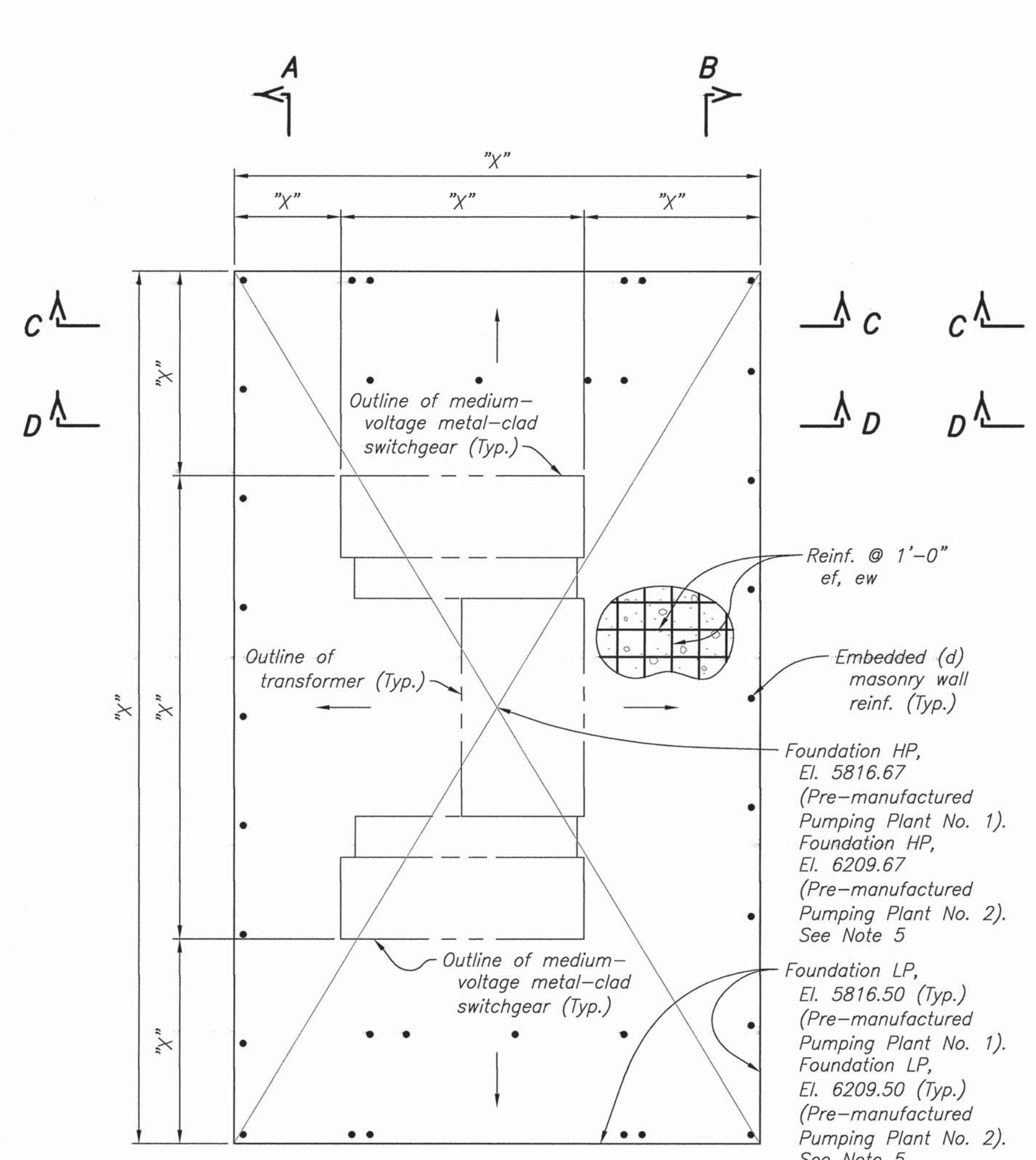
- For General Notes, see (60005).
- Pre-manufactured pumping plant is conceptual and shall be Contractor-designed. See Specifications for pumping plant design requirements.
- Excavate 5 feet below and 5 feet beyond the extents of the pumping plant building foundation and air chamber building foundation bearing surfaces. Excavate 10 feet below and 5 feet beyond the extents of the regulating tank foundation bearing surface. Compact the excavation pit bottom surface and backfill the excavated area with suitable native material per Specifications.
- Permanent cut slopes required for the construction of the site shall be 2:1 maximum, and permanent placement slopes required for the construction of this site shall be 2:1 minimum.
- Locally adjust the finished gravel surfacing elevations around the Pumping Plant No. 2 site as directed by the COR. Provide a 0.5-ft elevation offset between top of gravel and the finished concrete elevations for any vault, building, tank, or equipment foundation.
- For chain link fencing and double swing gate details, see 40-D-7016.
- For barrier post details, see (60046). Locate barrier post around the Air Valve Vault per the direction of the COR.

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
NAVAJO GALLUP WATER SUPPLY PROJECT - NEW MEXICO
CUTTER LATERAL - REACH 22B
PUMPING PLANT NO. 2

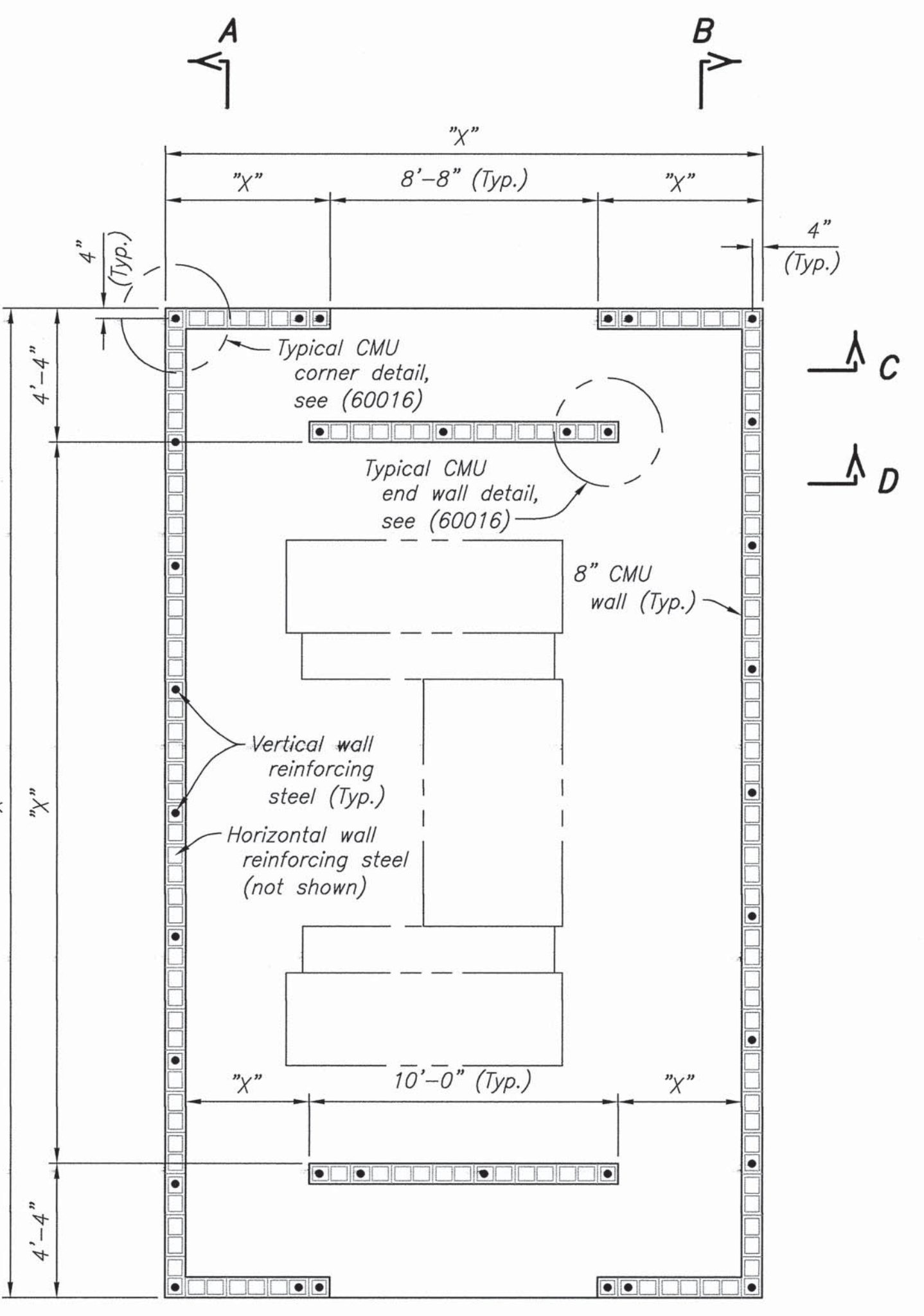
DESIGNED	B. D. VanOtterloo
DRAWN	B. D. VanOtterloo
CHECKED	Justin L. Dorrough
TECH. APPR.	Kevin O'Shea, P.E.
APPROVED	Alfred L. Bernstein
PEER REVIEWER	Alfred L. Bernstein
DENVER, CO	2016-03-31

PUMPING PLANT NO. 2
SITE PLAN
SECTIONS THRU YARD
AND SECTIONS

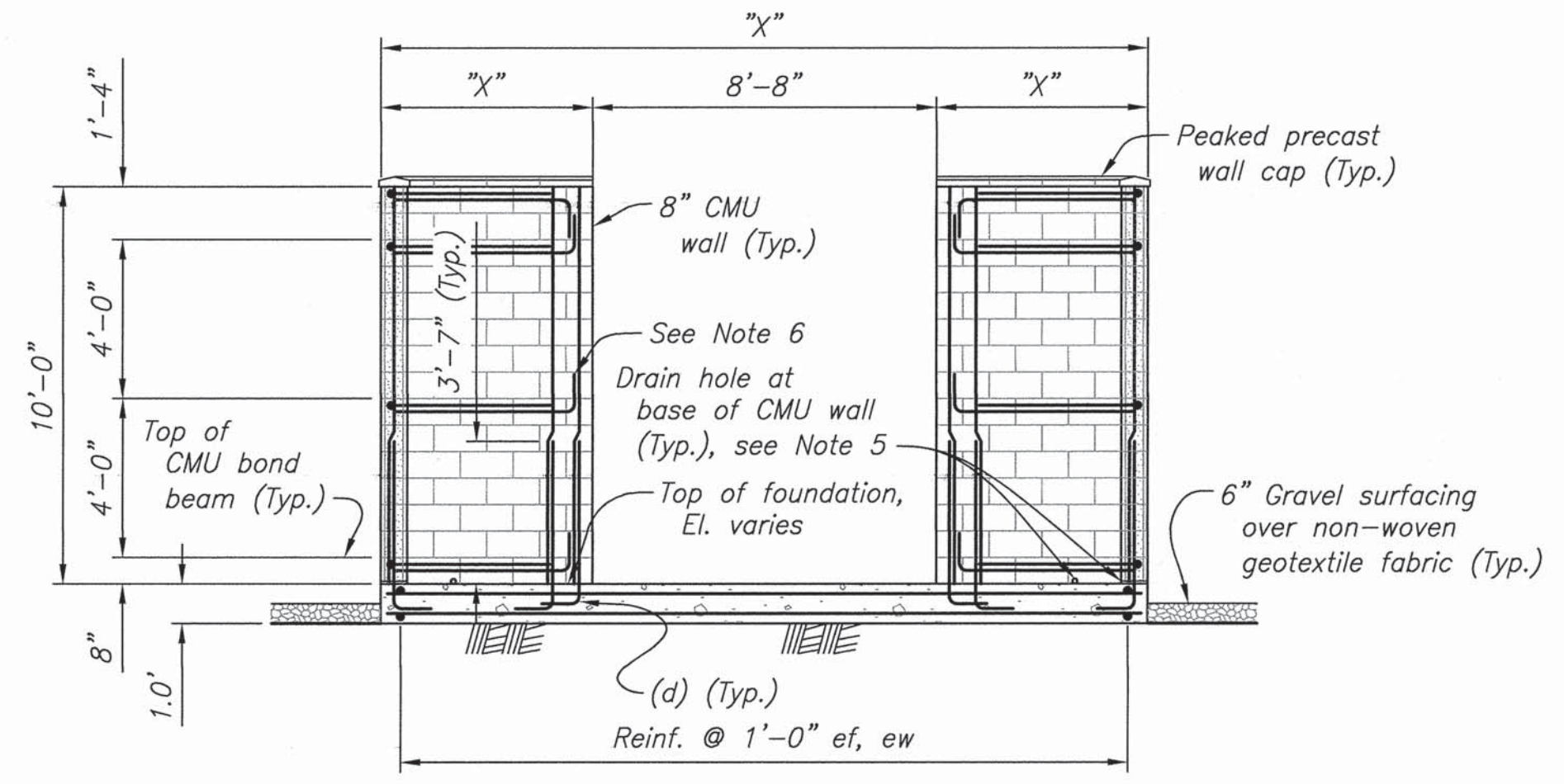
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CADD FILENAME: 1695-D-60008 - PPS SITE SECTIONS RDRWG



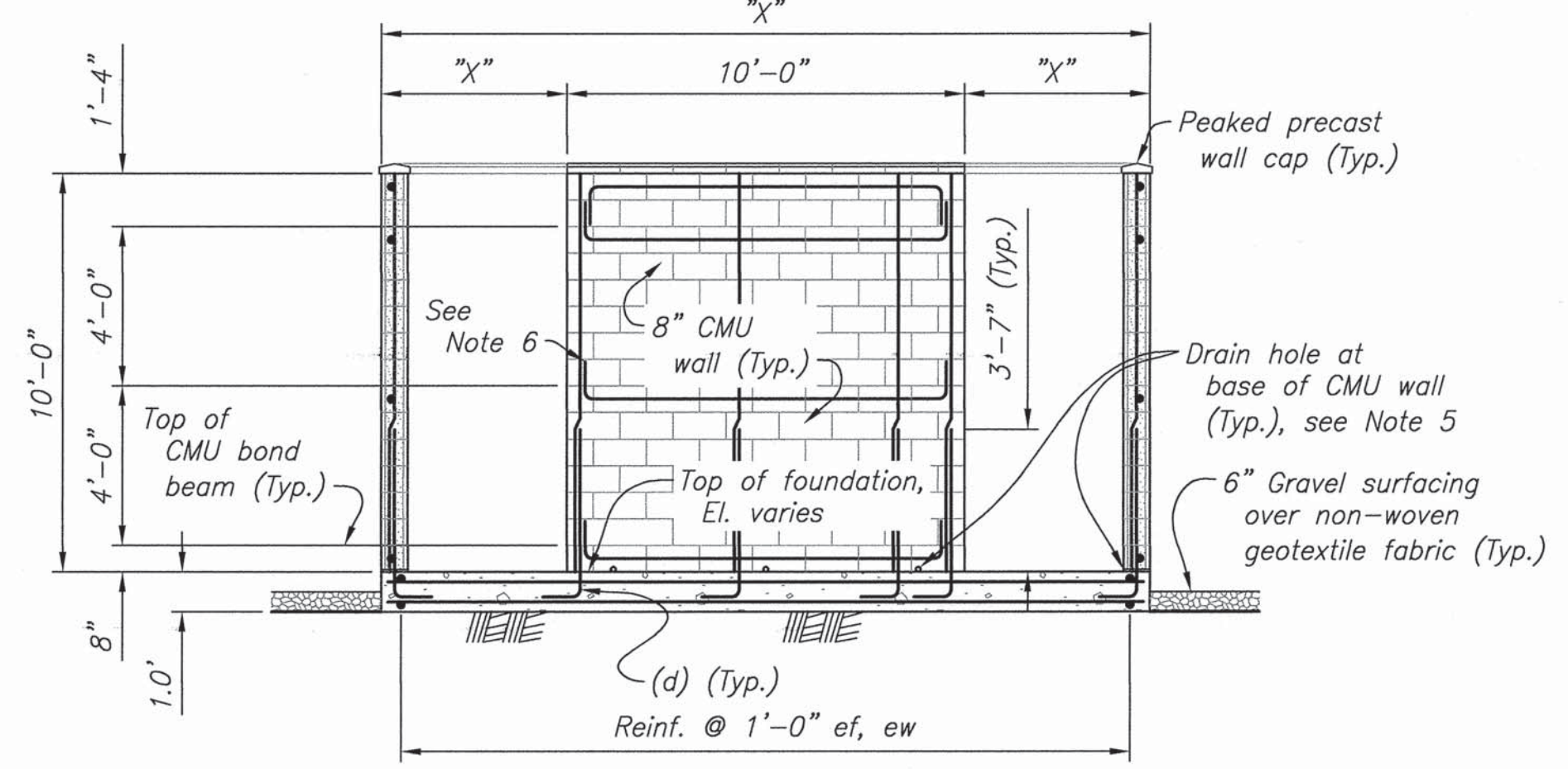
PLAN - TRANSFORMER FOUNDATION
TRANSFORMER AND MEDIUM-VOLTAGE METAL-CLAD SWITCHGEAR AT PRE-MANUFACTURED PUMPING PLANT NO. 1 AND NO. 2



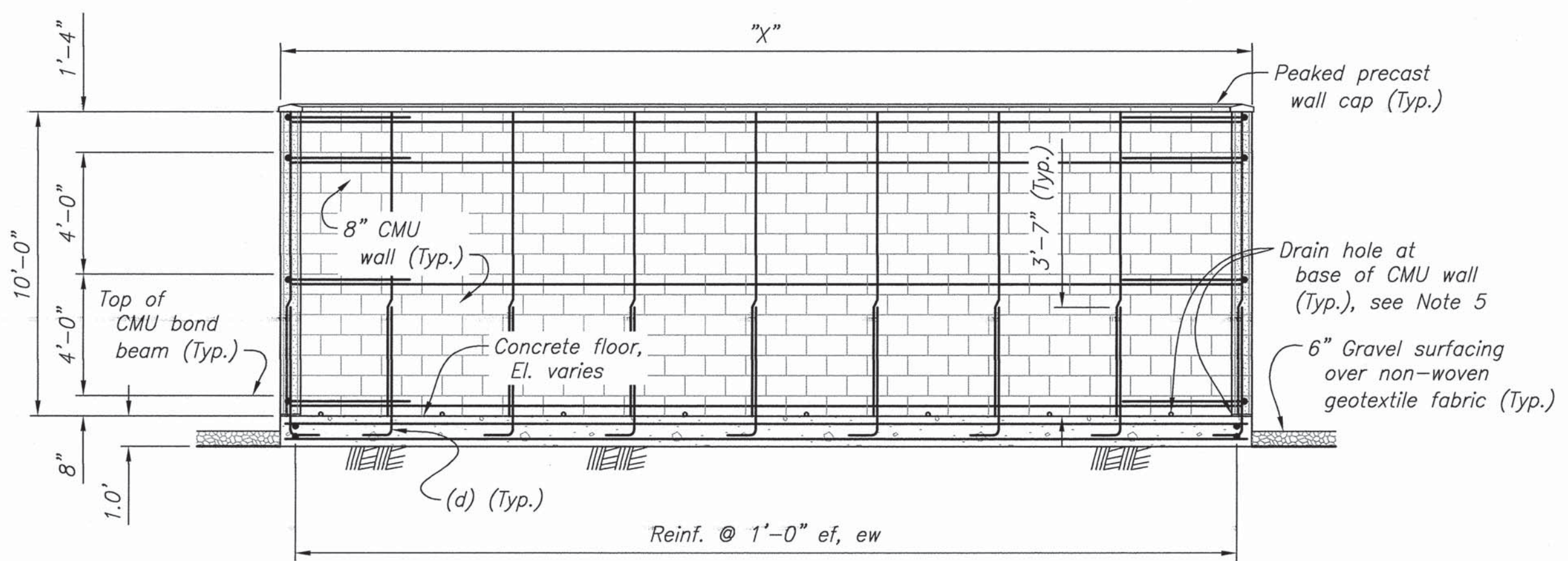
PLAN - TRANSFORMER ENCLOSURE
TRANSFORMER AND MEDIUM-VOLTAGE METAL-CLAD SWITCHGEAR AT PRE-MANUFACTURED PUMPING PLANT NO. 1 AND NO. 2



SECTION C-C



SECTION D-D



SECTION A-A
SECTION B-B

NOTES

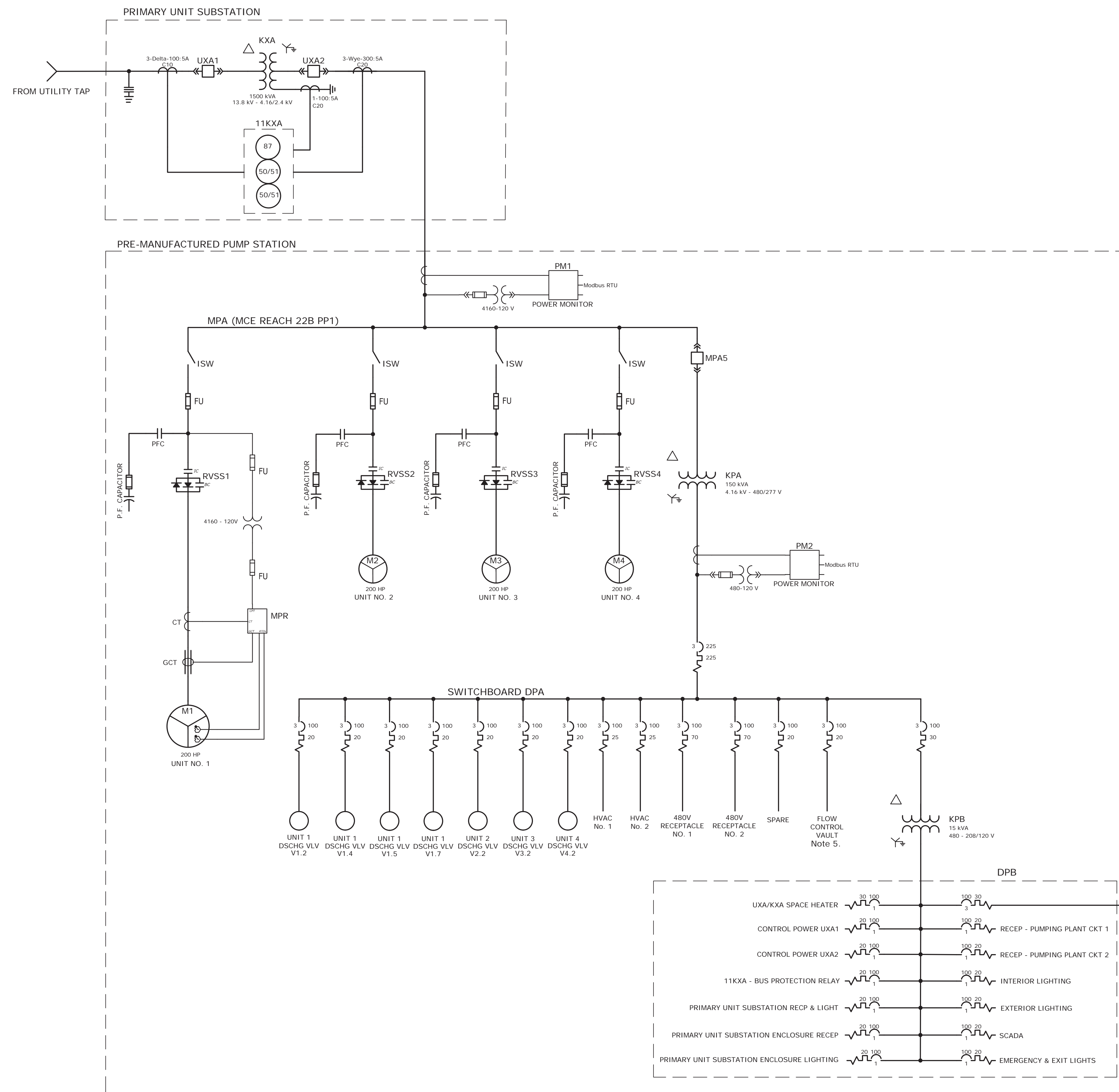
1. For General Notes, see (60005).
2. For locations and orientations of the transformer foundations and enclosures, see (60005) and (60007).
3. For Concrete Outline General Notes and Reinforcement Design General Notes, see (60015).
4. For Masonry Design General Notes and Typical Details, see (60016).
5. Slope the foundation surface from the centerline of the foundation as shown. Provide holes at the base of the CMU walls for drainage at 4'-0" on center or as directed by the COR.
6. Extension for a 90° standard hook shall not be less than 10".
7. All dowels, vertical reinforcement, and horizontal reinforcement are #6.
8. All CMU vertical wall reinforcement shall be spaced at 4'-0" max. on centers unless otherwise shown on the drawing.
9. For transformer and medium-voltage metal-clad switchgear information, see Specifications.
10. Government determines "X" dimensions after receipt of approved Contractor-furnished drawings and data for the electrical equipment involved.



DATE AND TIME PLOTTED: JULY 7, 2016 14:55
 PLOTTED BY: BMMOTTERLOO
 CAD SYSTEM: AutoCAD R14
 CAD FILENAME: 1695-D-60022 R1 - TRANSFORMER FOUNDATION AND ENCLOSURE.DWG
 1695-D-60022 R1 - TRANSFORMER FOUNDATION AND ENCLOSURE.DWG

DESIGNED: B. D. VanOtterloo
 DRAWN: Justin L. Dorrough
 CHECKED: Kevin O'Shea, P.E.
 TECH. APPR.
 APPROVED: Alfred L. Bernstein
 PEER REVIEWER - Alfred L. Bernstein
 DENVER, CO 2016-03-31

TRANSFORMER FOUNDATIONS AND ENCLOSURES
 PLANS AND SECTIONS
 1695-D-60022
 SHEET 1



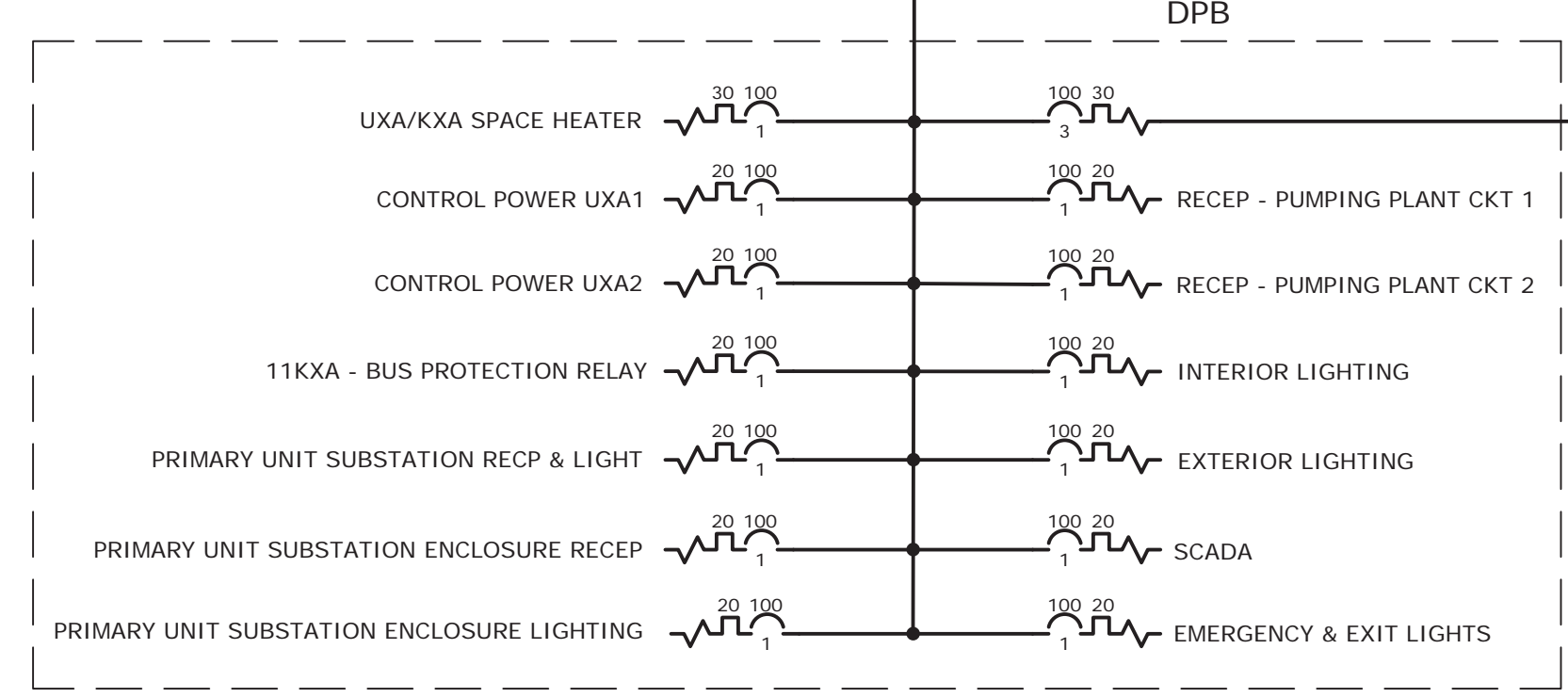
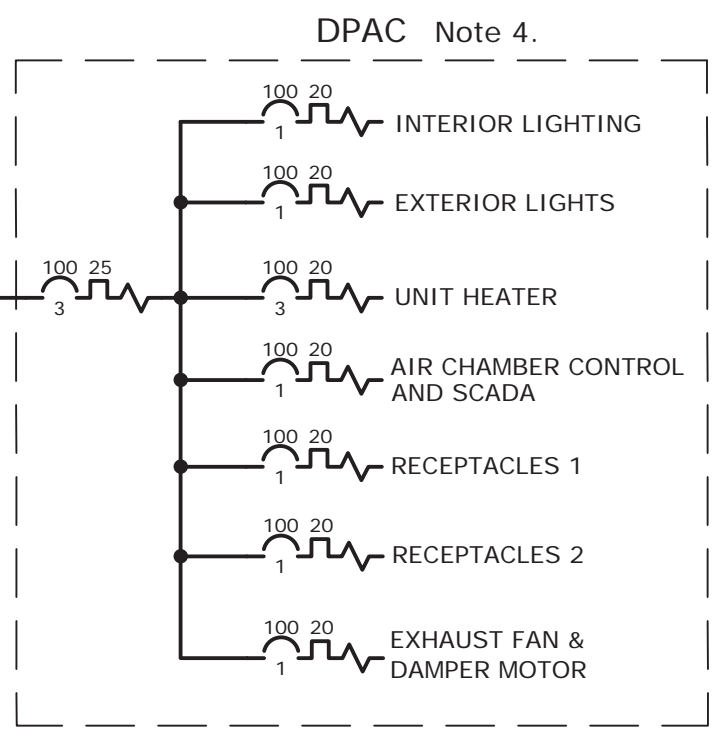
EXPLANATION

DEVICE	LOCATION	DESCRIPTION
11KXA	Primary Unit Substation	MULTIFUNCTION TRANSFORMER PROTECTIVE RELAY
MPR	Motor starter	MULTIFUNCTION MOTOR PROTECTIVE RELAY
PM1	MPA	POWER MONITOR 1
PM2	DPA	POWER MONITOR 2
RVSS1	Motor starter	MOTOR 1 REDUCED VOLTAGE SOFT STARTER (SIMILAR FOR MOTORS 2 THROUGH 4)

- NOTES**
- Pre-Manufactured Pump Station Single Line Diagram for reference only. Actual distribution equipment ratings and arrangement to be determined by pump station supplier.
 - Circuit breaker ratings are estimated. Actual ratings to be determined by contractor based on equipment furnished.
 - Facility equipment designations:
 - DPA 480 Volt Station-Service Switchboard
 - DPAC Air Chamber Building 208/120 Volt Panelboard
 - DPB Pump Station 208/120 Volt Panelboard
 - KPA 4.16kV-480 Volt Station-Service Transformer
 - KPB 480-208/120 Volt Station-Service Transformer
 - KXA 13.8-4.16 kVolt Primary Unit Substation Transformer
 - M1-M4 Main Pump Motors
 - MPA Pump Station Motor Control Equipment
 - MPA5 Medium Voltage Feeder Breaker for Station-Service
 - UXA1 15KV Switchgear
 - UXA2 4.16KV Switchgear
 - Air Chamber Panelboard, DPAC, provided by others. Power to be supplied from pre-manufactured pump station 208/120 V power panel. Approximate load 8kVA.
 - Approximate load 10kVA. See drawing 1695-D-375 for panelboard schedule.

REFERENCE DRAWINGS

Flow Control Vault Plan 1695-D-375
Panelboard Schedule 1695-D-375



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BUREAU OF RECLAMATION
NAVAJO-GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL - REACH 22B

PUMPING PLANT NO. 1

REV. NO. 1
2016-07-15
Kelly, John T P.E.

D ADDED PRIMARY UNIT SUBSTATION AND ASSOCIATED EQUIPMENT, REMOVED MV SWITCHGEAR EQUIPMENT.

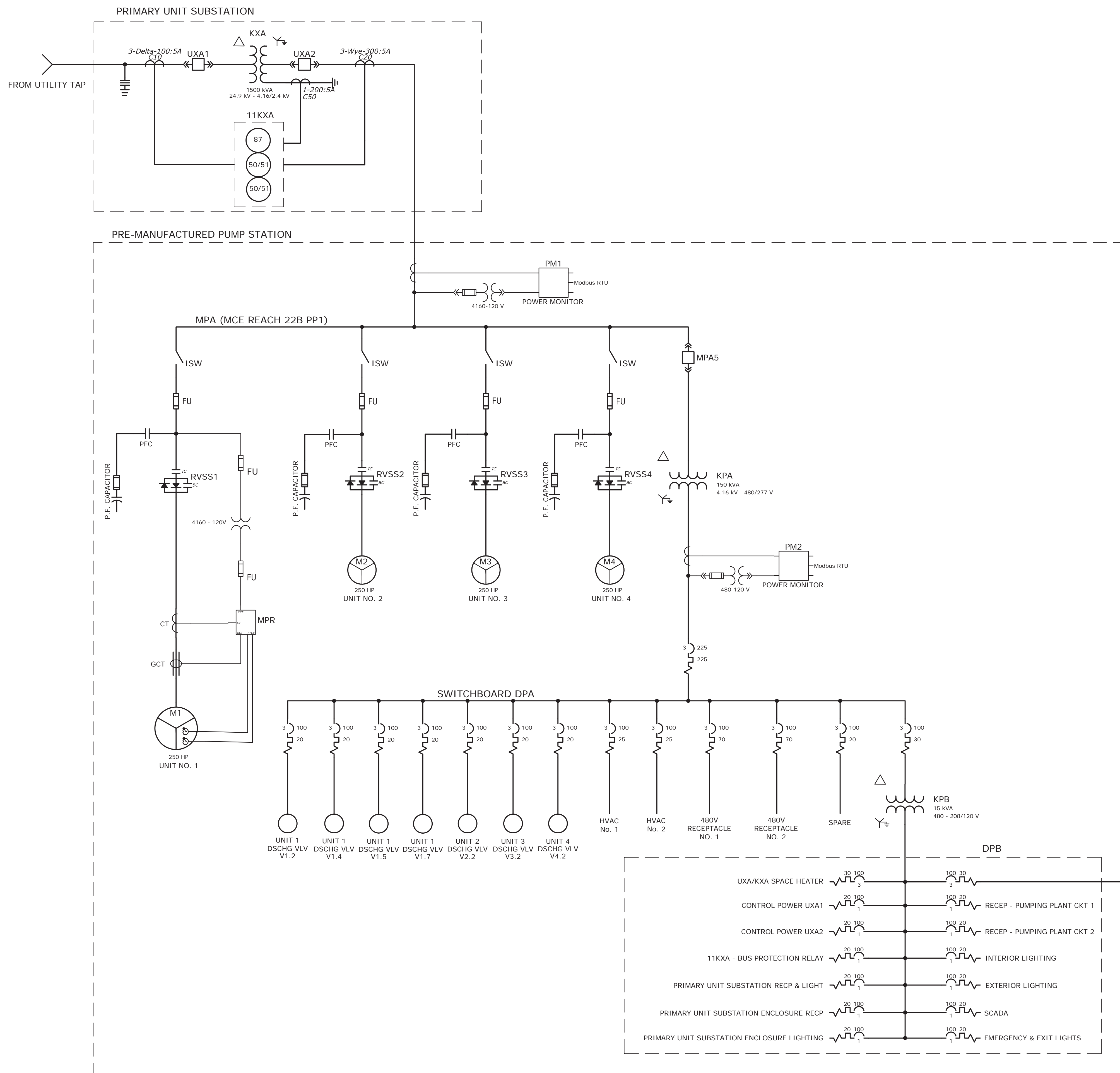
DESIGNED: Darryl Liscomb
DRAWN: Darryl Liscomb
CHECKED: Robert Cass
TECH. APPR.: Gentry, Lisa K P.E.
APPROVED: Boggess, Jay S
ADMIN. APPROVAL: Manager, Electrical Design Group
DENVER, CO 2016-03-28

PUMPING PLANT NO. 1

SINGLE LINE DIAGRAM

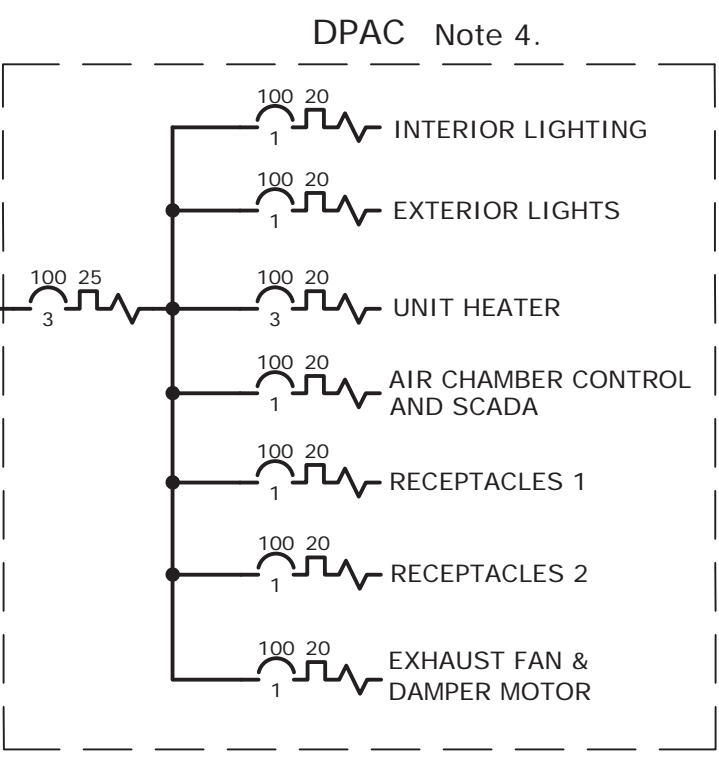
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 PLOTTED BY: DALISCOMB
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EXPLANATION		
DEVICE	LOCATION	DESCRIPTION
11KXA	Primary Unit Substation	MULTIFUNCTION TRANSFORMER PROTECTIVE RELAY
MPR	Motor starter	MULTIFUNCTION MOTOR PROTECTIVE RELAY
PM1	MPA	POWER MONITOR 1
PM2	DPA	POWER MONITOR 2
RVSS1	Motor starter	MOTOR 1 REDUCED VOLTAGE SOFT STARTER (SIMILAR FOR MOTORS 2 THROUGH 4)

- NOTES**
- Pre-Manufactured Pump Station Single Line Diagram for reference only. Actual distribution equipment ratings and arrangement to be determined by pump station supplier.
 - Circuit breaker ratings are estimated. Actual ratings to be determined by contractor based on equipment furnished.
 - Facility equipment designations:
 - DPA 480 Volt Station-Service Switchboard
 - DPAC Air Chamber Building 208/120 Volt Panelboard
 - DPB Pump Station 208/120 Volt Panelboard
 - KPA 4.16kV-480 Volt Station-Service Transformer
 - KPB 480-208/120 Volt Station-Service Transformer
 - KXA 24.9-4.16 kVolt Primary Unit Substation Transformer
 - M1-M4 Main Pump Motors
 - MPA Pump Station Motor Control Equipment
 - MPA5 Medium Voltage Feeder Breaker for Station-Service
 - UXA1 25KV Switchgear
 - UXA2 4.16KV Switchgear
 - Air Chamber Panelboard, DPAC, provided by others. Power to be supplied from pre-manufactured pump station 208/120 V power panel. Approximate load 8kVA.



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BUREAU OF RECLAMATION
NAVAJO-GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL - REACH 22B

PUMPING PLANT NO. 2

REV. NO. 1
2016-07-15
Kelly, John T. P.E.

Darryl Liscomb
DESIGNED
Darryl Liscomb
DRAWN
Robert Cass
CHECKED
Gentry, Lisa K P.E.
TECH. APPR.
Bogges, Jay S
APPROVED
ADEN APPROVAL - Manager, Electrical Design Group
DENVER, CO 2016-03-28

PUMPING PLANT NO. 2

SINGLE LINE DIAGRAM

1695-D-60217

SHEET 1

Released

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JULY 14, 2016 12:48
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DALSCOMB

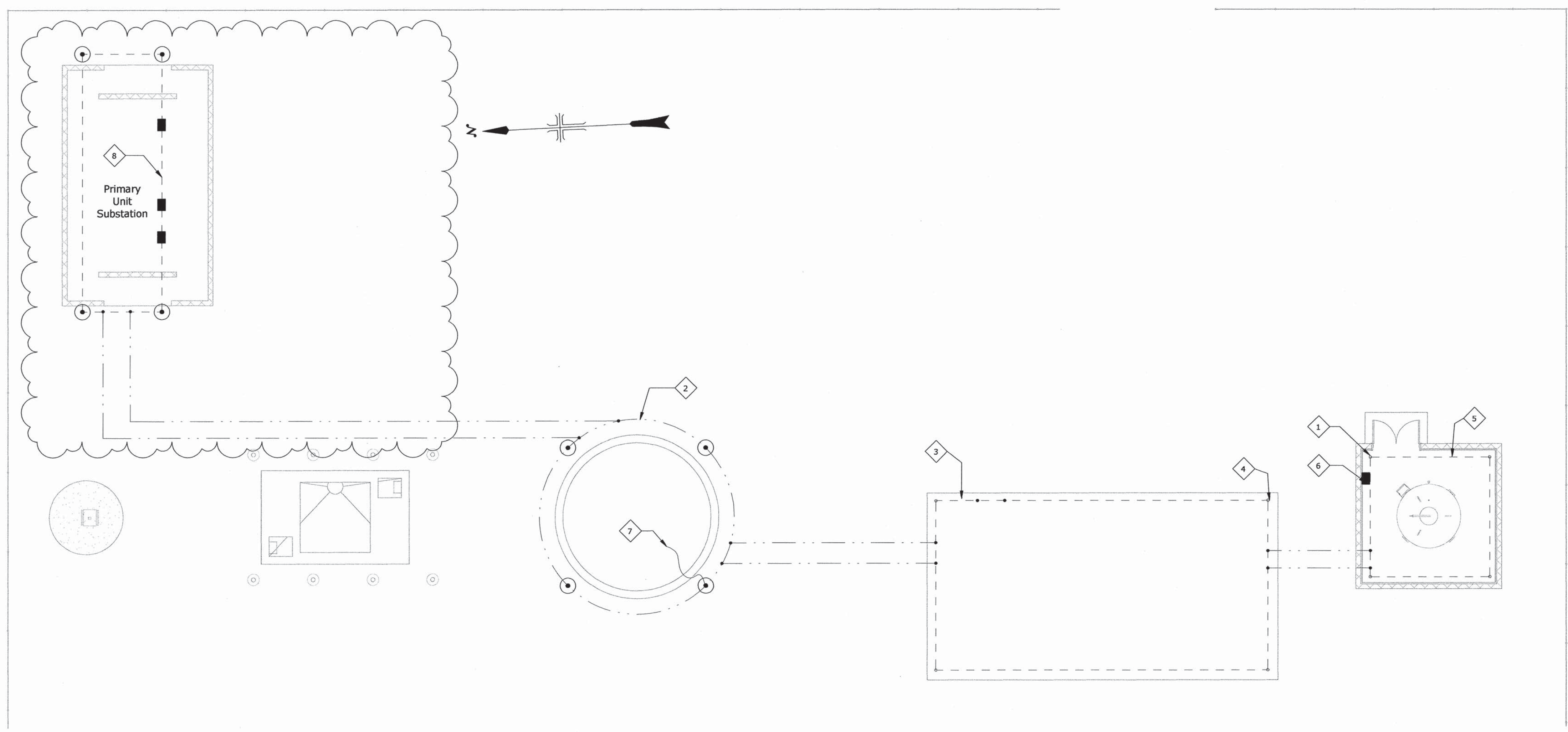
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1695-D-60217-RD-1.DWG

REV	NO	DATE	NAME	PROF. ABBR.	STA	DESCRIPTION
1		2016-07-14	John Acjly P.E.	SW	D	ADDED PRIMARY UNIT SUBSTATION GROUNDING EQUIPMENT, REMOVED MV SWITCHGEAR EQUIPMENT.

Darryl Liscomb	DESIGNED
Darryl Liscomb	DRAWN
Robert D. Cass	CHECKED
Lisa Gentry P.E.	TECH. APPR.
Jay Boggs	APPROVED
Adviser Approver - Manager, Electrical Design Group	
DENVER, CO	4/5/2016

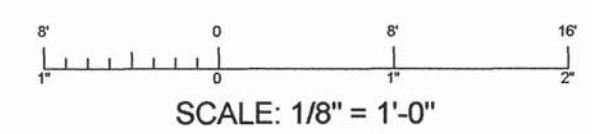
PUMPING PLANT NO. 1
SITE GROUNDING PLAN

1695-D-60219



SITE GROUNDING PLAN

Scale: 1/8" = 1'-0"



GENERAL NOTES

1. Grounding system conductors are stranded bare copper.
2. The pre-manufactured pump station ground ring is to be attached to the footing reinforcement steel or grounding rods. Grounding method is dependent on design and construction of the building foundation. Internal structure and equipment grounding to be designed by supplier and attached to the foundation ground ring.
3. All embedded ground terminations to be performed using Cadweld, Thermoweld, or an equivalent exothermic process.
4. Location of ground cable terminations to be determined by the contractor.
5. Grounding layout drawing shows typical locations of grounding plates.
6. Connect Forebay Tank steel structures to the tank ground ring.
7. Connect structural steel members to the embedded ground ring.
8. Connect steel roof structure for the air chamber building to the building ground ring using risers in locations shown. Risers to be fed through the concrete masonry units.

GROUNDING - KEYNOTES

Value	Text
1	RISER TO FOOTING REINFORCEMENT STEEL AND ROOF STRUCTURAL STEEL (TYPICAL).
2	TANK BURIED GROUND RING.
3	PRE-MANUFACTURED PUMP STATION EMBEDDED GROUND BUS.
4	RISER TO FOOTING REINFORCEMENT STEEL (TYPICAL).
5	AIR CHAMBER BUILDING EMBEDDED GROUND BUS.
6	DPAC GROUNDING PAD
7	BARE COPPER WIRE TO TANK STEEL STRUCTURE.
8	PRIMARY UNIT SUBSTATION GROUND BUS AND EQUIPMENT GROUNDING PADS.

GROUNDING SYSTEM CONDUCTORS

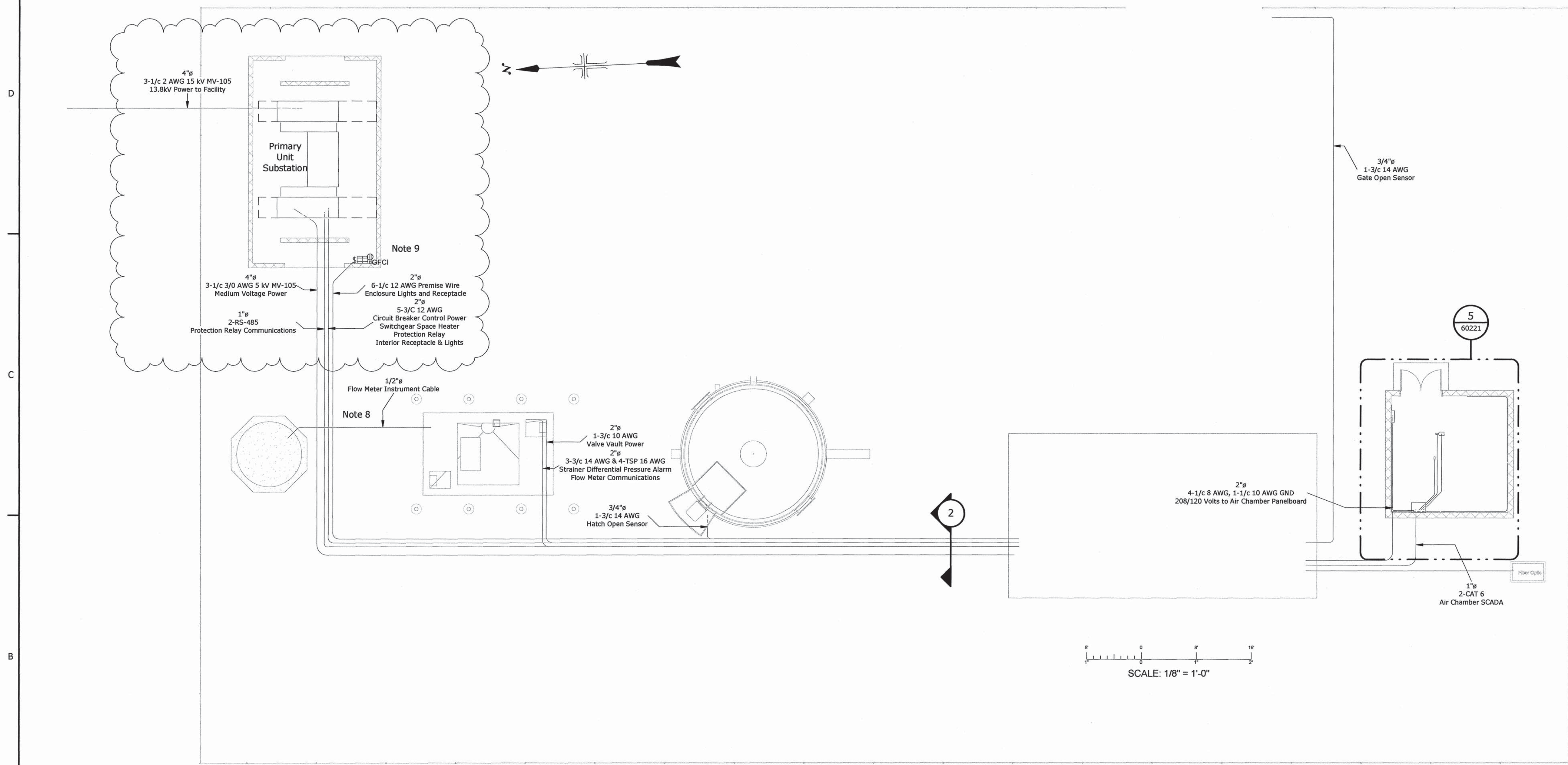
- 4/0 AWG Pump station embedded ground bus
- 4/0 AWG Forebay tank ground ring
- 4/0 AWG Ground risers
- 4/0 AWG Air chamber building embedded ground bus

EQUIPMENT GROUNDING JUMPERS

- 4/0 AWG Forebay Tank
- 4/0 AWG 4160V Switchboard UXA
- 2 AWG 208Y/120V Distribution Equipment
- 2 AWG Air Chamber PLC & SCADA Cabinet

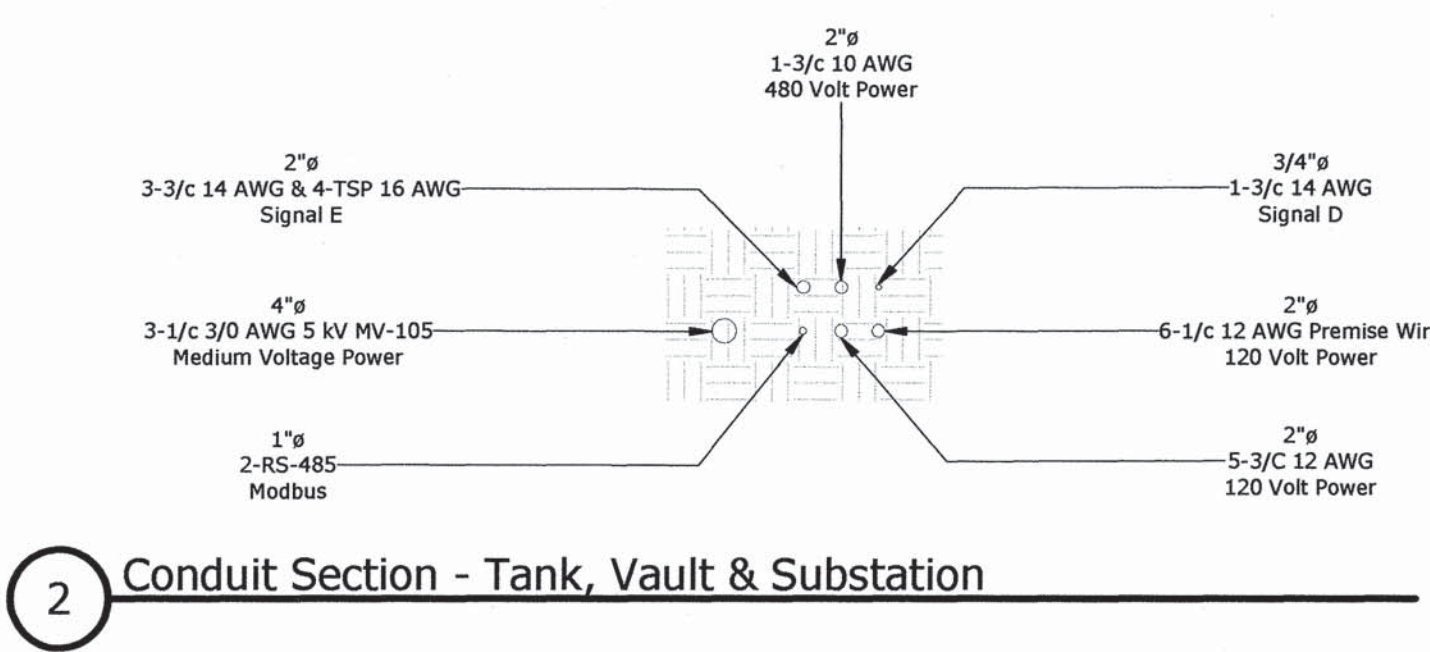
GROUNDING - SYMBOLS

- Ground cable buried in earth
- - - Ground cable embedded in concrete
- Ground cable exposed
- Welded or bolted connection
- Riser or grounding electrode conductor
- ⊙ Ground rod
- Grounding plate



SITE CONDUIT PLAN

Scale: 1/8" = 1'-0"



GENERAL NOTES

1. Conduit routings are typical. Determine actual location for conduit and stub-ups in the field.
2. The minimum cover for exterior conduit to 24 inches to top of highest conduit.
3. Coordinate placement of conduit entering pre-manufactured pump station with building manufacturer.
4. Coordinate conduit placement under/in building slabs with piping systems.
5. Ventilation and Lighting system conduit shown as an example only. Determine cable and conduit size based on approved equipment.
6. Buried conduit to be Plastic Coated Rigid Steel (PCRS).
7. Exposed conduit to be Rigid Metallic Conduit (RMC).
8. Conduit installed under the Reach 22A contract.
9. Unit Substation Enclosure to include the following lighting equipment: TYPE AA Fixture, Light Switch, and NEMA5-20R GFCI receptacle with while-in-use cover.

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
NAVAJO GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL - REACH 22B
PUMPING PLANT NO. 1

REV	NO	DATE	NAME	PROF. ABBR.	DESCRIPTION
2		2016-06-20	John Kelly P.E.		ADDED PRIMARY UNIT SUBSTATION AND SWITCHGEAR EQUIPMENT.
1		2016-05-05	Lisa Gentry P.E.		ADDED 1-1/2" 10 AWG GND TO CONDUIT FOR DPAC FEEDER.

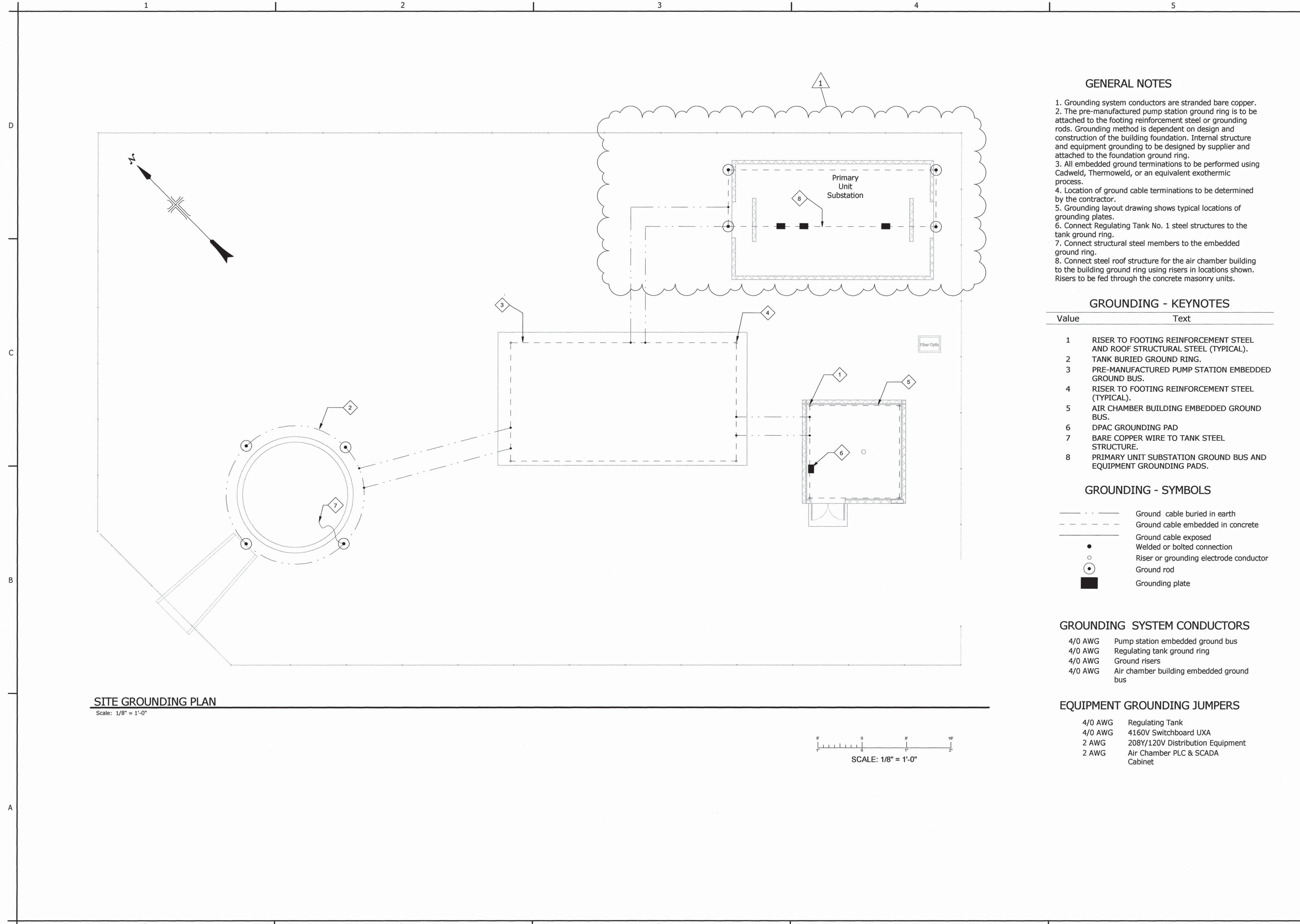
DESIGNED: Darryl Liscomb
DRAWN: Robert D. Cass
CHECKED: Lisa Gentry P.E.
TECH. APPR.: Jay Bogness
APPROVED: Admin Approver - Manager, Electrical Design Group

DENVER, CO 4/5/2016

PUMPING PLANT NO. 1

SITE SUBSURFACE CONDUIT PLAN

1695-D-60220



GENERAL NOTES

1. Grounding system conductors are stranded bare copper.
2. The pre-manufactured pump station ground ring is to be attached to the footing reinforcement steel or grounding rods. Grounding method is dependent on design and construction of the building foundation. Internal structure and equipment grounding to be designed by supplier and attached to the foundation ground ring.
3. All embedded ground terminations to be performed using Cadweld, Thermoweld, or an equivalent exothermic process.
4. Location of ground cable terminations to be determined by the contractor.
5. Grounding layout drawing shows typical locations of grounding plates.
6. Connect Regulating Tank No. 1 steel structures to the tank ground ring.
7. Connect structural steel members to the embedded ground ring.
8. Connect steel roof structure for the air chamber building to the building ground ring using risers in locations shown. Risers to be fed through the concrete masonry units.

GROUNDING - KEYNOTES

Value	Text
1	RISER TO FOOTING REINFORCEMENT STEEL AND ROOF STRUCTURAL STEEL (TYPICAL).
2	TANK BURIED GROUND RING.
3	PRE-MANUFACTURED PUMP STATION EMBEDDED GROUND BUS.
4	RISER TO FOOTING REINFORCEMENT STEEL (TYPICAL).
5	AIR CHAMBER BUILDING EMBEDDED GROUND BUS.
6	DPAC GROUNDING PAD
7	BARE COPPER WIRE TO TANK STEEL STRUCTURE.
8	PRIMARY UNIT SUBSTATION GROUND BUS AND EQUIPMENT GROUNDING PADS.

GROUNDING - SYMBOLS

- Ground cable buried in earth
- - - Ground cable embedded in concrete
- Ground cable exposed
- Welded or bolted connection
- Riser or grounding electrode conductor
- ⊙ Ground rod
- Grounding plate

GROUNDING SYSTEM CONDUCTORS

- 4/0 AWG Pump station embedded ground bus
- 4/0 AWG Regulating tank ground ring
- 4/0 AWG Ground risers
- 4/0 AWG Air chamber building embedded ground bus

EQUIPMENT GROUNDING JUMPERS

- 4/0 AWG Regulating Tank
- 4/0 AWG 4160V Switchboard UXA
- 2 AWG 208Y/120V Distribution Equipment
- 2 AWG Air Chamber PLC & SCADA Cabinet

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
NAVAJO GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL - REACH 22B
PUMPING PLANT NO. 2

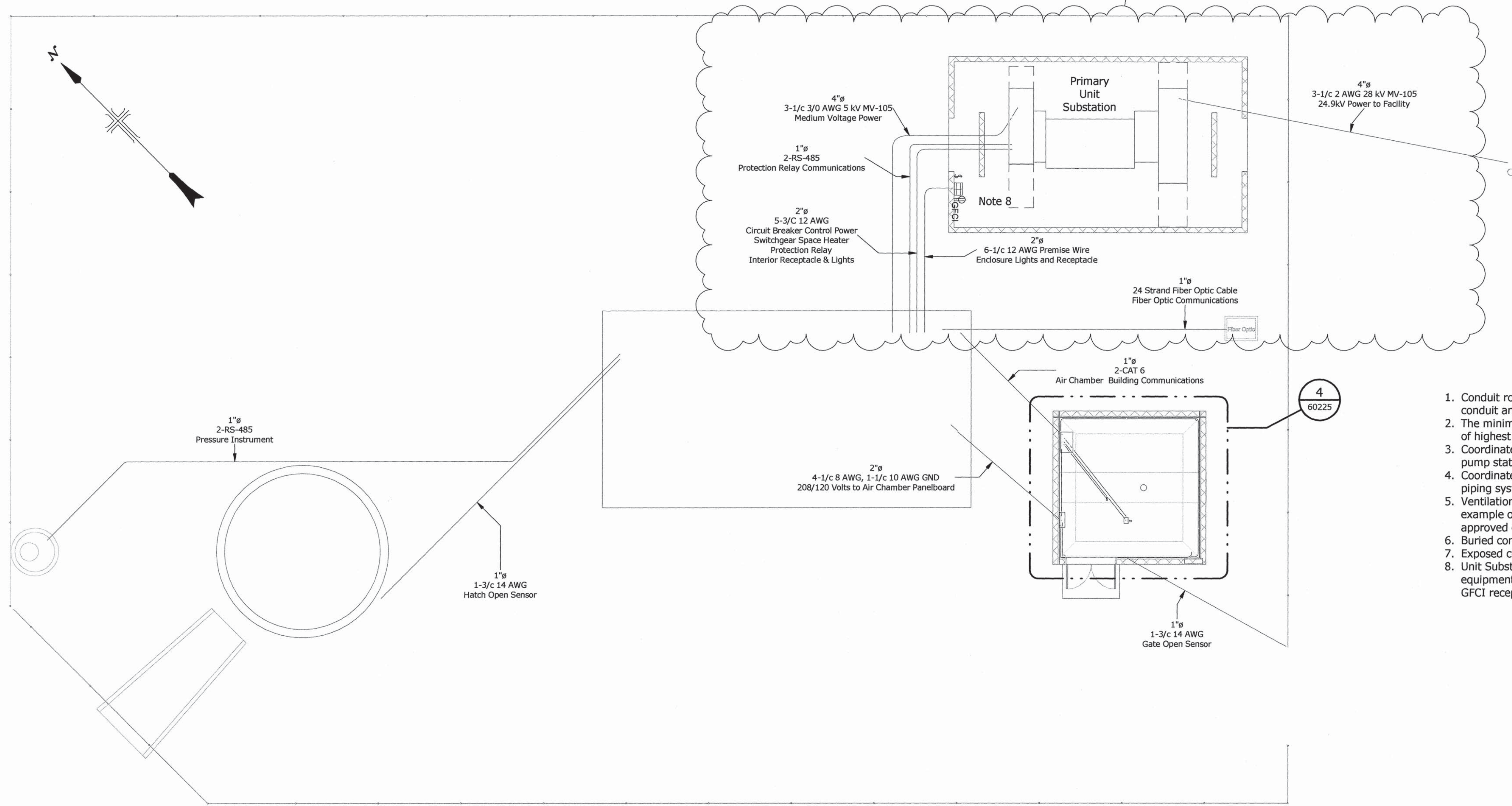
REV. NO.	DATE	NAME	PROJ. ABBR.	STA.	DESCRIPTION
1	2016-07-15	John Kelly, P.E.	JAK		D ADDED PRIMARY UNIT SUBSTATION AND ASSOCIATED EQUIPMENT. REMOVED MV SWITCHGEAR EQUIPMENT.

DESIGNED: Darryl Liscomb
DRAWN: Robert D. Cass
CHECKED: Lisa Gentry, P.E.
TECH. APPR.: Jay Boggess
APPROVED: Admin Approver - Manager Electrical Design Group
DENVER, CO 03/28/16

PUMPING PLANT NO. 2

SITE GROUNDING PLAN

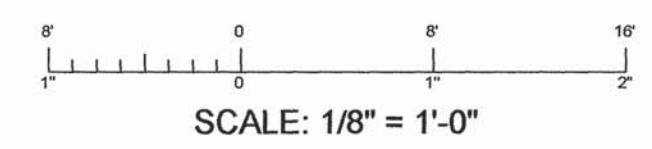
1695-D-60223



GENERAL NOTES

1. Conduit routings are typical. Determine actual location for conduit and stub-ups in the field.
2. The minimum cover for exterior conduit to 24 inches to top of highest conduit.
3. Coordinate placement of conduit entering pre-manufactured pump station with building manufacturer.
4. Coordinate conduit placement under/in building slabs with piping systems.
5. Ventilation and Lighting system conduit shown as an example only. Determine cable and conduit size based on approved equipment.
6. Buried conduit to be Plastic Coated Rigid Steel(PCRS).
7. Exposed conduit to be Rigid Metallic Conduit(RMC).
8. Unit Substation Enclosure to include the following lighting equipment: Type AA Fixture, Light Switch, and NEMA5-20R GFCI receptacle with while-in-use cover.

SITE CONDUIT PLAN
Scale: 1/8" = 1'-0"



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NAVAJO GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL - REACH 22B
PUMPING PLANT NO. 2

REV NO	DATE	NAME PROF. ABBR.	STA	DESCRIPTION
2	2016-07-15	John Kelly P.E.		ADDED PRIMARY UNIT SUBSTATION AND ASSOCIATED EQUIPMENT, REMOVED MV SWITCHGEAR EQUIPMENT. CHANGES TO 1-1/2" 8 AWG, ADDED 1-1/2" 10 AWG GND TO CONDUIT FOR DPAC FEEDER.
1	2016-05-05	Lisa Gentry P.E.	D	

DESIGNED: Darryl Liscomb
DRAWN: Darryl Liscomb
CHECKED: Robert D. Cass
TECH. APPR.: Lisa Gentry P.E.
APPROVED: Jay Boogess
Admin Approver - Manager Electrical Design Group

DENVER, CO 03/28/16

PUMPING PLANT NO. 2
SITE SUBSURFACE CONDUIT PLAN

1695-D-60224

1. QUESTION: In reviewing the Steel Tanks Spec and Drawings Part 1: I did not find in the spec as to what size capacity/dimensions the two Regulating Tanks are?

ANSWER: The dimensions of the tanks are shown on drawings 1695-D-60069 (Sheet 64) and 1695-D-60072 (Sheet 67) of the Drawings Part 3 file.

2. QUESTION: In reviewing the Steel Tanks Spec and Drawings Part 1: the Steel Tank spec references drawing No. 1695-D-60017 which I did not find in Drawings Part 1?

ANSWER: Drawing 1695-D-60017 is included in the Solicitations as sheet 56 of the Drawings Part 3 file.

3. QUESTION: Sheet 1965-D-60041 indicates the Jack and Bore goes from station 22938+50 to 22939+30 (80') -- The Bore Detail on sheet 1965-D-60052 indicates the bore goes from station 22938+50 to 22939+55 (105'). Can you please verify which quantity we're to use?

ANSWER: 105 feet is the correct bore length. Drawing 1695-D-60052 shows the correct stationing and length. A pen and ink revision should be made to drawing 1695-D-60041 to correct the stationing to that shown on drawing 1695-D-60052.

4. QUESTION: There are only Dwgs pertaining to "Regulating Tank No. 2" NONE are Included for "Regulating Tank No. 1" is "Regulating Tank No. 1" part of this job? Where is it located?

ANSWER: Regulating Tank 1 is located in Pumping Plant 2 yard, and Regulating Tank 2 is at the end of the reach. Drawings 1695-D-60007 (Sheet 6), 1695-D-60008 (Sheet 7), 1695-D-60069 (Sheet 64), and 1695-D-60070 (Sheet 65) contain drawings for Tank 1 and Drawings 1695-D-60009 (Sheet 8), 1695-D-60010 (Sheet 9), 1695-D-60021 (Sheet 10), 1695-D-60071 (Sheet 66), 1695-D-60072 (Sheet 67), and 1695-D-60073 (Sheet 68) contain drawings for Tank 2.

5. QUESTION: Spec 331150, "AT NATURAL GASLINES, PETROLEUM-RESISTANT GASKETS ARE NOT REQUIRED". Are all of the "GASLINES" shown Natural Gas Lines? None are labeled "PETROLEUM", please confirm.

ANSWER: There are no petroleum line crossings. Lines labeled as gas lines are natural gas lines.

6. QUESTION: Plan Sheet 1695-D-60045, Note #7 states that Warning Tape is not Shown, but is required, See specifications for details. Yet no reference to Marking Tape appurtenant to the Waterline is included in the Specifications. Please specify.

ANSWER: Section 31 23 22 – Pipe Trench Earthwork has been revised in Amendment 2 to include the warning tape product description. Per paragraph 3.07.A the warning tape is to be installed at least 18" below the ground and at least 18" above the pipe.

7. QUESTION: Fitting Table Sheet 1695-D-66049: @ sta 22666+00.00 calls for a 10°47'56" bend. No Bend is called out on the Dwgs, only a 2" Air Valve. Please clarify.

ANSWER: A pen and ink change is required to Drawing 1695-D-60036 to show the 10°47'56" miter bend at station 22666+00. Please follow the fitting table on Drawing 1695-D-60049 which includes the miter bend at Station 22666+00.

8. QUESTION: The following fittings have differing callouts from the Plan view to the profile view, please clarify what will be expected:

sta	Profile Callout	Plan Callout
22711+66.28	23°03'54"	22°30'00"
22717+73.01	23°29'52"	22°30'00"
22721+66.01	23°41'05"	22°30'00"
22671+84.60	33°48'51"	33°45'00"
22964+22.69	45°00'52"	45°
22611+15.45	45°36'35"	45°
22434+51.71	56°29'34"	56°15'00"
22678+10.00	8°07'18"	8°40'42"

ANSWER: All but the last bend (sta 22678+10.00) are combined bends. On the plan and profile drawings, the profile callout shows the combined angle whereas the plan view shows only the horizontal deflection angle. The combined angle was calculated as the composite between the vertical and horizontal deflection angles.

The angle at Station 22678+10 is a vertical only miter bend. On drawing 1695-D-60036, the deflection angle was incorrectly called out as 8°40'42". A pen and ink change is required to change the deflection angle at Station 22678+10 to 8°07'18".

9. QUESTION: Can you provide a specific and single point of contact for the Navajo Tribe that could answer any and all questions relating to TERO fees and requirements? We don't feel the current contract documents fully describe any TERO fees nor employment requirements?

ANSWER: There are no TERO fees/requirements on the Navajo Nation. All enquiries on Navajo taxes and employment should be directed to the following:

Office of the Navajo Tax Commission
 Highway 264, 100 Taylor Road
 Karigan Professional Building, Suite 115

St. Michaels, Arizona 86511
Telephone Number: (928) 871 - 6681
Fax Number: (928) 871-7608
Website: www.navajotax.org
Email: nnotc@navajotax.org

Office of Navajo Labor Relations
Window Rock & Ft Defiance Office
W008-222 Doublewide Trailer
Morgan Blvd.
Window Rock, Arizona 86515
Phone: (928) 871-6800
Fax: (928) 871-7088
Contact: Reynold Lee

10. QUESTION: Can you explain the contract time of 667 days? Are there assumed no work periods during various seasons to accommodate for weather or other concerns?

ANSWER: The contract time of 667 calendar days includes allowances for assumed winter weather shutdown periods and lost production days due to normal weather conditions. The contract completion date will be calculated by adding 667 calendar days to the date of the initial NTP for non-site work. Refer to Section F.1, Commencement, Prosecution, and Completion of Work, for details.

11. QUESTION: Has all Tribal archeological and/or environmental permits been issued and cleared for construction for this Reach?

ANSWER: All archeological clearances will be obtained prior to the issuance of NTP for site work. (Refer to Section F.1). Contractor responsibilities related to the preservation of historical and cultural resources are identified in Section I.27, Preservation of Cultural Resources, and Specifications Section 01 57 90, Preservation of Historical and Archaeological Data.

Reclamation will obtain the environmental permits identified in Specifications Section 01 57 30, Water Pollution Control, which are identified as to be obtained by the Government. These permits will be obtained prior to issuance of the NTP for site work. (Refer to Section F.1). All other environmental permits shall be obtained by the successful offeror.

12. QUESTION: Can a list of any and all other questions asked by interested parties be made public?

ANSWER: Yes, questions and answers are publicly posted as amendments.

13. QUESTION: Can you supply a list of the utility company contacts for any necessary permanent services needed for the lift/pumping stations?

ANSWER: Electrical service will be provided by others to the points identified in the specifications and drawings. The successful Contractor will be required to coordinate with the utility owner to connect to their facilities. Please also see the revised Section 26 05 12 – Basic Electrical Materials and Methods, Section 26 16 12 – Medium-Voltage Power Cable, and added Sections 26 16 13 – Primary Unit Substation, and 26 13 26 – Metal Clad Switchgear and associated electrical drawings contained within this amendment for specifications for connecting the utility’s power supply.

Utility companies that will be supplying the electrical service are as follows:

- Pumping Plant 1 power will be supplied by Farmington Electric Utility System (505-599-1353).
- Pumping Plant 2 power will be supplied by Jemez Mountain Electric Cooperative (505-753-2105)

14. QUESTION: Can you supply the anticipated Notice to Proceed Date?

ANSWER: Refer to Section F.1, Commencement, Prosecution, and Completion of Work, for details.

15. QUESTION: In review of the plan and profile drawings sheets, it appears that there is 41 gas line crossings, 10 existing water main crossings and 3 electrical crossings. From our site visit we have counted way more existing utilities than that. Can CLIN 5 be changed to a “per each” rather than lump sum? Also, are the gas crossings to be done via bore, special method, etc or just open cut and cross?

ANSWER: Based on our quantity take offs, there are 71 buried and 17 above ground utility crossings. Please bid according the specification as a lump sum.

Natural gas line crossings of 2 or more utilities are to be crossed via bore and jack. Smaller diameter, single line utility crossings can be crossed via open cut. Coordination with the utility owners is required. In accordance with Note 10 of Drawing 16956-D-60045, CLSM is required for backfill at open cut utility crossings.

16. QUESTION: Upon review of the above referenced project plans and specification, we would like to formally request clarification or modification for the following items. Please consider the following request for modifications to the project specifications sections listed below for the above reference project:

No.	Section/ Subsection	Specification Requirement	Proposed Modification	Comments
1	33 11 10 Table 33 11 10A	N/A	Add a Fiberglass column to this table.	There is a note at the end of this table stating to "submit in accordance with Section 33 11 19, but this does not make it clear to bidding contractors that fiberglass pipe can be used for all sections of the project.
2	33 11 10 1.02 B.2	"Metallic and Fiberglass pipe:	"Fiberglass pipe:"	Eliminate the word "Metallic" as it is not appropriate to this section.
3	33 11 10 1.02 B.2	"The alphabetic character represents the cover class of pipe where; A<5 ft, etc.	Add "15 ft < D < 20ft"	A "D" designation for depth is present in Table 33 11 10A, but it not represented in this section.
4	33 11 19 2.02 B	"Fittings: Fabricated from steel or ductile iron"	"Fittings: Fabricated from fiberglass, steel or ductile iron"	Fiberglass needs to be added as it is the first item in this section.
5	33 11 19 2.05 B.1.c	"Place metal piping securely in fiberglass laminated overlay outlet pipe"	Delete	This statement is not needed.
6	33 11 9 2.05 B.1.c	"Welding in accordance with AWS D1.4"	Delete	This statement is not needed.
7	Project Plans: Page 1695-D- 60045 "Pipe Trench Installation"	Shows that Material Type 2 and 3 are allowed for Fiberglass installation in one table ("Side Clearance Table") and then shows "NA" in the "Trench Section" table.	Add "Allowed per manufacturers recommendation with supporting AWWA M45 Deflection Calculations" to table "Trench Section"	We have verified two materials can be used with fiberglass pipe based on the 3% allowable deflection using the AWWA M45 Fiberglass Pipe Design Manual procedures and analysis for buried fiberglass pipe.

ANSWER:

- 1) Since pipe stiffness is to be determined by the fiberglass pipe manufacturer, the minimum pipe thickness is unknown and cannot be presented on the table. The pipe should be designed to accommodate hydrostatic head shown in the symbol pipe designation.
- 2) Section 33 11 10, Part 1.02.B applies to all pipe materials as this section defines the symbol pipe designation. This paragraph has been revised in Amendment 2.
- 3) A "D" designation depth for 15 ft < D < 20 ft has been added in Amendment 2.
- 4) Section 33 11 19, Part 2.02.B. Fiberglass fittings will be added to the section title. In addition, Section 33 11 19, Part 2.02.B.1 will be revised to "Fiberglass Fittings: In accordance with AWWA M45, AWWA C950, and ASTM D5685."
- 5) This requirement in Section 33 11 19, Part 2.05.B.1.c has been deleted.
- 6) This requirement in Section 33 11 19, Part 2.05.B.1.d has been deleted.
- 7) The trench side clearances shown in the "Side Clearance Table" are based on a soil trench and the use of either select material or CLSM embedment material. The "Trench Section" table provides the maximum cover depth if native material is used for embedment. No conflict exists in the tables. All values are based on a fiberglass stiffness factor of 18. If pipe with a greater stiffness factor is proposed, an RFI with supporting calculations could be

submitted to optimize the trench section. Fiberglass pipe with native material for embedment may be allowed per manufacturer's recommendations with supporting calculations in accordance with Reclamation's "Method for Prediction of Flexible Pipe Deflection, M-25".

17. QUESTION: Specification Section 33 11 10 – Table 33 11 10A states that Steel and Ductile iron are not allowed for Pipe Designation 24B50 – 24C540. Does this also mean that steel and ductile iron fittings are not allowed in these sections?

ANSWER: Table 33 11 10A refers to the line pipe material and not fittings. Steel and ductile fittings for the line pipe are allowed for the entire length of the project.

18. QUESTION: Specification Section 33 11 19 – G.2.b states that a 0.5 degree joint deflection may be permitted and that it must be on a 20 foot length of pipe. As a cost savings measure to eliminate fittings and to allow for field adjustments, is the contractor allowed utilizing the manufacturer's allowable joints deflections and alternate joint lengths to eliminate fittings and maintain alignment.

ANSWER: Section 33 11 19, Part 3.01.G.2.b - Fiberglass Pipe has been revised in Amendment 2 to allow a total pull of 1.0 degree joint deflection for pipe head class less than or equal to 450-feet and 0.75 degrees joint deflection for pipe head class equal to and greater than 475-feet. Pipelaying Diagrams under submittal RSN 33 11 10-2 shall comply with this requirement..

19. QUESTION: What is the required safety factor for the restrained joints? Is it 2:1?

ANSWER: Yes, the safety factor required for restrained joints is 2:1.

20. QUESTION: Project Plans: Page 1695-D-60045 "Pipe Trench Installation" – We have verified that the "Screened Native Material compacted to a minimum of 85% SPD" can be used with fiberglass pipe based on the 3% allowable deflection using the AWWA M45 Fiberglass Pipe Design Manual procedures and analysis for buried fiberglass pipe. Can "Screened Native Material" be used for fiberglass as it is allowed for other flexible pipe (PVC/HDPE)?

ANSWER: After verifying calculations utilizing an assumed fiberglass stiffness factor of 18, fiberglass pipe exceeds deflection criteria, for all practicable purposes, when native material is used for embedment. If pipe with a greater stiffness factor is proposed, then an RFI with supporting calculations may be submitted to utilize "Screen Native Material". Fiberglass pipe with native material for embedment may be allowed per manufacturer's recommendations with supporting calculations in accordance with Reclamation's "Method for Prediction of Flexible Pipe Deflection, M-25".

21. QUESTION: the List of Dwgs, Table 520000A Lists sheet 60069 as Pumping Plant No. 2 - Regulating Tank No. 2 - Plan, Sections, and Detail - Sheet 1. The title on the sheet is Regulating Tank No.1, Plans Sections and Details. Is this a typo.

ANSWER: Yes, there is a typo in Table 52 00 00A - List of Drawings. For Drawing 1695-D-60069 (Sheet 64), the drawing title has been revised in Amendment 2 to read, "Pumping Plant No. 2 - Regulating Tank No. 1 - Plan".

22. QUESTION: Plan Sheet 1695-D-60050, Section B-B: What size is the Flow Meter Probe Insertion assembly?

ANSWER: The size of the flow meter probe varies by Manufacturer and depends on the company from which it is purchased. The flow meter selected will be reviewed during the submittal process.

23. QUESTION: Bid Item 330 calls for "Bore and Jack Station 22938+50 to 22939+55", while Plan Sheet 1695-D-60041 calls for Bore and Jack Station 22938+50 to 22939+30. Which is correct?

ANSWER: 105 feet is the correct bore length. Drawing 1695-D-60052 shows the correct stationing and length. A pen and ink revision should be made to drawing 1695-D-60041 to correct the stationing to that shown on drawing 1695-D-60052.

24. QUESTION: Spec 33 11 18 is silent on whether the HDPE Pipe is to be IPS or DIPS. Which type of HDPE will be expected?

ANSWER: Either IPS or DIPS is acceptable.

25. QUESTION: The note eliminating the requirement for petroleum-resistant gaskets does not appear to be applicable to Ductile Iron Pipe, unless that pipe is Dielectrically coated. Are the coatings in Tabulation #6 of Spec 099620 considered Dielectrical coatings?

ANSWER: Yes. The coatings in Section 09 96 20 – Coatings, Tabulation No. 06 are dielectric coatings.

26. QUESTION: Would CERAMAWRAP™ EPOXY, or IRON STRONG Zinc Coating w/ V-Bio wrap be considered as options cor coating of Ductile Iron Pipe under Tabulation #6 of Spec 099620?

ANSWER: The coating requirements for ductile iron pipe can be found in Section 09 96 20 – Coatings, Tabulation No. 06. The CERAMAWRAP is a bonded dielectric coating that may be proposed as an "equal" product in accordance with specifications RSN 09 96 20-1. A final determination of acceptance would be made during the review and approval of RSN 09 96 20-1. IRON STRONG Zinc Coating w/ V-Bio wrap is not a bonded dielectric coating and would not be considered an "equal" product in accordance with the specifications.

27. QUESTION: During the site visit we were informed that an overlay map of Navajo and private lands would be provided; however, we did not see that included in Amendment 1. Will this be providing in an upcoming amendment?

ANSWER: The following table provides land ownership information by station ranges. The attached map includes the same information.

NAVAJO-GALLUP WATER SUPPLY PROJECT
REACH 22B STATION RANGES FOR LAND OWNERSHIP

OWNER	STA	TO	STA
BLM	22249+52.72	TO	22251+34.76
ALLOTTED LANDS	22251+34.76	TO	22329+52.98
TRIBAL TRUST	22329+52.98	TO	22335+37.06
BLM	22335+37.06	TO	22376+68.63
ALLOTTED LANDS	22376+68.63	TO	22525+72.95
BLM	22525+72.95	TO	22552+37.10
ALLOTTED LANDS	22552+37.10	TO	22607+92.80
BLM	22607+92.80	TO	22634+26.55
STATE	22634+26.55	TO	22689+20.17
BLM	22689+20.17	TO	22743+27.69
PRIVATE	22743+27.69	TO	22770+39.21
BLM	22770+39.21	TO	23093+38.55

28. QUESTION: On the lines designated as PVC or HDPE there are mitered bends called in steel or ductile, mitered bends don't exist in ductile and how are you picturing the connection be made then to the pvc or hdpe pipe using steel mitered bends?

ANSWER: Standard ductile bends are allowed where the line pipe angle is suitable. Per the relevant specification sections, the fitting details are to be submitted for approval. An acceptable non-restrained steel joint would be a bolted sleeve-type coupling meeting AWWA C219.

29. QUESTION: 4 Steel Manufacturers so far will not quote the wall thickness called out as it is too thin of a wall and the pipe will warp and become damaged when welded together at the joints. Will .1888 wall thickness be acceptable or something thicker?

ANSWER: The minimum steel thickness was determined by utilizing pressure and handling criteria found in AWWA M11. Steel pipe thicker than specified is allowed.

30. QUESTION: If quoting hdpe pipe instead of the pvc can we use hdpe mitered fittings instead of steel mitered fittings? If so instead of 2 piece mitered can they be 3 piece mitered fittings?

ANSWER: Heat fused HDPE miter bends are allowed per Section 33 11 18, Part 2.02.D. Per Section 33 11 18, the fitting details are to be submitted for approval. 3 vs. 2 piece mitered bend fittings are acceptable.

31. QUESTION: Please confirm the wall thickness and/or schedule of 16" steel pipe and small in the pump stations and appurtenances.

ANSWER: The wall thickness of the 16" Sch. 10 (.25" wall) manifold piping can be seen on drawings 1695-D-60066 and 1695-D-60069. The unit piping size of the pumps are not shown because the prepackaged manufactured pumping plant will be designed by others.

32. QUESTION: There are several detail drawings that make mention that the 24" steel should be schedule 10? The wall thickness of sched10 steel is .250 wall which is almost double the wall thickness called out on the bid schedule, please clarify which wall thickness is what is required for all steel pipe/all sizes.

ANSWER: The thickness of the steel pipe shown on detail drawings is greater due to specials of the steel pipe network in the yards. Reclamation uses a minimum 0.25 inch steel thickness due to fabricated tees, reinforcements, and specials as shown in yard piping requiring a greater factor of safety. Outside of the yard, minimum line pipe thicknesses are shown in Section 33 11 10 – Pipeline General Requirements.

33. QUESTION: On the CMP (Corrugated Metal Pipe) please confirm if standard Hel-Cor is acceptable or if it needs to be Ultra-Flow ?

ANSWER: If the CMP, such as Hel-Cor, meets the product requirements of Section 33 42 30, then the pipe is acceptable.

34. QUESTION: Sheet 1695-D-344 section D-D shows 6" Standard Steel pipe Valve box w/ Lockable covers; while Spec 332215, 2.01, E calls for Tyler 6855, Cast Iron, w/ no mention of Locking lid. Please clarify.

ANSWER: Section 33 12 10, Part 2.05.E Valve Box has been revised in Amendment 2 to add a lockable lid as shown on drawing 1695-D-60050 section E-E. We believe the specification reference in the question is incorrect. The correct reference is Section 33 12 10, Part 2.05.E.

35. QUESTION: Please define the connections that will be required or accepted at the Mitre Bends.

ANSWER: Per the relevant specification sections, the fitting details are to be submitted for approval. An acceptable non-restrained steel joint would be a bolted sleeve-type coupling meeting AWWA C219.

36. QUESTION: Bid Item #63 calls for 2800 LF of 24B475 while Plans show 2500 LF. Please verify Qty.

ANSWER: The 2800 LF of 24B475 is the correct length. As shown on the Air Valve Drawing (1695-D60046) and the Blow off drawing (1695-D-60048), an extra 10 feet of 24B475 at each assembly is required. Similarly there is a decrease of 10 feet of surrounding line pipe around these features.

37. QUESTION: Spec 331113, 2.01, A, 1 requires 20' Nominal Lay length. 24" DIP is manufactured at standard 18' lay lengths. Please confirm that this is acceptable.

ANSWER: A standard lay length of 18' is acceptable.

38. QUESTION: Polyethylene Wrap per AWWA C105 is only called out in Spec 331150 "Pipe Crossings at Existing Utility Pipelines", not called for in the Ductile Iron Pipe spec or Pipe General Requirements. Is that intentional? Will polywrap not be required except at Utility Crossings?

ANSWER: Correct. Polyethylene wrap serves as an additional barrier when the line crosses various types of utilities to avoid potential contamination. The allowable coating for ductile iron pipe can be found in Section 09 96 20 – Coatings, Tabulation No. 06.

39. QUESTION: RE: Section 33 11 12, 2.01, Paragraph D..." Prepare pipe ends for field welding" We are asking to have this paragraph deleted since it contradicts the reference to "3.01.C-Joints for Pipe with Gasketed Joints" on the Section 33 11 12 Steel Line Pipe NOTE: If you do not delete that paragraph we will have to supply lap welded joints, which needs to be welded and such increasing the installation cost; Also the pipe wall thickness has to be increased to 0.25" per Note 7' on 1695-D- 60049: (all restrained , ie.- lap welded) WSP is to have 0.250" minimum wall thickness)

ANSWER: Section 33 11 12, Part 2.01.D has been modified in Amendment 2 to read: "Prepare pipe ends for field welding where welded joints will be installed."

40. RE: Note 7' on 1695-D- 60049, all restrained WSP is to have 0.250" minimum wall thickness. We are asking to have Note 7 deleted, since the minimum calculated wall thickness appears to be 0.16" NOTE: Our minimum calculated wall thickness appears to be 0.16". This is more than thick enough to accept a fillet weld. As you know, welders in the pipe community regularly fillet weld material down to and including 10 ga.

ANSWER: 0.250 inch minimum pipe wall thickness and resulting larger weld is needed due to the eccentricity stress that develops in the single lap weld when resisting the longitudinal thrust force.

41. Is there a specific brand and model number for the 15" OIT touch panel display?

ANSWER: Any generic panel that is compatible with the Modicon M340 PAC/PLC will be acceptable. The brand and model number for the programmable controller (PLC) is a Modicon M340, as specified in Section 25 00 02, Part 2.01 A.

42. On sheet 1695-D-60095 in the Notes you'll find references to the Sub-Master HMI terminal screens being ported to the Fort Defiance Master Station for remote monitoring. Also in the Specifications document pg. 25 00 02 – 4 there is a reference to a large display on OIT for fire or security alarm that gets operator's attention at the Fort Defiance control room. Is modifying the existing fort defiance system in the scope of this project? If so, what software does the existing Fort Defiance Master Station use?

ANSWER: The referenced display will be installed at the pumping plants, with a trouble alarm sent to headquarters (Fort Defiance). Modifying the existing Fort Defiance system is not within the scope of this contract.

43. In the Notes sheet 1695-D-60095, the Cutter Lateral Sub-Master Station is shown to include System Monitoring & Control, Historian – Trending, Human-Machine Interface, Operator Intervention and Environmental Controls. Is the Cutter Water Treatment Facility Sub-master Station and Cutter Water Treatment & Pumping Plant already in existence? If so, will we be adding to or modifying the existing HMI software at this location to show information and allow control of the new Plants 1 & 2, NAPI Turnout and Regulating Tank?

ANSWER: No, the Cutter Water Treatment facility (Reach 21) will be in construction concurrently with this contract. The scope of this contract is defined on 1695-D-60095 as the work within the Reach 22B phantom lines on the drawing. The contractor is required to allow for the future signal to Cutter Lateral Sub-Master Station and Fort Defiance system. Systems integration for the Cutter Lateral systems is part of the Reach 21 contract. Coordination will be required with the Reach 21 contractor.

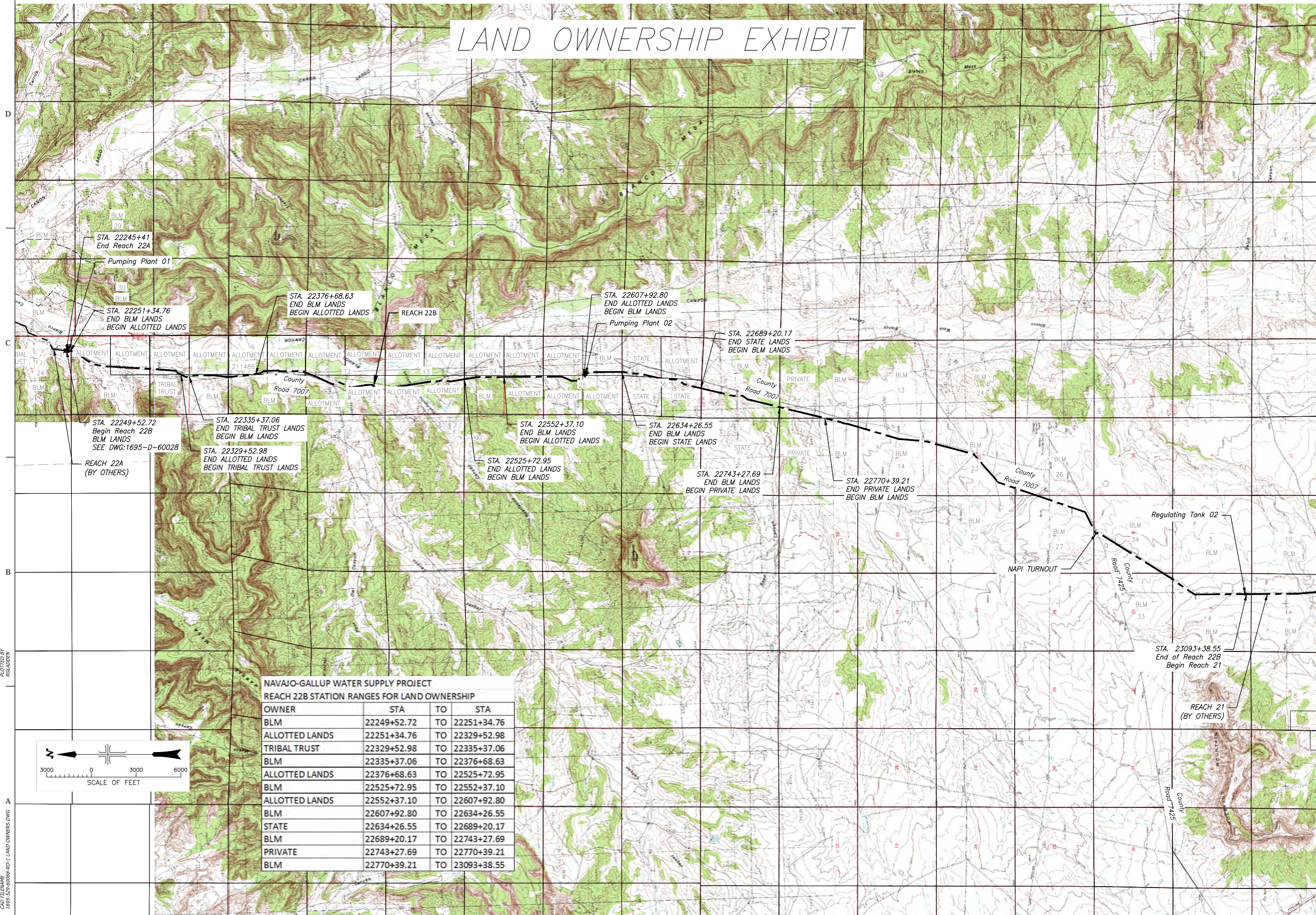
44. What software is used or planned to be used for the Human-Machine Interface (HMI) at the Cutter Water Treatment Facility?

ANSWER: Compatible with Modicon Vijeo Citect.

45. Do u require prefab material aluminum, or carbon steel, structure or pipe?!

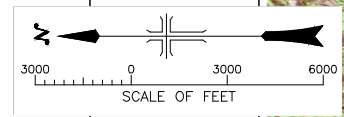
ANSWER: Requirements for the various types of materials utilized in this contract are addressed in the solicitation specifications. We suggest contacting potential bidders to determine any prefabricated material needs.

LAND OWNERSHIP EXHIBIT



NAVAJO-GALLUP WATER SUPPLY PROJECT
REACH 22B STATION RANGES FOR LAND OWNERSHIP

OWNER	STA	TO	STA
BLM	22249+52.72	TO	22251+34.76
ALLOTTED LANDS	22251+34.76	TO	22329+52.98
TRIBAL TRUST	22329+52.98	TO	22335+37.06
BLM	22335+37.06	TO	22376+68.63
ALLOTTED LANDS	22376+68.63	TO	22525+72.95
BLM	22525+72.95	TO	22552+37.10
ALLOTTED LANDS	22552+37.10	TO	22607+92.80
BLM	22607+92.80	TO	22634+26.55
STATE	22634+26.55	TO	22689+20.17
BLM	22689+20.17	TO	22743+27.69
PRIVATE	22743+27.69	TO	22770+39.21
BLM	22770+39.21	TO	23093+38.55



DATE AND TIME PLOTTED: 10/27/16
 PLOTTED BY: RGAADREY
 CADD SYSTEM: 2016
 CADD FILENAME: 1695-529-60068-RC-1 LAND OWNERS.DWG

ALWAYS THINK SAFETY
 U.S. DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 NAVAJO-GALLUP WATER SUPPLY PROJECT
 NEW MEXICO

CUTTER LATERAL - REACH 22B
 LAND OWNERSHIP EXHIBIT MAP

FARMINGTON, NM 2016-07-15

CUTTER LATERAL
REACH 22B

LAND OWNERSHIP
EXHIBIT

SECTION F – DELIVERIES OR PERFORMANCE

F.1 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK APR 1984

The Contractor shall be required to

(a) commence work under this contract within **10 calendar days** after the date the Contractor receives: ~~the notice to proceed;~~

1) ~~Notice to Proceed for non-site work under this contract.~~

2) ~~Notice to Proceed for site work for Station 22249+52.72 to Station 22634+26.55, and Station 22774+58.31 to Station 23093+38.55, is anticipated to be issued no later than December 1, 2016, and~~

3) ~~Notice to Proceed for site work for Station 22634+26.55 to Station 22774+58.31 is anticipated to be issued no later than March 1, 2017.~~

(b) prosecute the work diligently, and

(c) complete the entire work ready for use not later than **667 calendar** days after the contractor receives the **initial non-site work Notice to Proceed** ~~notice to proceed~~ issued in accordance with (a)(1) above. The time stated for completion shall include final cleanup of the premises.

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F.2 52.211-12 LIQUIDATED DAMAGES – CONSTRUCTION SEPT 2000

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of **\$6,017.00** for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

F.3 52.211-18 VARIATION IN ESTIMATED QUANTITY APR 1984

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgment of the Contracting Officer, is justified.

F.4 52.242-14 SUSPENSION OF WORK APR 1984

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted

(1) by an act of the Contracting Officer in the administration of this contract, or

(2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed --

(1) For any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order); and

(2) Unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.