SECTION 01 00 00

BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

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1.2 CONTRACT DESCRIPTION

A. Work of the Project includes the installation of approximately 363 feet of 10-inch PVC DR 18 C-900 waterline (bell-and-spigot and fusible joints), approximately 2.4 miles of 12-inch PVC DR 18 C-900 waterline (bell-and-spigot and fusible joints), and one approximately 150,000 gallon water storage tank, with appurtenances.

B. Perform Work of Contract on a unit cost basis with Owner in accordance with Conditions of Contract.

1.3 SPECIAL CONSIDERATIONS

A. Contractor shall abide by all permit stipulations and requirements, including but not necessarily limited to BIA and Jicarilla Apache Nation environmental and archaeological stipulations, utility encroachment agreements or requirements, and BIA-Jicarilla, Sandoval County, and New Mexico Department of Transportation road crossing and access permits, where applicable, regardless of whether such permits are obtained by the Owner, Engineer or Contractor.

1. Environmental and cultural requirements for the pipeline are provided in Appendix C.

2. Construction Drawings provide minimum requirements for utility crossings and encroachments along with utility owner contact information.

3. Final acceptance of ROW restoration, including but not limited to re-seeding, erosion controls, fencing repairs and gates, and finished grading, shall be subject to approval by the Owner.

4. Contractor shall comply with all of these stipulations, terms and conditions. Said compliance shall be considered incidental to the cost of the project.

B. It is the Contractor's responsibility to apply for and obtain all permits required for the Work that have not already been obtained by the Owner or Engineer. No additional compensation will be provided for obtaining permits and all costs will be considered incidental to the Project. It is anticipated the Contractor will need to obtain, at a minimum, a 402 permit from U.S. EPA for pipeline flushing, and building permits (including electrical, if applicable) from the New Mexico Construction Industries Division. Contractor is wholly responsible to determine what additional permits may be required.

1. Contractor,subcontractors, and their employees as applicable, must obtain vendor operating permit(s) and individual Work Permits for employees from the JAN Department of Labor Compliance Office. Contractor is responsible for verifying and meeting all requirements of the Compliance Office. The Compliance Office may be contacted at (575) 759-4412. See Appendix B for more details.

C. Contractor is responsible for obtaining encroachment agreements from petroleum/gas line companies, and other overhead and buried utility companies/authorities. Contractor is responsible for all correspondence including notifying Owner, Engineer and utility companies/authorities at least 30 working days prior to any construction activities at crossings. Contractor shall adhere to all requirements of the utility companies/authorities and any special notes provided on Drawings, including notification requirements. Contractor is advised that the exact depth, location and diameter of some of these utility lines are unknown, and must be determined by the Contractor in the presence of the corresponding utility company/ authority representatives. Furthermore, any depth, location or diameter information provided in the Drawings regarding existing utility lines are only approximations and the Contractor shall be responsible to verify such information in the presence of the corresponding utility company/authority representatives.

D. Some existing roads in the project vicinity are primarily used and maintained by local residents for access to their homes and ranching activities. These roads, identified on the Construction Drawings are not to be used by the Contractor for access to the project site. The pipeline ROW can however, be accessed at multiple other locations off of US 550 and maintained dirt and gravel BIA roads.

E. Cultural Resources Requirements:

1. Contractor must be familiar with and abide by any BIA cultural resource stipulations included in Appendix C of the Contract Documents.

2. Contractor must allow archaeologist and/or Owner's representative to have access to the project site for examination of cultural resources. Contractor must allow archaeologist and/or Owner's representative to halt work, as necessary, to examine cultural resources in spoils and/or trenches. Contractor may move equipment to another location while archaeologist completes his/ her examination of cultural resources. Contractor shall not request additional compensation for any delays caused by archaeological examinations. However, such delays may be considered excused delays and not count toward Contractor's deadline for substantial completion, provided Contractor requests additional time within one (1) week of the delay.

a. Per Appendix C, no significant cultural resources have been identified within or immediately adjacent to the project R.O.W. and T.C.E. that require Archaelogical monitoring.

3. Archaeological Discovery in the Presence or Absence of Archaeological Monitoring: If, in its operations, the contractor discovers any previously unidentified historic or prehistoric cultural resources, then all work within 100 feet of the discovery will be suspended and the discovery promptly reported to the Engineer. The Jicarilla Apache Nation Tribal Historic Preservation Office will then specify what action is to be taken. If the discovery is evaluated as being significant, treatment of the discovery may be required prior to allowing the project to proceed. Further damage to significant cultural resources will not be allowed until any required treatment is completed.

F. Biological Resources Requirements:

1. The Owner will provide, at no cost to the Contractor, a qualified wildlife biologist to conduct pre-construction survey(s) for for migratory bird nests if work is to be performed during the active bird breeding season between May 15 and July 31.

a. In the event an active bird nest or species habitat is discovered, the Owner's wildlife biologist will flag the required buffer zone around the nest. The buffer zone is typically a 165 ft radius around the nest.

b. The Owner's wildlife biologist will monitor the nest and notify the Contractor when work may commence within the buffer zone.

c. The Contractor shall not encroach within the flagged buffer zone until notified by the Owner's wildlife biologist.The Contractor shall notify the Engineer at least 10 work days prior to commencing ground disturbing activities, and is responsible to coordinate scheduling with the wildlife biologist to perform the pre-construction surveys.

2. The Contractor shall not encroach within biologically sensitive zones indicated on the drawings.

G. At all wash crossings, the contractor will adhere to all Clean Water Act Section 404 General Conditions, Regional Conditions, and Conditional Section 401 Certification for all approved Nationwide Permits, as well as any Special Conditions that may be determined by the U.S. Army Corps of Engineers (refer to URL given below for each document pertaining to the relavent Nationwide Permit process).

1. 2012 Nationwide Permits, Conditions, District Engineer's Decision, Further Information, and Definitions (with corrections):
http://www.usace.army.mil/Portals/2/docs/civilworks/nwp/2012/NWP2012_corrections_21-sep-2012.pdf
(page 1, pages 7 through 9 [up to but not including paragraph 14], page 28 [starting at C. Nationwide Permit General Conditions] through page 46)

2. 2012 Regional Conditions in New Mexico
http://www.spa.usace.army.mil/Portals/16/docs/civilworks/regulatory/Regional%20Conditions/NM%20regional%20conditions%20FINAL.pdf
(pages 1 through 2)

3. NMED conditional Water Quality Certification for Nationwide Permits

http://www.spa.usace.army.mil/Portals/16/docs/civilworks/regulatory/Water%20Quality%20Certification/404%20NWP%20Final%20Certs.pdf
(all pages)

H. Storm Water Pollution Prevention Plan (SWPPP): Contractor shall be wholly responsible for the preparation and implementation of the SWPPP, and any erosion/ sediment practices described therein. Such implementation shall include, but not necessarily be limited to, obtaining any required NPDES permit(s) and submitting the contractor's Notice of Intent (NOI) to competent agencies prior to construction, implementation and maintenance of all Best Management Practices (BMPs) specified in the SWPPP, inspection of entire project site as specified in the SWPPP, maintaining and providing all documentation required in the SWPPP (including keeping up-to-date project maps and as-builts before, during and after construction), filing of a Notice of Termination (NOT) upon completion of the project and removal of BMPs upon the required time interval after completion of the project.

I. No reports or drawings relating to Hazardous Environmental Conditions at the site are known to the Owner.

J. Exhibit A to the Contract Documents contains geotechnical reports which include observations of soil/rock types measured at approximate depths from drill bores completed nearby washes and roads that will be crossed via horizontal directional drilling or bore and jack methods. Contractor is advised that test holes reveal information about only a very small area, and sub-surface conditions between or adjacent to the test holes may vary. Contractor is wholly responsible for any assumptions made about sub-surface conditions between the test holes. This is not considered "Technical Data", as defined in Article 5.03 of the General Conditions, upon which the Contractor is entitled to base his/ her bid.

1. The Contractor is entitled to rely upon the soil bearing capacity and other geotechnical design criteria for the design of tank foundations at the tank site. Moreover, the Contractor shall be required to follow the recommendations of the geotechnical report for tank foundation design, sub-foundation, and overexcavation.

K. Contractor is advised that if there is subsurface rock present requiring specialized equipment to remove, as defined in Section 31 23 18 - Rock Removal, Contractor shall notify Engineer prior to commencement of rock removal work each time such rock is encountered, and await approval from Engineer before proceeding. Furthermore, the Contractor and Engineer must agree on rock quantity at the end of each work day, and both parties much sign off on the quantity of rock in the corresponding Engineer's (RPR's) daily field report, and Contractor will be compensated for such work per Article 1.2.A of Section 31 23 18, which establishes the basis of measurement and payment for trench rock removal.

1. Data in Exhibit B - Soil and Rock Potholing Information identifies the results of the 'potholing' that was performed at various locations along the waterline alignment. This data is provided for informational purposes only and will not be used as a basis for payment. Final quantities will be determined in the field during the construction process, in coordination with the Engineer.

2. Excavated rock may be disposed of within the ROW as long as the conditions stipulated in Section 31 23 17 – Trenching, Article 3.8, are met.

L. Contractor is solely responsible for providing all water for the construction of the project and no guarantees are made by the Owner or Engineer as to the availability of any particular water sources. All costs associated with purchase, permits, hauling, etc. for construction water shall be considered incidental,

1. As a convenience only, Contractor is advised that possible sources of construction water have been identified at the locations listed below. Neither the Owner nor the Engineer makes any representations regarding the quantity, quality, accessibility, availability, or price of this water. Contractor remains wholly responsible to make all arrangements for water, whether from these sources or elsewhere.

    a. The Owner operates two wells with storage tanks for the purpose of selling water for construction and energy well drilling. The first of these wells is located along Hwy NM 537, approximately 1 mile northeast of the Apache Nugget Casino at the intersection of NM 537 and US 550. This well includes two tanks that hold 12,500 gallons each. The second well is located along Hwy NM 537 approximately 7 miles northeast of the NM 537 / US 550 junction. The JAN Water Administration requires a water purchase contract to obtain the water. Bidders are advised to contact Warren Vigil with the JAN Water Administration at 505-210-2463 to confirm pricing and availability.

M. No dedicated borrow area for fill material has been pre-determined for this project. Material may be borrowed from within the designated ROW, provided all conditions set forth in the specifications are met

1. For Bidders' convenience only, the following background information is provided: The native soil that was excavated on the last three (3) phases of the nearby Cutter Lateral pipeline stretching north, south and west of the project vicinity was predominantly suitable bedding material. No bedding material was imported from outside the project areas for the last three (3) phases of Cutter Lateral. For the last phase of the project (3 miles to the west), it is estimated that 90% of the excavated material was suitable bedding material. The remaining 10% was borrowed from within the project ROW. However, the soils found in constructed phases of Cutter Lateral are not necessarily representative of the soils that will be encountered in the current Project. Bidder is not entitled to base his/her bid upon this information.

N. Contractor is advised that compaction requirements shall be strictly enforced. In the event that the contractor is unable to meet compaction requirements for pipe embedment using select material, the Contractor shall have the option to use soil cement at no additional cost to the Owner.

O. Contractor is advised that the trench widths shown in the Drawings are minimum widths only. In the event that the Contractor is unable to meet pipe embedment and compaction specifications using the minimum trench width and needs to increase trench width in order to meet these specifications, such increase in trench width shall be provided at no additional cost to the Owner.

P. Contractor is advised that pipeline line and grade specifications will be strictly enforced. See Section 33 11 13 for specifications on horizontal and vertical pipe line and grade.

Q. Contractor may use the flush valves designed in the proposed pipeline, as well as tank floor drains, to flush water out of the system. Flushed water may be disposed of in the natural waterways adjacent to the flush valves and drains, provided the rate of flushing

does not damage the surrounding environment (i.e. by flooding, erosion, etc.). Do not flush water from designated site drains prior to installing riprap or cable-crete at the drain outlets. Water chlorinated to levels above those normally associated with drinking water shall be neutralized prior to discharge.

1. Contractor shall obtain Clean Water Act 402 permits from U.S. EPA, as required, and shall abide by all stipulations of said permits.

R. Contractor is advised that a 40' wide permanent right-of-way (ROW) easement is established along the proposed pipeline alignment, 20' to each side of the centerline. An additional 30' of temporary construction easement (TCE) is provided on each side of this permanent easement, resulting in a total of 100' wide corridor to which the Contractor must limit all construction activities.

1. Contractor is advised that at certain locations the TCE may be truncated on one side or the other to avoid encroaching on culturally sensitive areas or adjacent properties. These areas, if present, are indicated on the Drawings and shall be staked by the Surveyor. Contractor shall not encroach beyond the established work space in these areas.

2. Contractor is advised that additional TCE areas beyond the 100' corridor have been designated for the Contractor's use during construction of some HDD bores and casing installations under roads, washes and utilities. These areas are delineated on the Construction Drawings.

3. TCE is for temporary construction activities only. All pipe, valves and other appurtenances must remain within the permanent ROW.

4. Contractor is permitted to use any area within the approved permanent ROW and TCE for staging and storage, including the tank and surge tank sites, provided such use does not disturb other land users or areas outside the permanent ROW and TCE and that the staging areas are restored to their original condition prior to final completion.

    a. In limited locations where specifically identified on the plans, the Contractor will be allowed to layout fused PVC piping outside of the defined ROW/TCE in preparation for installation of the piping by horizontal directional drill methods.

    b. Contractor is wholly responsible for location, set-up, security, and any required temporary utilities associated with staging and storage areas.

    c. All staging and storage areas within the project area must be approved in advance by the Owner.

5. All areas disturbed during construction shall be reclaimed in accordance with the Contract Documents, regardless of whether they are part of the permanent ROW or temporary construction easement.

S. Contractor shall restore fences to original condition or better, and shall install 10-ft wide lockable 'rancher-style' gates with H-braces on both sides within pipeline right-of-way at all fence crossings. Each post shall be embedded in 3,000 psi concrete 36-inch deep, 18-inch diameter. Attach wire to the H-braces prior to cutting the fence to prevent slacking of wire. Contract shall repair all gates and fences in a timely manner to prevent livestock ingress/ egress.

1. Fence and gate requirements may vary along US 550. See plans for details.

T. Restore all open-cut driving surfaces, including parking lots, roads and driveways, to original condition or better, including replacement of base course, gravel or pavement as needed. Dirt roads and driveways shall be restored with compacted backfill as indicated in the drawings and specifications, plus surface material as specified. All restoration work for which no bid item is given shall be considered incidental.

U. Contractor is responsible for providing schedule and plans with locations for any lane and shoulder closures to the Engineer, BIA-Jicarilla, and Sandoval County (if applicable) prior to starting work. Contractor shall obtain any required supplemental permits from the relevant agencies.

V. Excess dirt from cutting may be disposed of on-site, provided the finished grade and compaction meet specifications and are approved by the Engineer.

W. For the present Project, Bidding Documents in electronic media format are furnished to bidding contractors for the sole purpose of preparing bids, and not for construction. The selected construction Contractor shall not rely on files provided in electronic media format for construction but rather hard copies of such data provided by the Engineer or Owner upon award of the Contract.

X. Prior to beginning construction activities, the Contractor will furnish full-coverage photo or video documentation of the entire construction site per requirements set forth in Article 3.2.A of Section 33 11 13 of the Technical Specifications.

Y. Drawings in CAD (Civil3D-2017, ACAD 2017, and Land XML) format related to earthwork required at the tank site are available from Souder, Miller & Associates at www.soudermiller.com. Any Bidder interested in obtaining access to the files must complete an 'Electronic Data File Transfer and Sharing Agreement' and submit to the office of the Engineer, Souder, Miller and Associates, attention Ryan Biehl, Project Engineer at ryan.biehl@soudermiller.com. Upon submittal of the attached form, the Bidder will receive instructions on how to access the files.

Z. Upon request, CAD files for the plan and profile sheets will be made available to the winning Contractor after Notice of Award. However, neither the Owner nor Engineer shall assume any liability for their use, nor shall use of any electronic files relieve the Contractor of his/her responsibility to meet the conditions of the Contract Documents, including the published Drawings. Contractor must submit an Electronic Data File Transfer and Sharing Agreement to the Engineer prior to receiving CAD files.

AA. HDPE is not an acceptable substitution for Fusible PVC. The use of HDPE would significantly change the engineered design. Internal restrained joint PVC is not an acceptable substitution for Fusible PVC. Internal restrained joint PVC is not a monolithic / leak free pipe and therefore not an acceptable substitution.

BB. Horizontal bends: At most locations, the plan and profile sheets show horizontal bends without specifying whether the horizontal bend is to be accomplished by DI ells, fusible PVC sweeps, bending of fusible PVC pipe, or joint deflection of jointed PVC pipe. At such locations, the method of bending is at Contractor's option, provided all design requirements set forth in the Drawings and Specifications are met. At any locations where fusible PVC sweeps are shown, they must be used.

CC. Contractor shall provide two (2) copies of the safety plan to the Engineer prior to commencing construction (one shall be for Owner's files). Neither the Owner nor

Engineer shall approve or comment on the Contractor's safety plan, nor shall the Owner or Engineer assume any responsibility for assuring compliance on the part of personnel on site, other than Owner's or Engineer's employees and representatives.

1.4 WORK BY OWNER

A. Owner-provided Surveyor:

1. Certain construction survey staking, benchmarks, and as-built surveying services shall be provided by the Owner at no cost to the Contractor.

2. Refer to Section 02 21 13 – Surveying for specific services to be provided by the Owner, exclusions, and responsibilities of the Contractor.

B. Owner-provided Wildlife Biologist:

1. The Owner shall provide the services of a qualified wildlife biologist, if applicable, at no cost to the Contractor. The Owner's wildlife biologist will perform pre-construction bird nest survey(s), delineate the required avoidance buffer around any discovered nests, and monitor any active nests until the nests are vacated. Refer to foregoing section for Contractor's responsibilities in these areas.

1.5 CONTRACTOR'S USE OF PREMISES

A. No work shall be done before 7:00 A.M. or after 7:00 P.M., local time on a working day, on Sundays, or on legal holidays, except as necessary for the proper care and protection of work already performed, or during emergencies. Any deviations from this specification shall require prior written approval by the Owner.

B. The Contractor shall make every effort to minimize noise caused by his operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise.

C. The Contractor shall restrict his operations as nearly as possible to the immediate site. Unnecessary cutting of vegetation adjacent to the site is prohibited. Every effort shall be made to minimize erosion during and after construction and the site shall be returned to its original condition, except where improvements are indicated or required.

D. The Contractor shall take affirmative action to prevent the misuse of the natural environment, wasting of natural resources, or destruction of natural values.

E. The Contractor shall conform to all requirements set forth in the latest edition of the "New Mexico Standard Specifications for Public Works Construction" with latest revision, and "Occupational Safety and Health Administration Regulations" for trenching, shoring and excavation.

1.6 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

B. The Contractor shall furnish all materials, labor, plant and equipment necessary to complete the contract work as called for by the Technical Specifications and as indicated on the Drawings. Material and work, either expressed or implied, necessary for the satisfactory completion of the contract work shall be considered an integral part thereof.

C. All standards incorporated herein by reference shall be the latest edition, unless otherwise specified. The abbreviations and applicable standards are described below:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AIA	American Institute of Architects
ANSI	American National Standards Institute, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CID	Construction Industries Division of the NM Regulation and Licensing Department
EJCDC	Engineers Joint Contract Documents Committee
EPA	Environmental Protection Agency
JAUA	Jicarilla Apache Utility Authority
IHS	Indian Health Service
ISO	International Organization for Standardization
MSJC	Masonry Standards Joint Committee
NACE	National Association of Corrosion Engineers
NAPF	National Association of Pipe Fabricators
NFPA	National Fire Protection Agency
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Department of Environment
NTUA	Navajo Tribal Utility Authority
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
SAE	Society of Automotive Engineers
SSPC	Society for Protective Coatings
IBC	International Building Code

1.7 MINIMUM WAGE RATE DETERMINATION

A. The minimum wage for work on the Jicarilla Apache Nation Reservation will apply for this project. As of April 2, 2020, the minimum wage on the Jicarilla Apache Nation Reservation is set at $10.00 per hour.
   1. Federal Davis-Bacon Wage Rates do NOT apply.
   2. State of New Mexico wage rates do NOT apply.

B.
   1. It is wholly the responsibility of the Contractor to inform him/herself of and abide by all regulations and requirements set forth by the applicable minimum wage.

1.8 TESTING AND INSPECTION ALLOWANCES

A. Testing Allowance: The bid schedule includes a predetermined sum to cover the cost of testing and inspection services as required in the Contract Documents.

B. Costs Included in Allowance: Fees charged by testing firm performing the testing, including field and laboratory costs for compaction, concrete, and fusion joint testing only.

C. Costs Not Included in Allowance:

1. Incidental labor and facilities required to assist testing or inspection firm, such as preparation of test pits, surface preparation, provision of safe access for testing personnel, and other work performed by the Contractor to facilitate testing.
2. Work performed by the testing laboratory that is not part of actual testing.
3. Cost of disinfection of waterlines, chlorine tests, or bacteriological tests.
4. Costs of hydrostatic pressure testing or testing of material welds as called for in the Contract Documents.
5. Costs of tank weld testing.
6. Costs of steel piping weld testing.
7. Costs of failed tests as determined by Engineer.
8. Any other tests not specifically authorized in advance by the Engineer.

D. Costs will be drawn from testing allowance and paid based on invoice(s) submitted to Contractor by testing or inspection firm(s).

1.9 SCHEDULE OF VALUES

A. Submit schedule on EJCDC Form C-620 (2002 Edition), or on other form provided by Engineer. Contractor's standard form or electronic media printout will be considered.

B. Base structure of Schedule of Values on Bid Schedule with identical item numbering, quantities, and values.

C. Submit Schedule of Values in duplicate at least 15 days prior to first Progress Meeting.

1.10 APPLICATIONS FOR PAYMENT

A. Application for Payment is synonymous with Partial Payment Estimate.

B. Submit copies of each application on the Partial Payment Estimate form provided in the Contract Documents, together with updated Schedule of Values identifying fully the list of items in the Application for Payment.

C. The Application for Payment form shall be submitted to the Engineer and RPR electronically 15 days prior to the monthly progress meeting electronically as an Excal spreadsheet.Submit up-to-date revisions of the following documents every month with Application for Payment. Application for Payment will not be processed without these updated documents.

1. Record Drawings
2. Construction Schedule, including overall project schedule and look-ahead schedule
3. All relevant documentation of testing performed during the pay period, such as concrete testing, compaction testing, weld x-rays, fusion joint testing, holiday and other coating testing, and any other testing specified in the Contract Documents
4. Fusion machine data logs

5. Any Stored Material Invoices

D. Payment Period: Monthly

1.11 CHANGE PROCEDURES

A. All Change Orders shall be prepared on the form provided in these Contract Documents.

B. Unit Price Change Order: For pre-determined unit prices and quantities, Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work not pre-determined, refer to Article 11 - Change of Contract Price; Change of Contract Times, of the Standard General Conditions (EJCDC C-700 Standard General Conditions and C-800 Supplemental Conditions of the Construction Contract).

1.12 UNIT PRICES

A. Engineer will take measurements and compute quantities accordingly. The Contractor will assist in taking of measurements and determination of work completed prior to preparation of corresponding Application for Payment.

1.13 ALTERNATES

1. Not Applicable.

1.14 COORDINATION

A. Coordinate scheduling, submittals, and Work of various sections of specifications to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.

C. Abide by Traffic Control Plan provided by Engineer and coordinate all lane closures and other traffic control activities with relevant agencies, as described above.

D. Contractor shall obtain permits from BIA-Jicarilla and Sandoval County prior to encroaching on any county or BIA roads, except for permits already obtained by the Owner or the Engineer.

1. Contractor shall notify the BIA-Jicarilla and the Engineer at least five (5) working days prior to working within the ROW of any BIA road.

E. Tapping NTUA facilities, and use of of NTUA water for filling and flushing:

1. The Project will connect to the terminus of Navajo Gallup Water Supply Project Reach 24.1-JAN. Reach 24.1 JAN is operated by the Navajo Tribal Utility Authority (NTUA), not the Owner or JAUA.

2. Contractor shall obtain permission to tap from the Navajo Tribal Utility Authority (NTUA). A blank Permission to Tap application form is provided in Appendix H. Contractor shall not connect to existing NTUA system without written permission from NTUA and the Engineer to proceed.

3. Perform all work in conformance with the tapping permit and all written and verbal instructions from NTUA personnel, including notification and coordination with NTUA, maximum water usage rates, time and duration of shut-offs, and disinfection requirements.

4. Wet taps to NTUA pipelines shall not be permitted.

5. Contractor must coordinate use of NTUA potable water, such as for filling and flushing the pipeline, with NTUA at least two (2) weeks prior to tapping NTUA facilities or using NTUA water. Contractor must provide NTUA with key information, such as maximum instantaneous flow rate (gpm), maximum daily flow rate (gpd), schedule of water use, and other information as required by NTUA. NTUA will advise Contractor of flow rate available for pipeline filling and flushing.

6. Contractor is advised that a Water Use Permit from Navajo Nation Water Code Administration is required for use of the NTUA water. Contact Wayne Williams at (928) 729 – 4132 or wwilliamsjr@navajo-nsn.gov for more information.

7. Contractor must not infringe on NTUA's ability to serve its existing customers by excessive water use. Contractor shall limit water use to avoid such infringement.

8. Contractor is advised that actual flow rate of NTUA water available for line filling and flushing may be significantly less than the maximum allowable flow rate specified in the Technical Specifications. Contractor shall adjust construction schedule based on actual available flow rate.

F. Tie-ins to the existing JAUA facilities (if applicable) at the end of the JAN-Cutter Intertie pipeline shall be cut-in tees or crosses, not wet taps. Connections to existing tanks shall be floor penetrations.

1. Contractor must also notify JAUA at least two (2) weeks prior to tapping any existing JAUA water facility or crossing existing JAUA waterlines with proposed waterlines.

2. Contractor shall coordinate all tapping activities with JAUA and must receive utility authority approval prior to tapping any JAUA facility.

3. Contractor may be required to provide temporary tanks to maintain water service to JAUA's existing customers while tapping tanks. Such temporary tanks, if required, shall be provided at no additional cost to the Owner.

G. JAUA will not be the owner's RPR for the project; however, JAUA will be on the job site to gather its own survey data (in addition to that gathered by the Owner's Surveyor) of the constructed work and to periodically to inspect work.

H. Contractor is responsible for coordinating schedule for completion of hydrostatic pressure tests and bacteriological tests with the Owner's RPR and JAUA. At a minimun, either the Owner's RPR or JAUA personnel must witness all tests. **Please Note: Required Pressure Test Parameters are listed in Appendix H.**

I. Contractor is responsible for coordination with JAUA of final project inspection by JAUA personnel prior to JAUA acceptance of passing hydrostatic pressure tests, passing bacteriological tests, and completed punch list. Hydrostatic pressure tests and bacteriologic tests may need to be re-tested if punch-list or final inspection require additional repairs to the pipeline or appurtenances. Re-tests following repairs will be completed at no additional cost to the Owner.

J. The Contractor is responsible for obtaining all applicable local, county, state and tribal building and development permits not previously obtained by Engineer or Owner. Contractor is responsible for timely scheduling of any pertinent inspections with local, county, state and tribal agencies with jurisdiction, and as required by the permits.

K. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable.

L. All notices, demands, requests, instructions, approvals, proposals and claims must be in writing or email. Official email address(es) for notices will be designated during the pre-construction conference. Documents requiring written notice will be delineated at the pre-construction conference.

1. Any notice to or demand upon the Contractor shall be sufficiently given if delivered at the office of the Contractor stated on the signature page of the Agreement or to the official contact email address designated at the pre-construction conference.

2. All papers required to be delivered to the Owner shall, unless otherwise specified in writing to the Contractor, be delivered to the Owner at the address stated on the signature page of the Agreement, and a copy shall be delivered to the Engineer at the 5454 Venice Ave. NE, Suite D, Albuquerque, NM 87113.

3. Any such notice shall be deemed to have been given as of the time of actual delivery, in the case of mailing, when the same should have been received in due course of post, or in the case of telegrams, certified mail, or telephone facsimiles, at the time of actual receipt as the case may be.

M. Coordination with Surveyor: Refer to Section 02 21 13 – Surveying.

N. Contractor shall provide on-site office space/ work area for Resident Project Representative and other supervisory staff provided by Owner. Such office space may consist of a reasonably-sized room within the Contractor's project office trailer. The office is required to have a desk and power service.

1.15 SUSPENSION OF WORK

A. The Owner may order suspension of work due to seasonal or other conditions unsuitable for construction work.

B. Maintenance during suspension: Prior to suspension for any cause, the Contractor shall take necessary precautions to protect the work during the period of suspension from any factors which would contribute to its deterioration.

C. Time elapsed during suspension of the work shall not count as contract time. The Contractor shall make no claim for damages due to delay, additional mobilization charges, nor any additional costs that may be incurred solely due to suspension of work.

D. Requests for additional time to be added after the "contract completion date" due to delays or extra work shall be made to the Owner in writing by the Contractor within ten (10) days after the time of the occurrence of the delay or receipt of a Change Order for extra work. Such requests shall set forth the justification for the additional time.

E. Upon approval, the additional contract time shall then be in full force and effect, the same as though it were the original date for completion, and will be shown as the completion date plus an amount of additional working days. Any time required to complete the work beyond the contract time or additional contract time will result in the assessment of liquidated damages, as specified in the Contract Documents. Failure to make such requests within the above limits will be considered as a waiver on the part of the Contractor as to the need for additional contract time.

1.16 FIELD ENGINEERING

A. Establish elevations, lines, and levels and certify elevations and locations of the Work conforming with the Contract Documents.

B. Verify field measurements are as indicated on shop drawings or as instructed by manufacturer.

C. From the information provided by the Owner, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, easement alignments, stakes for pipe locations and other working points, lines, elevations and cut sheets.

1.17 PRE-CONSTRUCTION CONFERENCE

A. Engineer will schedule Pre-Construction Conference after Notice of Award for affected parties.

B. The Contractor, or his duly authorized representative, and subcontractor representatives will attend the meeting.

1.18 PROGRESS MEETINGS

A. Schedule in coordination with the Engineer at maximum monthly intervals, and attend all Progress Meetings throughout progress of the Work.

B. The purpose of the meetings will be to review the following:

1. Work progress since previous meetings.
2. Field observations, problems, conflicts.
3. Problems which impede construction schedule.
4. Corrective measures and procedures to regain projected schedule.
5. Revisions to construction schedule.
6. Plan progress and schedule during succeeding work period.
7. Coordination of schedules.
8. Off-site fabrication and delivery schedules.
9. Maintenance of quality standards.
10. Proposed changes, construction schedule and completion date.
11. Coordination of separate contracts.
12. Record or “as-built” drawings of completed work.
13. Other business as required.
14. Regulatory requirements including OSHA, New Mexico Board of Labor, and others as applicable.
15. Funding requirements including RUS, NMED, NMFA, DFA, USEPA and others as applicable.

C. During each meeting, the Contractor is required to present any issues which may impact his Work, with a plan to resolve these issues expeditiously.

1.19 CUTTING AND PATCHING

A. Submit written request in advance of cutting or altering elements with possible detrimental effects.

B. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.

C. Restore Work with new products according to requirements of Contract Documents.

D. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

E. Refinish surfaces to match adjacent finishes.

1.20 SUBMITTAL PROCEDURES

A. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

B. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

C. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of completed Work.

D. Revise and resubmit submittals as required by the Engineer; identify changes made since previous submittal.

E. Submit number of hardcopies Contractor requires, plus two hardcopies Engineer will retain, at a minimum, unless otherwise indicated at the Pre-Construction Conference. In addition, Contractor shall provide all submittals electronically in PDF format, unless otherwise directed by the Engineer.

F. Transmit each submittal with Engineer accepted form.

G. Provide a separate submittal for each item. Do not combine multiple distinct items into a single submittal without prior approval of Engineer. Improperly combined submittals shall be rejected.

H. Provide updated submittal log with each submittal. If multiple submittals are submitted concurrently, only one updated log needs to be provided with submittal package.

I. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

1.21 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in duplicate within fifteen [15] days after date of Owner-Contractor Agreement for Engineer review.

B. Submit revised schedules with each Application for Payment, identifying changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission. Interim applications for payment shall not be processed without updated schedules.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

1.22 PROPOSED PRODUCTS LIST

A. Upon submittal of Bid Form, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.23 PRODUCT DATA

A. Product Data: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit copies and distribute in accordance with Submittal Procedures article.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.24 SHOP DRAWINGS

A. Shop Drawings:

1. Submitted to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

2. Include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items.

3. Design calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.

4. After review, provide copies and distribute in accordance with Submittal Procedures article and for record documents purposes as specified.

5. Except as may otherwise be indicated herein, the Engineer will return copies of each submittal to the Contractor with comments noted thereon, within 30 calendar days following their receipt by the Engineer.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Submit number of opaque reproductions Contractor requires, plus two copies Engineer will retain.

1.25 TEST REPORTS

A. Submit for Engineer's knowledge as contract administrator or for Owner.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.26 MANUFACTURER'S INSTRUCTIONS AND CERTIFICATES

A. When specified in individual specification sections, submit manufacturer printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

C. When specified in individual specifications sections, submit certifications by manufacturer to Engineer, in quantities specified for Product Data.

D. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

E. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

1.27 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturer's instructions.

C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.28 TOLERANCES

A. Monitor fabrication and installation tolerance control of installed products over suppliers, manufacturers, products, site conditions, and workmanship, to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply fully with manufacturer's tolerances.

1.29 REFERENCES

A. Conform to reference standards by date of issue current as of date of Contract Documents.

B. When specified reference standard conflict with Contract Documents, request clarification from Engineer before proceeding.

1.30 MANUFACTURER'S FIELD SERVICES AND REPORTS

A. When specified in individual specification sections, require material or product suppliers or manufacturers to furnish qualified staff personnel to observe site conditions and to initiate instructions when necessary.

B. Report observations and site decisions or instructions that are supplemental or contrary to manufacturer's written instructions.

1.31 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify utility services are available, of correct characteristics, and in correct location.

C. Contractor is solely responsible for utility location, protection and verification. Contractor must notify New Mexico One Call System Inc., at 811, and all local utility providers (including JAUA and JANPA), at least three (3) days before starting utility line construction. Additional notice may be required for certain utilities, as noted on the Drawings and Specifications.

D. It shall be the responsibility of the Contractor to become acquainted with the location of all underground structures which may be encountered or which may affect the Work hereunder.

1.32 TEMPORARY SERVICES

A. Provide, maintain and pay for suitable quality water service as required.

B. Maintain uninterrupted water and electric service to all properties adjoining the Work, at all times, except where specifically approved by the authority having jurisdiction. Services damaged by the Contractor shall be immediately and permanently repaired or replaced at the expense of the Contractor. Give a minimum of 48-hour advance notice to occupants of adjacent properties, before interrupting any service. Any interruption of service shall be kept to the minimum length of time possible.

1. Contractor shall take necessary measures, including provision of temporary tanks and piping, to maintain uninterrupted water service until new tanks can be put back into service. Such temporary tanks, if needed, shall be provided at no additional cost to the Owner.

C. Until final inspection and approval of the Work and issuance of the Certificate of Substantial Completion, the Contractor is responsible for all Work directly or indirectly affected by the Contractor's activities. Such responsibility continues for all Work detailed on the punch list that may accompany the Certificate of Substantial Completion, until satisfactorily completed by the Contractor and approved by the Owner and Engineer.

D. Furnish, install and maintain any temporary water storage structures, electrical connections, meters, wiring, outlets, switches, lamps, etc., as necessary for the work. The Contractor shall provide such temporary heat as may be necessary for the prevention of injury to the work or material through dampness or cold. All temporary connections, installations, facilities and supplies furnished or installed as specified in this paragraph, shall be removed prior to the completion of the Contract, and the premises left perfectly clean and satisfactory to the Owner.

E. Maintain ambient temperature above freezing in enclosed/occupied areas where construction is in progress, unless indicated otherwise in specifications.

F. Provide temporary electricity and power outlets for construction operations, connections, branch wiring, distribution boxes, and flexible power cords as required. Do not disrupt Owner's need for continuous service.

G. Provide and maintain required sanitary facilities and enclosures in clean and sanitary condition.

H. All temporary power costs/bills, including power to new project infrastructure, if applicable, shall be borne by the Contractor until final project acceptance by the Owner and JAUA.

1.33 ACCESS ROADS

A. The project right-of-way and temporary construction easement may be used for construction traffic. Do not construct any new roads. All trafficked areas must be restored to original condition prior to final completion of the project.

B. Existing on-site roads, designated by the Owner, may be used for construction traffic, provided the roads are not damaged and access to roads by local land users is not affected. Existing roads must be restored to original condition prior to final completion of the project.

1.34 PROGRESS CLEANING AND WASTE REMOVAL

A. Collect and maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Maintain new and existing structures free of dust and construction debris at all times.

C. Remove waste and surplus materials, rubbish, and construction facilities from site. Restore all job sites and adjoining areas, including roads and driveways, to a condition equal to or better than the original status. Special attention will be made to not disturb unimproved roads by placing any excavated material to the sides of these roads when water lines are located along the right-of-way.

D. Brush and trees shall be felled parallel to the right-of-way to minimize damage to trees and structures on adjacent property. All brush, tree tops, stumps and other debris shall be removed from the right-of-way and disposed of by the Contractor, subject to and in conformity with the special provisions applying to the tract of land involved (if any). The Contractor shall not destroy nor remove any trees, shrubbery, nor any other improvements, without permission of the Owner.

E. The Contractor shall not dispose of debris, refuse or sanitary wastes in an open dump or in a natural watercourse, whether on public or private property, or in such places that undesirable wastes can eventually be exposed or carried to a natural watercourse.

F. Removal of obstructions required for completion of the project, whether specifically listed or not, shall be considered incidental to the work.

1. The Contractor shall remove and supply all usable materials to the Owner at a site designated by the Owner.

2. The Contractor shall remove and dispose of all unusable materials in accordance with relevant environmental regulations.

1.35 PROJECT IDENTIFICATION

A. Project sign requirements: None.

B. The Contractor shall not erect, or permit the erection of advertising signs. Only minimal identification and direction signs shall be permitted on the site. Unnecessary or obnoxious posters, pictures, signs, symbols, drawings or writing on work, material or equipment, resulting from vandalism or other causes, shall be covered or removed by the Contractor.

1.36 BARRIERS AND FENCING

A. Provide barriers or fencing to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage.

1.37 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Contractor shall remain wholly responsible for protection of all stored materials and installed work until final acceptance of the project by the Owner and JAUA.

1.38 SECURITY

A. Provide security and facilities to protect Work and existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Security of Contractor's equipment, stored materials, work, and staging areas shall be entirely the responsibility of the Contractor. The Owner assumes no liability for any damage, vandalism, or theft of Contractor's property.

1.39 WATER CONTROL

A. Provide erosion control.

B. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Contractor must abide by all stipulations and requirements within the Storm Water Pollution Prevention Plan (SWPPP) to be provided by the Contractor throughout all construction phases, including all proposed pollution prevention and sediment control measures. This shall be done in accordance with the National Pollution Discharge Elimination System (NPDES) general permit requirements for all construction activities, and shall include all required reporting. If the Bid Form does not include an item for preparation and implementation of the SWPPP, the cost thereof will be considered incidental to related work.

D. The Contractor shall conduct his operations to minimize damage to natural watercourses, and shall not permit petroleum products, volatile fluid wastes, or any other wastes which are prohibited by local ordinances, or excessive amounts of silt, clay, or mud to enter any drainage system. The bed of natural watercourses or man-made irrigation ditches shall be restored to normal gradient and cross-section after being disturbed.

E. Do not fill in any natural washes or drainages or impede natural water flow unless otherwise indicated in the plans or specifications, or directed by the Engineer in the field.

1.40 POLLUTION AND ENVIRONMENTAL CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

B. Provide dust control, erosion and sediment control, noise control, pest control and rodent control to allow for proper execution of the Work. Motor equipment shall be kept in repair and equipped with anti-pollution devices, if possible, to cut down on exhaust emissions. Burning as a method of cleaning or disposal will not be permitted without

approval of the proper authorities. Short term effects of dust produced by equipment will be mitigated by sprinkling traffic areas with water.

C. Comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act of 1970 (42 U.S.C. 1251 et seq.) as amended. Violations shall be reported to the New Mexico Environment Department.

D. The Contractor shall be responsible for the reporting and the cleanup of spills associated with project construction and shall report and respond to spills of hazardous materials such as gasoline, diesel, motor oil, solvents, chemicals, toxic and corrosive substances, and other materials which may be a threat to the public health or the environment.

E. The Contractor shall be responsible for reporting past spills encountered during construction and of current spills not associated with construction. Reports shall be made to the New Mexico State Police at 575-289-3443 or 505-334-6622, or call the New Mexico Environment Department Emergency Response Team at 505-827-9329 and to the Owner's Representative.

F. The Contractor shall clean up any unreported spills associated with project construction identified after construction.

G. Fuel, oil, hydraulic fluid, lubricants, and other petrochemicals must not be stored within the 100-year floodplain or within 100 ft of any wash, and must have a secondary containment systems to prevent spills.

H. Do not change or add oil, hydraulic fluid, or other petrochemical-based fluids to any piece of machinery within the 100-year floodplain or within 100 ft of any wash.

I. Appropriate spill clean-up materials suchs as brooms and absorbent pads must be available where materials are stored or equipment is working at all times.

1.41 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials, prior to Substantial Completion review.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.42 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components specifically identified for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically identified or allowed by the Contract Documents.

C. Provide interchangeable components of same manufacture for components being replaced.

1.43 DELIVERY, HANDLING, STORAGE, AND PROTECTION

A. Deliver, handle, store, and protect Products in accordance with manufacturer's instructions.

1.44 SUBSTITUTIONS

A. Substitutions will only be considered when Product becomes unavailable through no fault of Contractor.

B. Specific manufacturers may be required for certain items in order to maintain consistency with the Owner's existing inventory. In such cases, substitutions may not be allowed.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. Submit three [3] copies of request for Substitution to the Engineer for consideration. Limit each request to one proposed Substitution.

1.45 CLOSEOUT PROCEDURES

A. Submit written certification Contract Documents have been reviewed, Work has been inspected, and Work is complete in accordance with Contract Documents and ready for Engineer's inspection.

B. Submit final Application for Payment identifying total adjusted Contract Price, previous payments, and amount remaining due.

C. Project closeout submittals shall include, but not necessarily be limited to:

1. Affidavit of Punch List Completion
2. Project Record Documents
3. Operations and Maintenance Data
4. Spare Parts and Maintenance Materials
5. Extended Warranties
6. Release of Liens
7. Consent of Surety
8. Certification of Labor Standards
9. Complete packages of all testing results, start-up reports and data logs, including: manufacturer's testing data, pipe fusion data logs, fusible PVC fusion tests, line purge records, bacteriological tests, pressure tests, concrete tests, compaction tests, weld x-rays, cathodic protection start-up reports, and other quality control/ quality assurance documentation required in the Specifications.

D. Final payment will not be processed until the Owner and JAUA have accepted the project close-out submittals referenced above.

1.46 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Upon completion of the work under this contract, thoroughly clean and make any needed repairs caused by damage during construction to any existing utilities or other structures on the site.

C. Notify the Engineer in writing once final cleaning is complete. The final payment will not be made until the Contractor has complied with all requirements set forth and the

Engineer has made his final inspection of the entire work and is satisfied that it is properly constructed and the site properly cleaned.

D. All costs related to cleaning shall be considered incidental to the project.

1.47 STARTING OF SYSTEMS

A. Provide at least seven [7] days notification prior to start-up of each item. Contractor shall coordinate scheduling of such start-up services with the manufacturer and Engineer.

B. Ensure each piece of equipment or system is ready for operation.

C. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.

D. Submit written report stating equipment or system has been properly installed and is functioning correctly.

1.48 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six [6] months.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.

1.49 TESTING, ADJUSTING, AND BALANCING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Owner retains the right to appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with requirements of Contract Documents.

C. Contractor will cooperate with independent firm; furnish assistance as requested.

D. Re-testing required because of non-conformance to specified requirements will be charged to Contractor.

1.50 PROTECTING INSTALLED CONSTRUCTION

A. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

B. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

C. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

D. Prohibit traffic from landscaped areas.

1.51 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of Contract Documents to be utilized for record documents.

B. Record actual revisions to the Work. Record information concurrent with construction progress.

C. Specifications: Legibly mark and record at each Product section description of actual Products installed.

D. Record Documents and Shop Drawings (As-Built Drawings):

1. Legibly mark each item to record actual construction.

E. If any surveying is provided by the Contractor to supplement Owner-provided surveying, submit records and digital survey data.

F. Submit updated record documents to Engineer together with claims for interim Application for Payment. Interim and final applications for payment shall not be processed without updated record documents.

G. All mapping and other documentation requirements associated with the Contractor's SWPPP shall be the responsibility of the Contractor.

1.52 OPERATION AND MAINTENANCE DATA

A. Submit 3 sets prior to final inspection, bound in 8-1/2 x 11 inch text pages, 3 D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.

C. Internally subdivide binder contents with permanent page dividers, logically organized.

D. Contents:

1. Part 1: Directory

a. List names, addresses, and telephone numbers of Engineer, Contractor, subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system:

a. Equipment summary, operational procedures, preventive maintenance procedures and schedules, parts list, shop drawings, safety issues.

3. Part 3: Project documents and certificates.

a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

E. Operation and Maintenance Data may be accepted in electronic form as PDF documents in lieu of or in addition to hardcopies, at Engineer's discretion.

1.53 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.

B. Deliver to project site and place in location as directed by Engineer; obtain receipt prior to final payment.

1.54 WARRANTIES

A. Contractor warrants to Owner that all materials and workmanship covered by this Agreement, collectively referred to as the Work, supplied or performed by the Contractor, Contractor's sub-contractors, or Contractor's suppliers, will conform with the specifications, drawings, and other descriptions supplied or adopted by Owner and will be new, fit, and sufficient for the purposes for which they are intended as evidenced in this Agreement and in the drawings and specifications referred to therein, of good material, design and workmanship, free from defects, and will fulfill satisfactorily the operating conditions specified herein.

B. Contractor shall execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers for all products with extended warranties beyond one (1) year.

C. Contractor shall submit all warranty documentation prior to final Application for Payment.

D. All warranty periods shall commence upon the date of final acceptance of the work by Owner and JAUA.

E. If during the warranty period, any Work fails to conform with the foregoing guarantees, the defective Work shall be promptly repaired or replaced per these specifications and to the satisfaction of the Owner, at no cost to the Owner, including but not limited to prepayment of all packing and transportation costs; the cost of excavation, removal, and replacement of the defective material and all other adjacent materials affected by these actions; the cost of bedding and compaction and all required testing; as well as the costs of construction oversight, management and testing of materials by the Engineer.

F. Contractor will not be chargeable for repairs made by Owner to correct such failure within the foregoing warranty unless Contractor has been given written notice of such failure and thereafter has failed to take prompt and effective action to correct the failure in accordance with the foregoing.

1.55 RESIDENT PROJECT REPRESENTATIVE

A. The Owner shall provide a Resident Project Representative (RPR) to observe construction of the project.

B. The RPR shall:

1. Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings.

2. Serve as Engineer's liaison with Contractor, working principally through Contractor's authorized representative, assist in providing information regarding the intent of the Contract Documents.

3. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

4. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

5. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
6. Review Applications for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.
7. During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.
8. Participate in a Substantial Completion inspection, assist in the determination of Substantial Completion and preparation of punch lists.
9. Participate in a final inspection in the company of Engineer, Owner, and Contractor and prepare a final list of items to be completed and deficiencies to be remedied.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02 21 13

SURVEYING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surveying services to be provided by Owner related to establishment of elevations, lines, and levels and certification of elevations and locations of the Work conforming to the Contract Documents.

2. Contractor's responsibilities in support of Owner-provided surveying and additional surveying work to be paid by Contractor.

B. Related Sections:

1. Section 01 00 00 - Basic Requirements: Field Engineering.

2. Section 31 23 17 - Trenching: Execution requirements for trenching.

3. Section 31 23 23 - Backfill.

4. Section 33 11 13 - Public Water Transmission Systems.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Construction Staking and As-Built Surveying:

1. Owner shall provide the surveying services specifically delineated in this section at no cost to the Contractor.

2. Any additional surveying services shall be provided at Contractor's sole expense, and shall be considered incidental to the project.

a. Additional surveying services provided by the Owner's Surveyor shall be charged to the Contractor at the prices listed on the "Authorization for Contractor Reimbursed Work" and "Acknowledgement of Contractor Reimbursed Standby Time". These forms are provided in Appendix E to the Contract Documents.

b. Surveying services provided by any other surveyor shall be subject to Owner's approval of the surveyor's qualifications.

3. Contractor support required herein, and any other reasonable Contractor support for Owner-provided Surveyor, shall be provided at Contractor's sole expense and shall be considered incidental to the project.

1.3 PRIMARY CONTROL

A. The Engineer will establish primary control to be used for establishing work lines and grades.

B. Primary control will consist of bench marks and horizontal control points in work vicinity.

C. Contractor shall preserve and maintain primary control points until otherwise authorized. Engineer may reestablish damaged or destroyed primary control points and backcharge cost to the Contractor.

1.4 RIGHT-OF-WAY AND TEMPORARY CONSTRUCTION EASEMENT

A. Contractor is advised that a 40’ wide permanent right-of-way (ROW) easement is established along the proposed pipeline alignment, 20’ to each side of the centerline. An additional 30’ is provided on each side of this permanent easement to provide a temporary construction easement (TCE), resulting in a total of 100’ wide corridor to which the Contractor must limit all construction activities, staging, and construction traffic.

B. Contractor is advised that at certain locations the temporary construction easement is truncated on one side or the other to avoid encroaching on culturally sensitive areas or adjacent properties. These truncated areas are indicated on the Drawings and will be barricaded by the Owner’s Surveyor. Contractor shall not encroach beyond the established work space in these areas.

C. Contractor shall not work in any area where the designated work area has not been staked by Owner’s Surveyor.

D. Contractor shall be wholly liable for any damage caused by working in areas that have not been staked, or by encroaching outside the staked work area.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 OWNER-PROVIDED SURVEY SERVICES

The Owner’s Surveyor (herein defined as New Mexico-licensed Professional Surveyor or his designated field representative, contracted directly by the Owner) shall provide the following services at no cost to the Contractor:

A. Construction Staking:

1. ROW/ TCE limit Staking:

a. Owner’s Surveyor will stake the TCE boundaries every 100 feet and at all horizontal points of inflection.

b. If applicable, where the temporary construction easement is truncated to avoid culturally sensitive, biologically sensitive, or restricted areas, the Owner’s Surveyor will barricade the truncated ends of the temporary construction easement with multiple stakes spaced no more than 10 ft apart to protect against inadvertent encroachment outside the designated work area by construction personnel or others.

2. Pipe Centerline and Profile Staking:

a. Owner’s Surveyor will stake the pipe centerline, with offsets as requested by Contractor, at the following intervals:

1) Every 50(+/-) feet

2) All vertical points of inflection

3) At all horizontal points of inflection

4) At all valves, fittings, and other appurtenances, as shown on the Drawings

5) At all locations with additional minimum cover specified on the Drawings

b. Offset between pipe profile stakes and pipe horizontal centerline to be specified in writing by Contractor on the "Owner-Provided Survey Request Form".

c. Owner-provided stakes will provide vertical depth from hub to pipe.

1) Contractor shall specify in writing on "Owner-Provided Survey Request Form" if vertical depths on pipe profile stakes are desired to be measured to top of pipe, pipe vertical centerline, or pipe invert. This measurement convention shall be used consistently throughout the entire project.

3. Structures and Site Staking:

a. Owner's Surveyor will provide the following staking for the tank site(s):

1) Rough grading/ slope stakes, for pads and driveways

2) Sub-grade/ base course fine grading hubs, for pads and driveways

3) Site improvement stakes

a) Tank foundations

b) Vaults and manholes

c) Valves (center of valve)

d) Site piping and appurtenances

e) Storm drains

f) Fencing

g) Driveways

4) Temporary benchmarks for all Contractor's use

b. Contractor shall be wholly responsible for proper alignment of all pipes, utilities, foundations and buildings in the field, including flange locations and elevations of pipe risers at any surge tank or chlorinator buildings.

Tank overflow elevations: Owner's Surveyor will provide a benchmark in the vicinity of each tank. Contractor shall be wholly responsible to determine proper tank overflow elevations based on these benchmarks. Owner's surveyor will not survey the weir elevations of new tanks prior to as-built survey.

4. Roads:
    a. Slope stakes every 100 feet, left and right side.
    b. Fine grading hubs every 50 feet on tangent and every 25 feet on curves.
    c. Stake culverts.

B. As-builts:

1. Pipe:
    a. The centerline of pipe shall be surveyed after laying and embedment of pipe in trench but prior to placing backfill over the top of the pipe or other features to be surveyed.
    b. Any pipe that is backfilled prior to as-built surveying shall be uncovered at Contractor's sole expense to allow for surveying.
    c. If the pipe is found to be outside of the line and grade specifications established in Section 33 11 13 - Public Water Transmission Systems, Contractor will be required to correct line and grade and have the corrected work re-surveyed at Contractor's sole expense.
    d. If the Engineer suspects that the pipe has floated, shifted during placement or compaction of embedment, or otherwise moved after as-built surveying, the affected portion shall be re-surveyed as directed by the Engineer. All conditions noted above for pipe found to be outside line and grade specifications shall apply equally to re-surveyed pipe.
        1) If the pipe is found to have moved, the cost of re-surveying shall be borne by the Contractor.
        2) If the pipe is found not to have moved, the re-surveying shall be provided at no cost to the Contractor.
    e. Only actual measurement of top of the pipe shall be accepted. No as-built reference points shall be accepted, without prior approval by the Engineer.
    f. Wash crossings with specified additional cover: In addition to surveying the pipe, Owner's Surveyor shall also survey a cross-section of the existing grade of the wash itself to verify depth of cover from the bottom of the wash to the top of the pipe.
        1) Where possible the wash cross-section will be surveyed at the pipe centerline prior to ground disturbance at the wash.
        2) If wash cross-section surveying is required after ground disturbance (such as at the time the pipe is as-built surveyed), a representative cross-section of the wash to the right or left of the pipe crossing may be surveyed instead.

2. Structures and sites:
    a. Owner's Surveyor shall certify location and elevation of tank foundations after completion of the foundations, but prior to construction of structures on the foundations.
    b. Owner's Surveyor shall certify tank overflow weir elevations after tank erection.
    c. Owner's Surveyor shall survey all valves, vaults, fence corners, culverts, key drainage features, drain pipe outfalls, and other features within the sites.
    d. Owners' Surveyor shall survey pressure pipes and drain pipes within the tank site(s) to ensure compliance with minimum slope requirements.
3. Roads:
    a. Owner's Surveyor shall provide as-built surveying for all culvert ends.
    b. As-builts for road surface and associated drainage ditch shall be based on the blue tops provided by the Owner's Surveyor.
    c. In the event that actual construction differs from the blue tops, the road shall be as-built surveyed at the Contractor's expense.
4. Existing utilities:
    a. Any existing utilities, such as existing gas lines or water lines crossed by the project, shall be surveyed by the Owner's Surveyor after being potholed by the Contractor.
5. As-built surveying intervals:
    a. Pipeline:
        1) Every 50(+/-) feet along main pipeline
            a) For site piping, closer spacing may be required to ensure adequate slope
        2) All vertical points of inflection
        3) At all horizontal points of inflection
        4) At all valves, fittings, and other appurtenances, as shown on the Drawings
        5) At all locations with additional minimum cover specified on the Drawings
    b. Valves and pipe fittings:
        1) Centerline of pipe at all risers for air valves
        2) Centerline of all in-line valves
        3) Centerline of all fittings, such as tees, wyes and ells
        4) For flush valves, centerline of all valves, risers, horizontal and vertical points of inflection, and outfalls

c. Structures:

1) Finished floors at all corners and floor drains of buildings

2) Center of rims for all manholes and vaults

3) Tank base, surveyed at four locations at 90 degrees to each other

3.2 CONTRACTOR SUPPORT AND COORDINATION

A. Contractor shall provide Owner's Surveyor with a minimum of 48 business hours notice to commence any surveying activity, such as construction staking or as-built surveying,

1. Contractor shall use the "Owner-Provided Survey Request Form" (for Owner-provided survey work) or the "Authorization Form for Contractor Reimbursed Work" (for Additional Surveying Services). The Contractor shall also execute the "Acknowledgement of Contractor Reimbursed Standby Time" in the event that Surveyor standby time is required. These forms are provided in Appendix F to the Contract Documents to request all surveying work.

a. All survey request/ authorization forms shall be submitted to the Owner's Surveyor via fax.

2. Contractor shall not bury any Work requiring as-built survey prior to being surveyed.

3. If, and only if, the Owner's Surveyor is not available to provide as-built surveying within 48 business hours, or if the Work must be backfilled in less than 48 business hours due to unforeseeable circumstances beyond the Contractor's control, then the Contractor will be allowed to backfill the Work under one of the following conditions, subject to Engineer's approval:

a. Contractor sets reference points at station, offset, and cut or fill to the top of pipe every 50 feet and at all high and low points, or

b. Contractor potholes the Work at a later date

B. Contractor responsible to coordinate schedule and pace of work with Owners' Surveyor, and pace work accordingly.

1. Contractor shall provide the Owner's Surveyor with updated work schedules throughout the project.

2. Contractor shall request a minimum of one (1) mile of ROW/ TCE limit staking at a time.

3. Contractor shall request a minimum of one-half (1/2) mile of pipe centerline staking at a time. Contractor shall not request pipe centerline staking until the area has been cleared and grubbed.

4. Contractor shall request a minimum of 1,000 LF of pipe as-built surveying at a time. Contractor may submit request for as-built surveying prior to actual pipe installation at Contractor's own risk; Contractor shall be back-charged for standby time if the pipe is not ready for surveying at the scheduled time.

C. Contractor shall provide safe access for Owner's Surveyor to survey as-built facilities in accordance with this section, including pipe within uncovered trenches. All locations which Owner's Surveyor must access must meet OSHA safety standards for the Owner's

Surveyor, as judged by the Surveyor. The Owner's Surveyor reserves the right to refuse to enter any location he or she deems to be unsafe, in which case it shall be the Contractor's responsibility to provide the Owner's Surveyor safe access to the locations that must be surveyed. In case of any dispute as to the safety of a particular location for the Surveyor to enter, the Owner reserves the right to contact OSHA for a determination.

1. Neither the Owner, nor the Engineer, nor the Owner's Surveyor will make any determination or assume any responsibility regarding the safety of any aspect of the project for the Contractor's own personnel or sub-contractors.
2. Beyond provision of safe access to facilities requiring survey, Contractor assumes no responsibility for Owner's Surveyor's, Engineer's, or Owner's safety.

D. Contractor shall coordinate with Owner's Surveyor regarding desired location of Owner-provided benchmarks.

3.3 RE-STAKING AND CORRECTION OF SUB-STANDARD WORK

A. All construction staking will be provided one time at no cost to the Contractor.

1. Any required re-staking due to Owner-requested changes to the Work shall be provided at no cost to the Contractor.
2. Any re-staking not due to Owner-requested changes shall be at Contractor's sole expense.

B. Any stake removed, damaged beyond usability, or moved from its original location shall be replaced by the Owner's Surveyor at Contractor's expense.

C. In the event that any pipe or other facility moves after it has been surveyed for as-builts, it shall be re-surveyed at Contractor's expense.

D. Any sub-standard work that needs to be re-installed shall be re-surveyed at Contractor's sole expense.

1. In the case of pipeline that fails to meet line and grade requirements, the Contactor shall be responsible for the cost of re-excavation, re-installation, re-embedment, re-compaction, re-surveying and re-testing of any embedment material that must be removed in order to correct pipe line and grade.

3.4 ADDITIONAL SURVEYING SERVICES

A. All Additional Surveying Services shall be borne at the Contractor's sole expense.

1. Prices for Additional Surveying Services shall be as set forth on the "Authorization Form for Contractor Reimbursed Work" and "Acknowledgement of Contractor Reimbursed Standby Time", provided in Appendix E to the Contract Documents.

B. Additional Surveying Services include:

1. Re-staking
2. Re-surveying of sub-standard work
3. Re-surveying of work that has moved subsequent to as-built surveying

4. Any surveying associated with Best Management Practices (BMPs) included in the Contractor's SWPPP

5. Any surveying services not specifically delineated in this Section as Owner-provided surveying services

3.5 ACCURACY

A. Degree of accuracy of surveying:

1. Horizontal and vertical alignment of pipeline tangents and curves: Within 0.10 ft.

2. Structure Points: Set within 0.03 foot, except where installation or operation considerations require tighter tolerances.

3. Blue Tops: Set within 0.03 foot.

4. Cross-Section Points: Locate within 0.10 foot, horizontally and vertically.

5. Benchmarks: Set within 0.08 foot, horizontally and vertically.

3.6 DISCREPANCIES

A. Contractor, Engineer, and Owner's Surveyor shall notify each other immediate upon the discovery of any discrepancies in the plans, surveys, or staking. The Engineer, in consultation with the Contractor and Owner's Surveyor, shall promptly review the discrepancies and issue corrections or clarification. If the Contractor elects to proceed with construction before such corrections or clarifications are made, Contractor shall do so at Contractor's own risk and expense.

B. Any claims by the Contractor against the Owner's Surveyor of inaccurate construction stakes must be substantiated based on the original, intact stakes. The Contractor shall not make any claim against the Owner's Surveyor of alleged inaccurate construction stakes unless all survey stakes set by the Owner's Surveyor are maintained and can be verified as to their origin.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all materials for concrete formwork, bracing, shoring and supports and shall design and construct all forms, bracing, shoring and falsework, all in accordance with the requirements of the Contract Documents.

B. Section Includes:

1. Formwork for cast-in place concrete.
2. Shoring, bracing, and anchorage.
3. Form accessories.
4. Form stripping.

C. Related Sections:

1. Section 03 20 00 - Concrete Reinforcement.
2. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

A. International Building Code (IBC), as referenced herein, shall be the most recent New Mexico Construction Industries Division (CID) adopted edition

B. American Concrete Institute:

1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

C. Government Standards:

1. PS 1-74 U.S. Product Standard for Concrete Forms, Class I.

D. American Forest and Paper Association:

1. AF&PA - National Design Specifications for Wood Construction.

E. The Engineered Wood Association:

1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

F. ASTM International:

1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. List of form materials and locations of use.

2. Form release agent with EPA Certification.

1.4 QUALITY ASSURANCE

A. Tolerances: The variation from established lines and grades shall not exceed 1/4-inch in ten (10) feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the "Suggested Tolerances" specified in Section 3.3 and 3.4 of ACI 347.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Except as otherwise expressly accepted by the Engineer, all lumber brought on the job site for use as forms, shoring or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:

1. Walls: Steel or plywood panel

2. All Other Work: Steel panels, plywood or tongue and groove lumber

2.2 FORM TIES

A. Form ties with Integral water stops shall be provided with a plastic cone or other suitable means for forming a conical hole to ensure that the form tie may be broken off back of the face of the concrete.

1. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-inch and all such fasteners shall be such as to leave holes of regular shape for reaming.

2. Form ties for water-retaining structures shall have integral water stops. Removable taper ties may be used when approved by the Engineer. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

2.3 FORM AND FALSEWORK MATERIALS

A. Materials for concrete forms, formwork and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS10.
2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements for PS 1 for Concrete Forms, Class I, and shall be edge sealed.
3. Form materials shall be metal, wood, plywood or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

B. Unless otherwise shown, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.2 GENERAL

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms. Forms which are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced at the Contractor's expense. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework and shoring shall comply with applicable Local, State and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

B. Concrete forms shall conform to the shape, lines and dimensions of structural components as called for on the Drawings and shall be free from surface defects and sufficiently tight to prevent leakage.

3.3 FORM DESIGN

A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade and shall be of sufficient strength and rigidity to

maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.

B. Suitable and effective means shall be provided on all forms for holding adjacent edges and end of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets or similar surface defects in the finished concrete.

C. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The form joints shall be tight so as to prevent the loss of water, cement and fines during the placing and vibrating of the concrete. The bottom of the wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Adequate cleanout holes shall be provided at the bottom of each lift of forms.

3.4 INSTALLATION

A. Formwork - General:

1. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
2. All vertical surfaces of concrete members shall be formed.
3. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
4. Complete wedging and bracing before placing concrete.

B. Forms for Smooth Finish Concrete:

1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

C. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

D. Framing, Studding and Bracing:

1. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.

2. Distribute bracing loads over base area on which bracing is erected.

3. When placed on ground, protect against undermining, settlement or accidental impact.

E. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

F. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

G. Obtain Engineer's approval before framing openings in structural members not indicated on Drawings.

H. Install fillet and chamfer strips on external corners of beams, joists, and/or columns, as called for on the Drawings.

I. Install void forms in accordance with manufacturer's recommendations.

3.5 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.6 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

D. Install water stops continuous without displacing reinforcement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

G. Form Ties:

1. Use sufficient strength and sufficient quantity to prevent spreading of forms.

2. Leave inner rods in concrete when forms are stripped.

3. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

4. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section 03 30 00 - Cast-In-Place Concrete.

5. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete form stripping or tie removal will not be permitted.

6. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

H. Removable Ties:

1. Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond.

2. A precast neoprene or polyurethane taped plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink grout for above-grade walls that are dry on both sides.

3. Exposed faces of walls shall have the outer 2-inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:

1. Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer.

2. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.

3. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.

4. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.

5. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:

1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:

1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not permitted.

O. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.7 MAINTENANCE OF FORMS

A. Forms shall be maintained at all times in good condition, particularly as to cleanliness, strength, rigidity, tightness and smoothness of surface. After forms have been removed from a concrete placement they shall be immediately and thoroughly cleaned and repaired and surface treated before reuse.

B. The form surfaces shall be treated with a non-staining mineral oil or other lubricant acceptable to the Engineer. Any excess lubricant shall be satisfactorily removed before placing the concrete. Oil shall be kept off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.8 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.

B. No forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained seventy-five percent (75%) of the specified 28-day strength and has been in place for a minimum of seven (7) days. Forms for all vertical walls and columns shall remain in place at least forty-eight (48) hours after the concrete has been placed, except for periods of cold weather when forms shall remain in place at least seventy-two (72) hours after concrete has been placed.

C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

D. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

E. Leave forms in place for minimum number of days as specified in ACI 347.

3.9 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces that are permanently exposed to view.

3.10 FALSEWORK

A. The Contractor shall be responsible for the design, engineering, construction, maintenance and safety of all falsework, including staging, walkways, forms, ladders and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements specified herein.

B. All falsework shall be designed and constructed to provide the necessary rigidity and to support the required dead load plus a minimum of 40 psf live load. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time. Falsework shall be placed upon a solid footing, safe against undermining and protected from softening. When falsework is supported on any portion of the structure that is already constructed, the load imposed by the falsework shall be spread, distributed and braced in such a way as to avoid any possibility of damage to the structure. Falsework supported off finished floor slabs shall be set in such a way to protect the finish floor surface from being scarred, chipped or gouged.

3.11 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish, fabricate and place all concrete and masonry reinforcement steel, including all the tie wires, clips, supports, chairs, spacers and other accessories, all as shown and specified in the Contract Documents. All requirements included on the Drawings shall apply and shall take precedent over any indications in the present Section of the technical specifications in the case of contradictions.

B. Related Sections:

1. Section 03 10 00 - Concrete Forms and Accessories.

2. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

A. Codes:

1. The International Building Code, as referenced herein, shall be the most recent New Mexico Construction Industries Division (CID) adopted edition of International Building Code (IBC).

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.

2. ACI 315 - Details and Detailing of Concrete Reinforcement.

3. ACI 318 - Building Code Requirements for Structural Concrete.

4. ACI SP-66 - ACI Detailing Manual.

C. ASTM International:

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

3. ASTM A185 - Specification for Welded Steel Wire Fabric (Latest Edition) for Concrete Reinforcement.

4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

6. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

7. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
8. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
9. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

D. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

E. Concrete Reinforcing Steel Institute:

1. CRSI - Manual of Standard Practice (Latest Edition).
2. CRSI - Placing Reinforcing Bars (Latest Edition).

F. Wire Reinforcement Institute:

1. Manual of Standard Practice for Welded Wire Fabric.

1.3 SUBMITTALS

A. The Contractor shall furnish to the Engineer reinforcing steel placing drawings. These drawings shall show the number, grade, size, length, mark, location and bending diagrams for all reinforcing steel and related products, together with lists of bent and straight bars in accordance with the ACI Detailing Manual (latest edition) of the American Concrete Institute and the requirements specified herein and shown on the Contract Drawings. The Engineer may or may not review the placement drawings. Any review of the placement drawings by the Engineer will be limited to general compliance with the Contract Documents and will not be returned to the Contractor. Reinforcing steel placement will be checked in the field using the design drawings. Any discrepancies, errors or omissions from the requirements of the Contract Documents shall be corrected prior to placement of concrete and at the sole expense of the Contractor.

1.4 QUALITY ASSURANCE

A. When required by any applicable permits, such as CID permits, Contractor shall have reinforcement inspected by the agency with jurisdiction prior to placement of concrete.

B. If requested by the Engineer, the Contractor shall provide a certified copy of the mill test report showing physical and chemical analysis for each heat of reinforcement steel delivered.

PART 2 PRODUCTS

2.1 REINFORCEMENT STEEL

A. Reinforcement steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A615 for Grade 60 Billet Steel Reinforcement.

2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A185 and the details shown. Welded wire fabric with longitudinal wire equal to or less than 4.0 size wire shall be either furnished in flat sheets or in rolls with a core diameter or not less than 10-inches. Welded wire fabric with longitudinal wires larger than 4.0 size shall be furnished in flat sheets only.

B. Accessories:

1. The Contractor shall furnish and install all accessories including necessary chairs or bolsters, concrete blocks (dobies), tie wires, supports, spacers and other devices to position reinforcement during concrete placement.

2. Wire bar supports shall be made of plain cold-drawn steel wire with pre-molded, gray-colored, plastic tips to the legs of the support. The plastic shall have a thickness of 1/8-inch or greater at points of contact with formwork and extend upward on the wire a minimum of 1/2-inch. Wire sizes and geometric dimensions shall be made in accordance with Table II of the latest edition of CRSI Manual of Standard Practice.

3. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

4. The wire tie shall be 16-gauge or heavier, black annealed.

2.2 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where shown and where approved by the Engineer. The couplers shall develop a tensile strength that exceeds one hundred fifty percent (150%) of the yield strength of the reinforcement bars being spliced at each splice.

PART 3 EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric, couplers and other appurtenances shall be fabricated and placed in accordance with the requirements of the Contract Documents, including referenced specifications, codes and standards.

3.2 FABRICATION

A. Reinforcement steel shall be accurately fabricated to the dimensions and shape shown in the Contract Documents. Fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings. Bends shall conform to bend dimensions defined as standard in accordance with details in the ACI Detailing Manual and/or CRSI Manual of Standard Practice, unless otherwise shown. Bars shall be bent cold and shall not be bent or straightened in a manner that will injure the material. All hooks shall conform to bend dimensions defined as ACI Standard Hooks.

B. The Contractor shall fabricate reinforcement bars within the tolerances shown in the ACI Detailing Manual and/or CRSI Manual of Standard Practice.

C. Reinforcing bars delivered to the field shall be tagged with durable material and marked in a legible manner with waterproof markings. Tags shall show the grade, number of pieces, size and mark or length of bars.

3.3 PLACING

A. Reinforcing steel shall be accurately positioned as shown on the Contract Documents and placed per the minimum clearance requirements given on the Drawings, and shall be adequately supported and wired together to prevent displacement. All reinforcement steel shall be supported or spaced off the forms by concrete or metal supports which are rigid enough to prevent any displacement or the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement. Concrete blocks shall not be used as spacers between mats. All concrete blocks used to space reinforcement steel off vertical formed surfaces shall be tied to the steel with wire ties which are embedded in the blocks. For reinforcement including welded wire fabric over formwork, the Contractor shall furnish concrete or metal supports with plastic covered legs for bar supports.

B. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

C. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at its own expense.

D. Placing Tolerances: Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318, except where in conflict with the requirements of Building Code.

E. Bars may need to be moved to avoid interference with other reinforcement steel, conduits or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer. Additional bars may be necessary to prevent cracking or provide additional reinforcement in this case and shall be provided by the Contractor at its own expense.

F. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than three (3) feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

3.4 SPACING OF BARS

A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than 1-inch.

3.5 SPLICING

A. General: Reinforcement bar splices shall only be used at locations shown, unless otherwise acceptable to the Engineer.

B. Splices of Reinforcement: The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318, Section 12.15.1 for a class C splice.

C. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each two (2) running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent, except as specifically permitted by the Engineer.

3.6 CLEANING AND PROTECTION

A. Reinforcing steel delivered to the jobsite shall be suitably stored off the ground and protected from oils, mud, concrete splatter and all conditions conducive to corrosion until embedded in concrete.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary, recleaned.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents. All requirements included on the Drawings shall apply and shall take precedent over any indications in the present Section of the technical specifications in the case of contradictions.

B. The following types of concrete shall be covered in this Section:

1. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, thrust blocks, fence and guard post embedment, and other concrete ties unless otherwise shown.

2. Structural Concrete: Concrete to be used where noted in the Contract Documents.

3. Lean Concrete: Concrete to be used for pipe trench cut-off walls and cradles, where the preceding items are detailed on the Drawings as un-reinforced.

4. Duct Bank Concrete: Red colored concrete to be used for electrical duct banks.

C. The term "hydraulic structure" used in these specifications shall refer to environmental engineering concrete structures for the containment, treatment, or transmission of water, wastewater, or other fluids.

D. Related Sections:

1. Sheets DT-14 and DT-23 of the Design Drawings - General Notes and Specifications.

2. Section 03 10 00 - Concrete Forms and Accessories.

3. Section 03 20 00 - Concrete Reinforcement.

4. Section 03 29 00 - Joints in Concrete.

5. Section 03 60 00 - Grout.

6. Section 31 23 23 - Backfill.

7. Section 32 31 13 - Chain Link Fences and Gates.

8. Section 33 11 13 - Public Water Distribution Systems.

1.2 REFERENCES

A. American Concrete Institute:

1. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

2. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.

3. ACI 301 - Specifications for Structural Concrete.

4. ACI 306 - Cold Weather Concreting.
5. ACI 308.1 - Standard Specification for Curing Concrete.
6. ACI 309 - Consolidation of Concrete.
7. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
6. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C156 - Test Methods for Water Retention by Concrete Curing Materials.
10. ASTM C157 - Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
11. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
12. ASTM C192 - Method of Making and Curing Concrete Test Specimens in the Laboratory.
13. ASTM C227 - Test for Potential Alkali Reactivity of Cement- Aggregate Combinations.
14. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
15. ASTM C309 - Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C441 - Test for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to Alkali-Aggregate Reaction.
17. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction & Criteria for Laboratory Evaluation.
19. ASTM D2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
20. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

1.3 SUBMITTALS

A. General**:** Submittals shall be submitted to the Engineer for review in accordance with Section 01 00 00, Contractor Submittals. Submittals shall include, but not be limited to the following:

1. Mix Designs**:** Prior to beginning the Work and within 14 days of the Notice To Proceed, the Contractor shall submit to the Engineer, for review, the proposed ready-mix supplier and their Laboratory-Certified concrete mix design for each class and type of concrete specified for the Work. Submitted mix designs shall have been performance-tested and certified by an independent laboratory approved by the Owner. Physical properties, including slump, air content, density and compressive strength shall be included with the submitted tests. All costs related to providing mix design shall be borne by the Contractor. Mix designs shall show the following in accordance with ACI 301:

   a. Proportions for all materials proposed.

   b. Mill tests for cement.

   c. Admixture certification, chloride ion content must be included.

   d. Aggregate gradation and certification.

2. Delivery Tickets: Where ready-mix concrete is used, the Contractor shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the approved mix design number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the site, when unloading began, and when unloading was finished.

3. Materials and methods for curing:

   a. List of curing methods to be used on each type and class of concrete.

   b. Curing compound.

   c. Curing blankets and mats.

   d. Evaporation retardant.

1.4 QUALITY ASSURANCE

A. When required by any applicable permits, such as CID permits, Contractor shall have reinforcement inspected by the agency with jurisdiction prior to placement of concrete.

B. General:

1. Tests on concrete will be field performed in accordance with all requirements of applicable ASTM standards for such tests, including but not limited to obtaining samples, temperature, slump, air entrainment, making and curing specimens, breaking concrete cylinders, and other as may be applicable.

2. The cost of all laboratory tests on cement, aggregates, and concrete, for the development of the mix design, will be borne by the Contractor. The laboratory must meet or exceed the requirements of ASTM C1077.

3. Concrete for testing shall be supplied by the Contractor as part of the project cost, and the Contractor shall provide assistance in obtaining samples, and disposal and cleanup of excess material.

4. Test cylinders will be prepared one (1) test each day of placement for each mixture for the first 50 or less cubic yards and one (1) test for each additional 100 cubic yards of concrete.

C. Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as indicated above to ensure continued compliance with these specifications. Each set of test specimens will be a minimum of 5 cylinders.

2. Compression test specimens for concrete shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.

3. Compression tests shall be performed in accordance with ASTM C39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinders will be held to verify test results, if needed.

4. Compression testing will be paid for by the Owner.

D. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, and as specified herein.

2. All concrete that fails to meet the ACI requirements and these specifications, is subject to removal and replacement at the cost of the Contractor.

3. Concrete delivered to the site that does not meet the requirements as herein specified may be rejected.

1.5 CONSTRUCTION TOLERANCES

A. The Contractor shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.

B. The following construction tolerances are hereby established and apply to finished walls and slabs unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch In 20 feet or more: 1/2-inch
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch In 20 feet or more: 1/2-inch
Variation from the plumb.	In 10 feet: 1/4-inch In 20 feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings.	Plus or minus 1/4-inch

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Unless sulfate tests dictate otherwise, all cement shall be standard brand Portland Cement conforming to ASTM C150 for Type II, low alkali. Portland Cement shall contain not more than 0.60 percent total alkalies. The term "alkalies" is defined as the sum sodium oxide (Na_2O), potassium oxide (K2O), calculated as sodium oxide (.658 K2O). Only one (1) brand of cement shall be used for exposed concrete in any individual structure. The cement shall be suitably protected from exposure to moisture until used. Certified mill test reports for each shipment of cement to be used shall be submitted to the Engineer. Mill test reports shall include the alkali content.

B. Water shall be potable, clean and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purpose of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.

C. All concrete aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, sound, uniformly graded and free of deleterious material in excess of allowable limits specified. Combined aggregates shall be well graded from coarse to fine sizes, and be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Lightweight sand for fine aggregate will not be permitted. Aggregates shall conform to ASTM C33.

1. Coarse Aggregate: Coarse aggregate shall consist of gravel, crushed gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter or other foreign substances. Thin or elongated pieces having a length greater than four (4) times the average thickness shall not exceed fifteen percent (15%) by weight. Deleterious substances shall not be present in excess of the following percentages by weight, and in no case, shall the total of all deleterious substances exceed one and one-half percent (1.5%):

Soft Fragments	1.5%
Shale	1.5%

Coal and Lignite	0.25%
Clay Lumps	0.25%
Materials Finer than No. 200 Sieve	0.50%*

*Except that when material finer than No. 200 sieve consists of crusher dust, the maximum amount maybe 1%.

Except as otherwise specified or approved in writing by the Engineer, coarse aggregate shall be graded as specified in ASTM C33, size No. 57.

2. Fine Aggregate: Fine aggregate for concrete or mortar shall consist of clean, natural sand or a combination of natural and manufactured sands that are hard and durable. Deleterious substances shall not be present in excess of the following percentages by weight of contaminating substances. In no case, shall the total exceed three percent (3%):

Removed by Decantation (Dirt, Silt, Etc.)	3%
Shale	1%
Clay Lumps	1%

Fine aggregate shall not contain strong alkali nor organic matter which gives a color darker than a standard color when tested in accordance with ASTM C40. Fine aggregate shall have a fineness modulus not less than 2.50 nor greater than 3.00. Except as otherwise specified, fine aggregate shall be graded from coarse to fine in accordance with the requirements of ASTM C33.

D. If non-reactive aggregates are unavailable, and either the coarse or fine aggregates are found to be alkali-silica reactive, the Contractor shall submit a proposed design mix that effectively mitigates the alkali-silica reactivity, per ASTM C441. The admixture will be considered effective if the mean mortar bar expansion at 14 days is less than or equal to 0.10%.

E. Admixtures of any type, except as otherwise specified, shall not be used unless written authorization has been obtained from the Engineer. The use of calcium chloride will not be permitted.

1. All concrete shall contain five percent (5%), plus or minus one percent (1%) entrained air of evenly dispersed air bubbles at the time of placement. The air-entraining agent shall contain no chloride and conform to ASTM C260, or U.S. Army Corps of Engineers Specifications CRD-C13. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. The Engineer, or Owner and his duly authorized representatives reserve the right, at any time, to sample and test the air-entraining agent or the air content of concrete received on the job by the Contractor. Air entrainment in the concrete shall be tested by ASTM C138, ASTM C231 or ASTM C173. If any sample tested does not have the specified air content, a second test shall be performed. If the second test does not meet the specified air content, the concrete represented by the test shall be removed from the job.

2. A "super plasticizer" water reducing agent may be used at the Contractors option, subject to approval by the Engineer, for concrete in hydraulic structures. The amount of cement in the mix shall not be reduced. The slump may be increased

to a maximum of 8-inches. Quantities of admixtures and procedures shall be in accordance with the manufacturers published recommendations. The super plasticizer shall conform to ASTM C494, Type F or G. The admixture shall be a second-generation type, free of chlorides and alkalies, composed of a synthesized sulfonated complex polymer that shall be added to the concrete mixer at the batch plant.

3. Fly ash/pozzolan shall conform to ASTM C618, including the requirements of Table 1A, therein, and the following supplementary requirements:

a. Class F Fly Ash

Loss on ignition, maximum	1%
SO3 content, maximum	3%
Moisture content, maximum	1%
$R = (CaO - 5\%)/(Fe_2O_3)$, maximum	1.5

2.2 CONCRETE CURING MATERIALS

A. Materials for curing concrete shall conform to the following requirements:

1. Concrete curing compound shall be Protex LR-151 as manufactured by Protex Industries, Denver, CO; Hunt Process Clear ARB as manufactured by Hunt Process Co., Santa Fe Springs, CA; Select Cure CRB as manufactured by Select Products Co., Upland, CA; or equal. The curing compound shall contain a fugitive dye so that areas of application will be readily distinguishable. All admixtures, including superplasticizers, shall be included in submittals in the mix proportions.

2. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a normal thickness of 10 mils.

3. Burlap, cotton mats or other covering material for use as concrete curing blanket must be overlapped adequately to ensure 100% coverage at all times, and must not be allowed to become dry at any point during the curing period

4. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.

2.3 CONCRETE DESIGN REQUIREMENTS

A. General: The concrete mixes shall be designed to produce a concrete of such consistency and composition so as to obtain maximum density and minimum shrinkage. Mix designs with more than forty-one percent (41%) of sand of the total weight of fine and coarse aggregate shall not be used.

B. Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall not be less than that specified in the following Table, or as otherwise indicated on the Drawings:

Type of Work	Min. 28-Day Compressive Strength (psi)	Max. Size Aggregate (in.)	Maximum Ratio (by wt.)
Slabs on grade, footings, floor slabs, and all other concrete items not specified elsewhere.	4,000	1	0.5
Exterior Flat Work	4,000	1	0.45
Sitework Concrete	3,000	1	0.45
Lean Concrete	2,500	1	0.59

C. Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability and surface finish and the Contractor shall be entitled to no additional compensation because of such changes.

D. At the Contractors option, fly ash/pollozan may be used as a partial cement replacement in concrete as follows:

1. Fly ash shall replace not more than twenty five percent (25%) by weight of the Portland Cement in the design mix. The design mix shall contain a minimum of six (6) sacks of cement per cubic yard before the replacement is made.

2. Fly ash for all structures shall be Class F fly ash.

3. If the coarse or fine aggregates are proven to be potentially alkali-silica reactive per ASTM C227, the mineral admixture Class F fly ash shall be proportioned by weight of cement to provide a fly ash to portland cement ratio not less than 1:4, not less than 20 per cent of the total cementitious material. The Contractor shall provide the Engineer with chemical and physical analysis of the fly ash, and detailed design mix to meet the requirements of ASTM C441.

2.4 CONSISTENCY

A. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work	Slump (inches)
Footings and Slabs	3-inches + 1/2-inches, - 1 inch.
Other Work With High Range Water Reducer Added 8-inches maximum.	3-inches $\pm$ 1-inch.

2.5 TRIAL BATCH AND LABORATORY TESTS

A. Before placing any concrete, the Contractor shall submit the certified trial batch results of each class of concrete having a 28-day strength of 3,500 psi or higher, based on the preliminary concrete mixes submitted by the Contractor. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractors preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates,

cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain three (3) drying shrinkage, and six (6) compression test specimens from each batch. The costs for the trial batch tests shall be borne by the Contractor.

B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C192 and ASTM C39. Three (3) compression test cylinders will be tested at 7-days and three (3) at 28-days. The average compressive strength for the three (3) cylinders tested at 28-days for any given trial batch shall not be less than one hundred twenty-five percent (125%) of the specified compressive strength.

C. A standard sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements for ASTM C136. Values shall be given for percent passing each sieve.

2.6 SHRINKAGE LIMITATION

A. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10-inches, fabricated, cured, dried and measured in accordance with ASTM C157 modified as follows: Specimens shall be removed from molds at an age of 23+ hours after trial batching, shall be placed immediately in water at 70 degrees F. ±3 degrees F. for at least thirty (30) minutes, and shall be measured within thirty (30) minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F. ±3 degrees F. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7-days. This length at age 7-days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F. ±3 degrees F. and fifty percent (50%) ±4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21 and 28-days of drying after 7-days of moist curing.

B. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001-inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing during shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be specified herein.

C. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age, shall be 0.036 percent or 0.042 percent, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements.

D. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than twenty-five percent (25%).

E. If the required shrinkage limitation is not met during construction, the Contractor shall take all necessary action, at not additional cost to the Owner, for securing the specified

shrinkage requirements. These actions may include changing the source of aggregates, cement and/or admixtures; reducing water content ratio; washing or aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.7 CEMENT GROUT

A. Cement grout materials shall be as specified in Section 03 60 00 - Grout.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 MIXING CONCRETE

A. Mixing equipment shall be subject to the Engineers approval. Mixers shall be of the stationary plant or truck mixer type. Adequate equipment and facilities shall be provided for accurate measurement and control of all materials and for readily changing the proportions of the material. The mixing equipment shall be maintained in good working order and shall be capable of combining the aggregates, cement and water within the specified time into a thoroughly mixed and uniform mass and of discharging the mixture without segregation. Cement and aggregate shall be proportioned by weight.

B. The batch plant shall be capable of controlling and delivering of all material to within one percent (1%) by weight of the individual material. If bulk cement is used, it shall be weighed on a separate visible scale that will accurately register the scale load at any stage of the weighing operation from zero to full capacity.

1. Cement shall not come in contact with aggregate or with water until the materials are in the mixer ready for complete mixing with all mixing water. The procedure of mixing cement with sand or with sand and coarse aggregate for delivery to the jobsite for final mixing and an addition of mixing water will not be permitted. Retempering of concrete (addition of water to previously prepared concrete mix) will not be permitted. The entire batch shall be discharged before recharging. The volume of the mixed material per batch shall not exceed the manufacturers rated capacity of the mixer.

2. Each mixer shall be equipped with a device for accurately measuring and indicating the quantity of water entering the concrete, and the operating mechanism shall be such that leakage will not occur when the valves are closed. Each mixer shall be equipped with a device for automatically measuring, indicating and controlling the time required for mixing. This device shall be interlocked to prevent the discharge of concrete from the mixer before the expiration of the mixing period.

3. Transit-mixed concrete shall be mixed and delivered in accordance with ASTM C94. After the drum is once started, it shall be revolved continuously until it has completely discharged its batch. Water shall not be admitted to the mix until the

drum has started revolving. The right is reserved to increase the required minimum number of revolutions allowed, if necessary, to obtain satisfactory mixing, and the Contractor will not be entitled to additional compensation because of such an increase or decrease.

C. Mixed concrete shall be delivered to the site of the work and discharge shall be completed within one (1) hour after the addition of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F. or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed forty-five (45) minutes. The use of non-agitating equipment for transporting concrete will not be permitted.

D. Truck mixers shall be equipped with counters so that the number of revolutions of the drum may be readily verified. The counter must be capable of being reset and shall be actuated at the time of starting mixers at mixing speeds. Concrete shall be mixed in a truck mixer for not less than seventy (70) revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

3.3 PREPARATION OF SURFACES FOR CONCRETING

A. Earth surfaces shall be thoroughly and uniformly wetted by sprinkling prior to the placing of any concrete. These surfaces shall be kept moist by frequent sprinkling up to the time concrete is placed thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.

B. The surfaces of all horizontal construction joints shall be cleaned of all latence, loose or defective concrete and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

C. No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel and preparation off surfaces involved in the placing have been completed and accepted by the Engineer at least four (4) hours before placement of concrete. All reinforcement, anchor bolts, sleeves, inserts and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor. All surfaces of embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

D. All form surfaces in contact with the concrete shall be thoroughly cleaned of all previous concrete, dirt and other surface contaminants prior to use. Damaged form surfaces shall not be used.

1. Wood form surfaces in contact with the concrete shall be coated with an approved release agent prior to form installation. The release agent shall be non-staining and non-toxic after thirty (30) days. Mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface of steel forms.

2. All steel forms shall have the contact surfaces coated with an approved release agent. The release agent shall be effective in preventing discoloration of the concrete from rust and shall be non-toxic after thirty (30) days.

E. Where concrete is to be cast against old existing concrete, the old concrete shall be thoroughly roughened to exposed, hard aggregate by sandblasting or chipping. Any additional surface preparation shall be as called for in the drawings.

F. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or diverted out of the forms and clear of the work. No concrete shall be deposited under water or allowed to rise on any concrete until the concrete has attained its initial set. Pumping or other necessary dewatering operations for removing ground water, if required, shall be the responsibility of the Contractor and will be subject to review by the Engineer.

G. Pipe, conduit, dowels, sleeves and other ferrous items required to be embedded in concrete construction shall be adequately positioned and supported prior to placement of concrete. There shall be a minimum of 2-inches clearance between embedded items and any of the concrete reinforcement. Securing embedments in position by wiring or welding them to the reinforcement will not be permitted.

3.4 PLACING CONCRETE

A. No concrete shall be placed without prior inspection of the forms, reinforcing and embedded items and approval from an authorized representative of the Engineer. The Contractor shall notify he Engineer at least twenty-four (24) hours in advance of any scheduled concrete placement and shall call for final inspections no later than four (4) hours in advance of the scheduled placement. The Contractor shall notify the Engineer at least two (2) hours in advance of setting the opposite side of wall forms so that the construction joint preparation, water stop installation and reinforcing steel inspections can be conducted. It is the Contractors responsibility to see that the forms are properly cleaned and oiled before being set, the construction joints properly prepared, reinforcing steel is securely and properly supported in the correct position and that all embedment items including electrical conduit is correctly installed before calling for inspections. The Engineer may at his option require the use of placement cords if deemed necessary.

B. Placement of concrete shall conform to the requirements and recommendations of ACI 301, 304 and 318, except as modified herein.

C. Concrete, which upon or before placing is found not to conform to the requirements specified herein, shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these specifications, or which is of inferior quality, shall be removed and replaced at the expense of the Contractor.

D. No concrete shall be placed during rain or snow storms, unless completely covered to prevent storm water from coming in contact with it. Sufficient protective covering material shall be kept on hand at all times should rain or snow storms arise during concrete placement operations.

E. Concrete shall be deposited at or near its final position to avoid segregation caused by rehandling or flowing. Concrete shall not be deposited in large quantities in one place and worked along the forms with vibrator or other means. Concrete shall be uniformly distributed during the placing process and in no case after depositing shall any portion be displaced in the forms more than 2-feet in horizontal direction. Concrete shall be deposited in forms in horizontal layers not to exceed 24-inches in depth and shall be

brought up evenly in all parts of the form. The rate of placement of concrete in forms shall not exceed 5-feet of vertical rise per hour. As the concrete is placed it shall be consolidated thoroughly and uniformly by mechanical vibration to secure a dense mass, close bond with reinforcement and other embedded items and smooth surface. The mechanical vibrator shall penetrate not only the freshly placed concrete, but also the previously placed lift to ensure the lifts become monolith. New concrete shall be placed against previously placed concrete, not away from it. When concrete is placed on a slope, placement shall begin at the lower end of the slope and progress to the upper end for the full width of the placement. Consolidation by mechanical vibration shall follow directly behind placement and the rate of placement shall never get ahead of the consolidation crew. Concrete placement shall continue without avoidable interruption, in a continuous operation until the end of the placement is reached.

F. The drop of concrete into slab or wall forms shall be vertical. Concrete shall not be dropped through reinforced steel, but deposited in forms using a hopper with a drop chute to avoid segregation and to keep mortar from coating the reinforcement steel and forms above the in-place concrete. In no case shall the free fall of concrete exceed 4-feet below the end of the hopper or chute.

G. If it takes more than 20-minutes to get back to place concrete over concrete previously placed, the depth of the layers being placed at one time shall be reduced, and/or placing equipment increased, until it is possible to return with the placing operation to previously placed concrete within 20-minutes. If concrete is to be placed over previously poured concrete and more than 20-minutes have elapsed, then a layer of grout not less than 1/2-inch thick shall be spread over the surface before placing the additional concrete.

H. The placement of concrete for slabs, beams or walkways cast monolithically with walls or columns shall not commence until the concrete in the walls or columns has been allowed to set and shrink. The time allowed for shrinkage shall be not less than one (1) hour.

I. Concrete shall be placed with the aid of approved mechanical vibrators. Vibration shall be supplemented by manual forking or spading adjacent to the forms on exposed faced in order to secure smooth dense surfaces. The concrete shall be thoroughly consolidated around reinforcement, pipes or other shapes built into the work. The vibration shall be sufficiently intense to cause the concrete to flow and settle readily into place and to visibly affect the concrete over a radius of at least 18-inches.

1. Sufficient vibrators shall be on hand at all times to vibrate the concrete as placed. In addition to the vibrators in actual use while concrete is being placed, the Contractor shall have on hand one (1) spare vibrator in serviceable condition. No concrete shall be placed until it has been ascertained that all vibrating equipment, including spares, is in serviceable condition.

J. Special care shall be taken to place the concrete solidly against the forms so as to leave no voids. Every precaution shall be taken to make all concrete solid, compact and smooth, and if for any reason the surfaces or interiors have voids or are in any way defective, such concrete shall be repaired as directed by the Engineer. No defective work shall be patched or repaired without the prior inspection and approval of the Engineer.

K. The temperature of concrete when it is being placed shall be not more than 90 degrees F. nor less than 40 degrees F. in moderate weather, and not less than 50 degrees F. in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the

temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F., the Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.

L. Concrete shall not be placed on a frozen subgrade or subgrade that contains frozen materials. All ice and snow shall be removed from inside forms and from reinforcing steel and embedded items. The temperature of all surfaces that the concrete will contact shall be raised above the freezing point for at least 12-hours prior to placing new concrete.

1. The minimum temperature of fresh concrete as mixed shall be 60 degrees F. for ambient temperature above 30 degrees F.; 65 degrees F. for ambient temperature 0 degrees F. to 30 degrees F.; and 70 degrees F. for ambient temperature below 0 degrees F. The minimum temperature of fresh concrete after placing shall be 55 degrees F. for the first 72-hours.

2. The use of calcium chloride shall not be permitted.

3. In general, the Contractor shall adhere to the recommendations as outlined in ACI Standard 306 for cold weather concreting, except as required herein.

3.5 PUMPING OF CONCRETE

A. Pumping of concrete will be permitted only with the Engineer's approval. The pumping equipment must have two (2) cylinders and be designed to operate with one (1) cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor shall have a standby pump or crane and concrete bucket on site during pumping to provide assurance the concrete will be placed without cold joints in the event of pumping equipment breakdown. The minimum diameter of the hose (conduits) shall be 4-inches. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced. Aluminum conduits for conveying the concrete will not be permitted.

B. Concrete samples for slump and test cylinders will be taken at the discharge end of the pumping conduit.

3.6 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the work shall be acceptable to the Engineer. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7-days before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the two (2) adjacent wall panels have cured at least 14-days.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To ensure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one (1) hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel.

3.7 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets and bringing only a slight excess of water to be exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8,000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are horizontal, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred or worked with suitable appliances, tamping bars, shovels or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified with fifteen (15) minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner than causes segregation of its constituents.

3.8 FINISHING CONCRETE SURFACES

A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles and dimensions shown are defined as tolerances and are specified in Paragraph 1.5, herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. Unformed Surfaces: After placing and consolidating concrete, all unformed top surfaces of slabs, walls, curbs, gutter and steps, shall be brought to a uniform finished surface. The classes of finish specified for unformed concrete surfaces are defined as follows:

1. Finish U1 (screeded concrete): Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.

2. Finish U2 (floated surface): After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating or surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the Engineer.

3. Finish U3 (steel trowel finish): After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples and trowel marks. The finish shall be smooth and free of all irregularities.

4. Finish U4 (light broom finish): Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a non-skid finish.

C. The schedule for finished unformed surfaces shall be as follows:

Unformed Concrete Surface Schedule

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material.	U1
Floor slabs to be covered with grouted tile or topping grout and slabs to be covered with built-up roofing.	U2
All building and machine room floors, basin floors not receiving a grout topping, channel floors, top of interior walls, top of interior curbs, steps and walkways.	U3
Exterior walkways, curb, gutter, sidewalk and steps, top of valve or meter vaults, electrical pull boxes and catch basins.	U4

D. Floor Sealer Hardener (Surface Applied):

1. Floor hardener shall be applied where shown or noted on the drawings.

2. Floors to receive hardener shall be cured, cleaned and dry with all work above them completed. Apply zinc and/or magnesium fluosilicate evenly, using three (3) coats, allowing 24-hours between coats.

3. The first coat shall be 1/3 strength, second coat 1/2 strength and third coat shall be 2/3 strength. Each coat shall be applied so as to remain set on the concrete surface for fifteen (15) minutes. If sodium silicate is used, it shall be applied evenly, using three (3) coats, allowing twenty-four (24) hours between coats, and the material shall be applied full strength a the rate of one (1) gallon per 300 square feet. Approved proprietary hardeners shall be applied in conformance with the manufacturers' instruction. After the final coat is completed and dry, surplus hardener shall be removed from the surface by scrubbing and mopping with water.

E. Formed Surfaces: Immediately following the removal of forms, the concrete shall be inspected for defects such as rock pockets, grout loss, damage from stripping forms, surface defects such as fins, offsets, bulges, excessive bug-holes and stains. All defective concrete work shall be removed and replaced or repaired to the satisfaction of the

Engineer. Any work which has not been constructed in accordance with the plans and specifications will be considered defective.

Correction of defective work shall be as directed by the Engineer and specified herein. No defective work shall be patched, repaired or covered without prior inspection and approval of the Engineer.

Holes left by tie-rod cones or taper ties shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with non-metallic grout.

The classes of formed concrete surfaces are defined as follows:

1. Finish F1: No special treatment is required after form removal except for curing, repair of defective concrete treatment of surface defects, removal of fins and projections, filling of tie holes and filling of depressions and bug-holes 3/8-inch or larger in width or depth with mortar.

2. Finish F2: All defective concrete shall be repaired, all fins, offsets, bulges and projections ground smooth, filling of tie holes and filling of depressions and bug-holes 1/4-inch or larger in width or depth with mortar.

3. Finish F3: All defective concrete shall be repaired, all fins, offsets, bulges and projections ground smooth and tie holes filled with grout. The entire surface shall then receive a light stoning or grinding using a No. 50 or No. 60 grit carborundum stone or grinding wheel to remove any latence and curing film and to open up bug-holes hidden beneath the thin surface grout film. The surface shall then be given a stoned-sand type architectural finish as follows:

    a. The concrete surface shall be pre-wet for several hours or overnight before treatment.

    b. While the surface is still damp, spread a sand mix, consisting of one (1) part of Type II Cement and one to one and a half (1 to 1-1/2) parts of fine sand passing the No. 70 screen mixed with enough water and an emulsified bonding agent to have the consistency of thick cream. The sand mix should be spread thinly over the damp surface with a rubber float and rubbed in over the entire area leaving only a minimum amount of material on the surface necessary to produce a sand texture, approximately 1/32-inch in thickness.

    c. The surface shall be kept continually damp for seventy-two (72) hours following this finish treatment.

F. The schedule for formed surface finish shall be as follows:

Formed Concrete Surface Schedule

Area	Finish
Formed concrete surfaces to be covered by backfill or coated with below grade waterproofing systems.	F1
Formed concrete surfaces in water channels, below water surface of basins, inside meter and valve vaults, inside cells of hydraulic splitter boxes and weirs.	F2

Formed concrete surfaces inside buildings and machine rooms and all exposed exterior surfaces of foundations, basins, vaults, hydraulic structures and curbs.	F3

3.9 CURING AND DAMPPROOFING

A. General: All concrete shall be cured for not less than ten (10) days in warm to hot weather and fourteen (14) days in cold weather after placing, unless otherwise indicated by the Engineer, in accordance with the methods specified herein for the different parts of the Work, and described in detail as follows:

1. Water Curing: Keep the concrete structures thoroughly and continuously wet and covered for at least 7 days. Place and anchor covers, mats, and sheeting to ensure continuous contact with the concrete surfaces. Use one of the water curing methods as detailed in ACI 308.1.

2. Curing Compound: The surface shall be sprayed with a liquid membrane-forming curing compound applied in accordance with the manufacturers printed instructions.

a. Care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

b. Curing compound specified shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within one (1) hour after removal of forms from contact with formed surfaces. Repairs to formed surfaces shall be made within the said one (1) hour period. If repairs cannot be made with the one (1) hour period they shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be sandblasted to remove the curing compound, following which repairs shall be made as specified herein.

3. Cold weather is defined as when the temperature reaches or goes below 35 degrees F for one (1) hour during any 24-hour period during the curing period.

B. Method 2 shall be used for wall sections with forms removed, encasement concrete and all concrete surfaces where Method 1 is not feasible.

3.10 PROTECTION

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damage to finish surfaces.

B. Finished floor slabs in buildings and machine rooms shall be suitably protected from wear or damage from construction operations. The Contractor shall not use newly finished floors or buildings for machine assembly, fabrication, pipefitting, curing or welding operations without covering the working area with plastic sheets and/or plywood. Any concrete found to be damaged or which may have been originally defective or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any

other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

C. Immediately following the first frost in the fall, the Contractor shall be prepared to protect all concrete against freezing.

3.11 CURING IN COLD WEATHER

A. After the first frost, and until the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one (1) day, the concrete shall be protected against freezing temperatures for not less than forty-eight (48) hours after it is placed. After the mean daily temperature in the vicinity of the worksite falls below 40 degrees F. for more than one (1) day, the concrete shall be maintained at a temperature not lower than 50 degrees F. for at least seventy-two (72) hours after it is placed.

B. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F. over a (3) three day duration.

C. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected from drying and excessive carbon dioxide atmosphere by application of curing Method 2 or Method 3, as specified under Article 3.9, Paragraph A herein.

3.12 REPAIR OF DEFECTIVE CONCRETE

A. No concrete repairs shall be made until after inspection and approval of the method of repair by the Engineer. In no case, will extensive patching of honeycombed concrete be permitted. Concrete containing extensive voids, holes, honeycombing or similar depression defects shall be completely removed and replaced. Concrete containing minor voids, holes, honeycombing or similar depression defects shall be repaired as specified herein. All concrete repairs and replacements shall be promptly executed by the Contractor at its own expense.

B. The repair of holes left by rock pockets, penetrations, tie rods or other reasons will require the use of non-shrink, non-metallic grout material.

END OF SECTION

SECTION 03 60 00

GROUT

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish, place, finish and cure the following types of grouting mortars as called for herein and as shown in the Contract Documents.

1. Non-Shrink Grout: This type of grout shall be used wherever grout is shown or called for in the Contract Documents, unless another type is specifically referenced.

2. Topping Grout: This type of grout shall be used for grouting in submerged applications, such as clarifier bottoms.

3. Epoxy Grout: This type of grout shall be used for anchor bolt or reinforcing steel embedment, repairs and resurfacing.

B. Related Sections:

1. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.

2. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Society of Testing and Materials:

1. ASTM C33 - Standard Specification for Concrete Aggregates.

2. ASTM C109 - Standard Test Method for Compressive (Latest Edition) Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens).

3. ASTM C150 - Standard Specification for Portland Cement.

4. ASTM C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):

1. CRD C621 - Non-Shrink Grout.

1.3 SUBMITTALS

A. Non-Shrink Grout: Submit manufacturers' technical data including compressive strength and expansion data at plastic, flowable and fluid consistencies. Also, submit manufacturer's applications manual containing instructions and recommendations for mixing, handling, placement and appropriate uses for each type of non-shrink grout used in the work.

B. Topping Grout: Provide certified mix design including proportions and gradations of all materials and compressive strength test results from at least one (1) trial batch. Tests

shall be performed by a certified testing laboratory. All costs for such mix design and trial batch tests shall be borne by the Contractor.

C. Epoxy Grout: Submit manufacturers' technical data including strengths and application manual of instructions for mixing, handling and placing.

1.4 QUALITY ASSURANCE

A. Mix design tests for topping grout shall be performed per the standards referenced herein.

B. During the progress of construction, the Engineer may have tests made of each type of grout used in the work to ensure compliance with the Contract Documents. These tests will be made in accordance with the standards referenced herein. The test expense during construction, except for the mix design and trial batch tests, will be borne by the Owner. The costs of additional tests including non-destructive tests and core drilling needed to verify or investigate the quality of questionable work or material shall be borne by the Contractor.

C. Grout for testing shall be supplied by the Contractor at no cost to the Owner.

D. If any grout fails to meet the requirements of these specifications, immediate corrective action shall be taken for all subsequent batches. Grout already in place that fails to meet these requirements is subject to removal and replacement with all costs borne by the Contractor.

E. Construction tolerances shall be as specified in Section 03 30 00 - Cast-In-Place Concrete, except as modified herein and elsewhere in the Contract Documents.

PART 2 PRODUCTS

2.1 NON-SHRINK GROUT

A. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged.

B. Non-shrink grouts for use as herein specified shall conform to the Corps of Engineers specifications for Non-Shrink Grout, CRD-C621-85 and to these specifications. The grout shall have a 28-day compressive strength of 6,000 psi or greater.

C. Non-shrink grouts shall be as manufactured by: Tremcrete Systems Inc., Woodland, California; Gifford-Hill & Company, Inc., Dallas, Texas; or approved equal.

2.2 TOPPING GROUT

A. Grout for topping of slabs and concrete fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as indicated herein. All materials and procedures specified for concrete in Section 03 30 00 shall apply except as indicated otherwise herein.

B. Topping grout and concrete fill shall contain a minimum of 564 pound of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, structural concrete as indicated in Section 03 30 00 may be used when accepted by the Engineer.

C. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent by Weight Passing
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.

E. Strength: Minimum compressive strength at 28-days shall be 4,000 psi.

2.3 EPOXY GROUT

A. Epoxy grout shall be a pourable, non-shrink, one-hundred percent (100%) solids system. The epoxy grout system shall have three components; resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

B. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F. The epoxy grout shall develop a minimum compressive strength of 5,000 psi in 24-hours and 10,000 psi in 7-days.

2.4 CEMENT GROUT

A. Portland Cement: ASTM C150, Type I and II.

B. Water:

1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:

   a. Corrosion of steel.

   b. Volume change increasing shrinkage cracking.

   c. Efflorescence.

   d. Excess air entraining.

C. Fine Aggregate:

1. Washed natural sand.

2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.

3. Free from injurious amounts of organic impurities as determined by ASTM C40.

D. Mix:

1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2. Water content shall be such that the grout can be readily spread, yet not wet enough to cause trouble with surface water or laitance, or failure to stay in place after screeding. All grout mixes and mixing procedures shall be submitted in accordance with Section 01 00 00 - Contractor Submittals, and shall be subject to review and approval by the Engineer prior to commencing the grouting operations.

E. The minimum compressive strength at 28 days shall be 4000 psi.

F. Procedures for Grout placement shall be approved by the equipment supplier, to insure that no equipment is overstressed, as well as proper placement tolerances. Equipment Supplier shall have final say on grouting procedures and final tolerances.

2.5 UNIT MASONRY GROUT

A. Unit masonry grout materials shall be as specified in Section 04 20 00 – Unit Masonry.

2.6 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as required for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.7 CURING MATERIALS

A. Curing materials shall be as specified in Section 03 30 00 - Cast-In-Place Concrete, for cement topping grout and as recommended by the manufacturer of non-shrink grouts.

PART 3 EXECUTION

3.1 PREPARATION

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03 30 00. The finish of the grout surface shall match that of the adjacent concrete

B. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

C. Rough concrete lightly, but not enough to interfere with placement of grout.

D. Remove foreign materials from metal surfaces in contact with grout.

E. Align, level and maintain final positioning of components to be grouted.

F. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.2 PLACING NON-SHRINK AND EPOXY GROUT

A. All forming, mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Place grout material quickly and continuously.

C. Do not use pneumatic-pressure or dry-packing methods.

D. Apply grout from one side only to avoid entrapping air.

E. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

F. Thoroughly compact final installation and eliminate air pockets.

G. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.3 PLACING TOPPING GROUT

A. All mechanical, electrical, and finish work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.

B. The minimum thickness of grout topping and concrete fill shall be one inch, unless otherwise indicated on the Design Drawings. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.

C. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping or fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.

D. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.

E. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

3.4 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

3.5 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 7 days, or as otherwise indicated by the manufacturer.

END OF SECTION

SECTION 09 97 14

WATER STORAGE TANK PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. The work of this section includes the coating of all interior surfaces, and the painting of all exterior surfaces on new tanks.

B. Related Sections:

1. Section 33 13 13 Water Storage Tank Disinfection.

2. Section 33 16 19 Welded Steel Water Storage Tank.

1.2 REFERENCES

A. Without limiting the general aspects of other requirements of these specifications, all surface preparation, coating and painting of interior and exterior surfaces and inspection shall conform to the applicable requirements of the Steel Structures Painting Council, NACE International, ASTM (American Society for Testing and Materials), AWWA and the manufacturer's printed instructions.

B. American Society for Testing and Materials (ASTM) International:

1. ASTM D520 Standard Specification for Zinc Dust Pigment

2. ASTM D4417 Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

3. ASTM E337 Standard Practice Test Method for Measuring Humidity with a Psychrometer

4. ASTM D2200 Standard Methods of Evaluating Degree of Rusting on Painted Surfaces

5. ASTM D5402 Solvent Resistance Rub Test

C. American National Standards Institute (ANSI)

1. ANSI/ASC 29.4 Exhaust Systems
Abrasive Blasting Operations – Ventilation and Safe Practice

D. American Water Works Association (AWWA)

1. AWWA D102 Coating Steel Water Storage Tanks

E. Consumer Product Safety Act, Part 1303

F. Environmental Protection Agency

1. EPA 524.2 Revision 4 Purgeable VOCs by GC/MS

G. National Association of Corrosion Engineers (NACE) International

1.	NACE Publication TPC2	Coatings and Linings for Immersion Service: Chapter 1 Safety, Chapter Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection
2.	NACE Standard RP0178	Standard Recommended Practice - Fabrication Details, Surface Finish Requirements and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service
3.	NACE Standard RP0188	Standard Recommended Practice - Discontinuity (Holiday) Testing of Protective Coatings
4.	NACE Standard RP0287	Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
5.	NACE Standard RP0288	Standard Recommended Practice, Inspection of Linings on Steel and Concrete

H. Occupational Safety & Health Administration (OSHA)

1. 1915.35Standards – 29 CFR – Painting

I. Steel Structures Painting Council (SSPC)

1.	SSPC-SP2	Hand Tool Cleaning
2.	SSPC-SP3	Power Tool Cleaning
3.	SSPC-PA-1	Shop, Field and Maintenance Painting
4.	SSPC-PA-2	Measurement of Dry Film Thickness with Magnetic Gages
5.	SSPC-PA-3	Guide to Safety in Paint Application
6.	SSPC-Guide 12	Guide for Illumination of Industrial Painting Project
7.	SSPC-VIS 1-89	Pictorial Surface Preparation Standards for Painting Steel Surfaces
8.	SSPC Paint Spec 36	Two Component Weatherable Aliphatic Polyurethane Topcoat, Performance-Based

J. SSPC/NACE Joint Standards

1.	SSPC-SP5/NACE 1	White Metal Blast Cleaning
2.	SSPC-SP6/NACE 3	Commercial Blast Cleaning
3.	SSPC-SP7/NACE 4	Brush-Off Blast Cleaning
4.	SSPC-SP10/NACE 2	Near-White Metal Blast Cleaning

K. NSF International / American National Standards Institute (ANSI)

1. NSF/ANSI 61 - Drinking Water System Components - Health Effects.

L. The Engineer's decision shall be final as to the interpretation and/or conflict between any of the referenced specifications and standards contained herein.

1.3 QUALIFICATIONS

A. Contractor shall have five years' practical experience and successful history in the application of specified product to surfaces of steel water tanks. Upon request, he shall substantiate this requirement by furnishing a list of references and job completions.

B. The personnel performing the work shall be knowledgeable and have the required experience and skill to adequately perform the work for this project, in accordance with SSPC-PA1, "Shop, Field and Maintenance Painting".

1.4 QUALITY ASSURANCE

A. General: Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the Engineer.

B. Surface Preparation: Surface preparation will be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces: SSPC-VIS 1-89", ASTM D2200-95, "Standard Methods of Evaluating Degree of Rusting on Painted Surfaces", ASTM D 4417-91, Method A and/or Method C or NACE Standard RP0287-87. In all cases the written standard shall take precedence over the visual standard. In addition, NACE Standard RP0178-91, along with the Visual Comparator, shall be used to verify the surface preparation of welds.

C. Application: No coating or paint shall be applied when: 1) the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein, 2) rain, snow, fog or mist is present, 3) the surface temperature is less than 5 degrees F above the dew point, 4) the air temperature is expected to drop below the minimum temperature for the products specified within six hours after application of coating. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. If any of the above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.

D. Thickness and Holiday Checking: Thickness of coatings and paint shall be checked with a non-destructive, magnetic-type thickness gauge, as per SSPC-PA 2 "Measurement of Dry Film Thickness with Magnetic Gages". References in SSPC-PA 2 which allow 80% of the minimum thickness specified are not acceptable. Use an instrument such as a Tooke Gauge if a destructive test is deemed necessary by the Engineer.

E. The integrity of interior coated surfaces shall be checked with a low voltage holiday detector in accordance with NACE Standard RP0188. Non-destructive holiday detector shall not exceed 67.5 volts, nor shall destructive holiday detector exceed the voltage recommended by the manufacturer of the coating system. A solution of 1 ounce non-sudsing type wetting agent, such as Kodak Photo-Flo, or approved equal, and 1 gallon of tap water shall be used to perform the holiday testing. All pinholes and/or holidays shall

be marked and repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating. Holiday testing frequency shall be 100%.

F. Inspection Devices: Contractor shall furnish, until final acceptance of coating and painting is accepted, inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates and/or plastic shims, depending upon the thickness gauge used, to test the accuracy of dry film thickness gauges and certified instrumentation to test the accuracy of holiday detectors. Dry film gauges and holiday detectors shall be made available for the Engineer's use at all times until final acceptance of application. Holiday detection devices shall be operated in the presence of the Engineer.

G. Independent NACE Inspection: Inspection for this project shall include inspections conducted by an independent National Association of Corrosion Engineers (NACE) certified inspector with a minimum of five years documented experience on similar projects.

1. Contractor shall identify and propose an independent NACE certified inspector, who possesses appropriate professional liability insurance and is completely independent of the tank and coating manufacturers, to inspect the work at Contractor’s expense. Contract shall submit name and qualifications of NACE certified inspector to Engineer and Owner for approval prior to commencing work.

2. The NACE certified inspector will identify the testing and test sequencing requirements prior to commencement of the work. The Contractor shall coordinate activities with the Engineer and NACE certified inspector related to the inspection of surface preparations and coatings as well as a holiday inspection, as required by the NACE certified inspector.

3. At a minimum, the inspector shall inspect the surface prior to abrasive blasting, after abrasive blasting but prior to application of coating materials, and between subsequent coats of material. Final inspection shall take place after all coatings are applied, but prior to placing the tank in service. Contractor will ensure that sufficient rigging is in place so that the inspector shall be able to conduct the required inspections.

H. MEK Double Rub Test: After the tank has reached “full cure” in accordance with the recommendations and written published data sheets of the coating manufacturer, the inspector shall perform MEK double rub tests in accordance with ASTM D5402 to verify curing of the interior coating system.

1.5 WARRANTY INSPECTION

A. Warranty inspection shall be conducted during the eleventh month following acceptance of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Engineer and/or Owner.

1. The NACE certified inspector will attend the Warranty Inspection at the Contractor’s expense, along with the Contractor, Engineer and Owner Representative.

B. Inspection Procedure:

1. Contractor shall coordinate with Owner, Engineer and NACE Inspector prior to inspection.
2. Owner shall drain the tank prior to inspection, at Owner's expense.
3. Contractor shall provide all equipment and support required to give the NACE Inspector safe access to all interior and exterior surfaces. Such equipment and support may include scaffolding, ventilation, or other safety equipment, as needed.
4. NACE Inspector shall inspect the interior and exterior of the tank for visual defects, holidays, and other criteria deemed necessary by the Inspector.
5. After inspection, Contractor shall immediately repair all defects identified by the Inspector, in accordance with coating manufacturer's recommendations.
    a. In the event that the Contractor is not able to repair all defects immediately and the tank must be refilled prior to repair, Contractor shall be responsible for any subsequent draining and refilling of the tank at Contractor's expense.
6. After all repairs are completed and accepted by the Owner, Contractor shall disinfect the tank at Contractor's expense, in accordance with Section 33 13 13 – Water Storage Tank Disinfection.
7. Water to refill the tank one time shall be provided at no expense to the Contractor.

C. Repair of Coating Failures:

1. Documented coating failures shall be repaired by the Contractor in accordance with the coating manufacturer's recommendations.
2. If the repairs require that the tank be drained, the Contractor shall coordinate the work with the water system operator and provide all equipment, labor and materials, including temporary storage if necessary, to complete the repairs.
3. Upon completion of the repair work, the tank will be disinfected in accordance with AWWA requirements and placed back into service.

1.6 SAFETY AND HEALTH REQUIREMENTS

A. The requirements listed herein are not exhaustive, and nothing in these specifications shall relieve Contractor from full responsibility over all aspects of safety on the project.

B. General: In accordance with requirements set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals, the Contractor shall provide and require use of personal protective lifesaving equipment for persons working on or about the project site. The Contractor's work forces should comply with the provisions outlined in SSPC-PA-3 "A Guide to Safety in Paint Application".

C. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air purifying half-mask or mouthpiece respirators with appropriate filters. Barrier creams shall be used on any exposed areas of skin.

D. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminants to a degree a hazard does not exist. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

E. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protection devices.

F. Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the Engineer, the Contractor shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the inspector.

G. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the Engineer to facilitate inspection and be moved by the Contractor to locations requested by the Engineer.

1.7 PRODUCT DELIVERY, STORAGE & HANDLING

A. All materials shall be brought to the jobsite in original sealed containers. They shall not be used until the Engineer, or Resident Project Representative, has inspected the contents and obtained data from information on containers or label. Materials exceeding storage life recommended by the manufacturer shall be rejected.

B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings and paints must be stored to conform to City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

PART 2 MATERIALS

2.1 ACCEPTABLE MANUFACTURERS

A. Materials specified are those that have been evaluated for the specific service. Products of the Tnemec Company, Inc. are listed to establish a standard of quality. Equivalent materials of other manufacturer's may be submitted on written approval of the Engineer. As part of the proof of equality, the Engineer will require at the cost of the Contractor, certified test reports from a nationally known, reputable and independent testing laboratory conducting comparative tests as directed by the Engineer between the product specified and the requested substitution.

B. Requests for substitution or equal products shall include manufacturer's literature for each product giving name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and product data showing it to be equal the performance criteria of the products specified herein.

C. All requests for product substitution shall be made via submittal.

D. Manufacturer's color charts shall be submitted to the Engineer at least 30 days prior to coating and/or paint application. General Contractor and Painting Contractor shall

coordinate work so as to allow sufficient time (normally seven to ten days) for paint to be delivered to the job site.

2.2 GENERAL REQUIREMENTS

A. All materials shall be lead-free as defined by the Consumer Product Safety Act, Part 1303.

B. All zinc dust pigment contained in any zinc-rich material shall meet the requirements of ASTM D520 Type III as regards zinc content and purity.

C. All materials for the interior wetted portion of the tank shall meet the requirements of ANSI/NSF Standard 61 for potable water contact.

D. All high gloss clear coat products shall incorporate the use of a fugitive dye to aid in the proper application and coverage of such coats.

E. All catalyzed polyurethane products shall meet the minimum requirements of SSPC Paint Specification Number 36, Level 3 Performance Level.

F. No products containing MOCA shall be allowed.

G. Inorganic zinc-rich primers shall not be utilized as a permanent part of the interior coating system on this project. Inorganic zinc-rich pre-primers, if used, shall be completely blasted and removed prior to installing the coating system on the interior water compartment. All surface preparation shall be to the degree specified herein.

2.3 MATERIAL PREPARATION

A. Mix and thin materials according to manufacturer's latest printed instructions.

B. Do not use materials beyond manufacturer's recommended shelf life.

C. Do not use mixed materials beyond manufacturer's recommended pot life.

2.4 TANK INTERIOR COATING SYSTEM

A. High-Build, Zinc/Epoxy System:

1. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour.

2. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

3. Surface Preparation: SSPC-SP10 Near-White Metal Blast Cleaning. Anchor profile shall be 1.5 to 2.5 mils as per ASTM D4417, Method C or NACE Standard RP0287. Anchor profile shall be primarily angular and irregular, as produced by grit.

4. Coating System:

Shop Primer:	Tnemec Series 91-H2O Hydro-Zinc, or equal, applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner, or equal.
Field Primer:	Unprimed Weld Seams and Touch Up Areas Only

Tnemec Series FC20 or FC20HS Beige Pota-Pox Plus, or equal, applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec No. 41-4 Thinner, or equal.

Stripe Coat: Tnemec Series FC20 or FC20HS Tank White Pota-Pox Plus, or equal, applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits shall receive a stripe coat.

Intermediate Coat: Tnemec Series FC20 or FC20HS 1255 Beige Pota-Pox Plus, or equal, applied at 5.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec No. 41-4 Thinner, or equal.

Finish Coat: Tnemec Series FC20 or FC20HS Tank White Pota-Pox Plus, or equal, applied at 5.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec No. 41-4 Thinner, or equal.

Total dry film thickness shall be 12.5 to 15.5 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

For cold weather applications, Tnemec Series 44-700 Urethane Accelerator, or equal, may be added to Series 91-H_2O, or equal.

2.5 TANK EXTERIOR COATING SYSTEM

A. Three Coat System for Extended Color and Gloss Retention:

1. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour.

2. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

3. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.5 mils as per ASTM D4417, Method C or NACE Standard RP0287.

4. Coating System:

Shop Primer: Tnemec Series 91-H20 Hydro-Zinc, or equal, applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner, or equal.

Field Primer: Unprimed Weld Seams and Touch Up Areas Only

Tnemec Series FC20 Beige Pota-Pox Plus, or equal, applied at 4.0 to 6.0 dry mils.

Intermediate Coat: Tnemec Series FC20 or FC20HS Pota-Pox Plus, or equal, applied at 5.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec No. 41-4 Thinner. (Two coats may be required if applied by roller.)

Finish Coat: Tnemec Series 1074-Color Endura-Shield II, or equal, applied at 3.0 to 4.0 dry mils. Thin only with approved thinner,

Tnemec 41-42 Thinner for spray, 41-39 for brush or roller. (Two coats may be required if applied by roller).

Total dry film thickness shall be 10.5 to 13.5 per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

For cold weather applications, Tnemec Series 44-710 Urethane Accelerator, or equal, may be added to Series 1074, or equal, at the rate specified on the Series 44-710, or equal, product data sheet.

2.6 Exterior Tank Floor (Underside):

A. Coat underside of floor with 20 mil DFT of coal tar epoxy, or 3 mil DFT alkyd primer.

B. It is not necessary to re-coat the underside of the floor after welding.

2.7 Interior Roof Laps:

A. All interior roof lap joints shall be sealed with Sikaflex-1a, or equal, after the coating system has been installed.

2.8 Above-Ground Pipes:

A. Interior: Match tank interior coating schedule

B. Exterior: Match tank exterior coating schedule

2.9 Buried Pipes and Fittings:

A. Interior: Match tank interior coating schedule

B. Exterior:

1. Surface preparation: SSPC-SP6 Near-White Blast
2. Coal tar epoxy coating, min. 10 mil DFT
3. Cold-applied tape coating in accordance with AWWA C209. Minimum overlap of 1-inch and total coating thickness not less than 40 mils of double wrap coal tar tape applied 20 mils each wrap. Provide tape coating in addition to coal tar epoxy coating.

PART 3 EXECUTION

3.1 GENERAL

A. All surface preparation, coating and painting shall conform to applicable standards of the Steel Structures Painting Council, NACE International and the manufacturer's printed instructions. Materials applied to the surface prior to the approval of the Engineer shall be removed and re-applied to the satisfaction of the Engineer at the expense of the Contractor.

B. All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be coordinated with the Engineer.

C. The Contractor shall provide a supervisor at the work site during cleaning and application operations. The supervisor shall have the authority to sign and change orders, coordinate work and make decisions pertaining to the fulfillment of the contract.

D. Dust, dirt, oil, grease or any foreign matter that will affect the adhesion or durability of the coating or paint must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags.

E. Coating and painting systems include surface preparation, prime coating and finish coatings. Unless otherwise approved in writing by the Engineer, prime coating shall be field applied. Where prime coatings are shop applied, the Contractor shall instruct suppliers to provide the prime coat compatible with the specified finish coat. Any off-site work which does not conform to this specification is subjected to damage during transportation, construction or installation shall be thoroughly cleaned and touched-up in the field as directed by the Engineer. The Contractor shall use repair procedures which insure the complete protection of all adjacent primer. The specified repair method and equipment may include wire-brushing, hand or power tool cleaning, or dry air blast cleaning. In order to prevent injury to surrounding painted surfaces, blast cleaning may require use of lower air pressure, smaller nozzle and/or abrasive blast particles, or shorter blast nozzle distances from surface shielding and masking. If damage is too extensive or uneconomical to touch-up, the entire item shall be blasted and then coated or painted as directed by the Engineer.

F. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Contractor's equipment shall be subject to approval of the Engineer.

G. Application of the first coat shall follow immediately after surface preparation and cleaning and stripe coat, if applicable, before rust bloom occurs or the same day, whichever is less. Any cleaned areas not receiving first coat within this period shall be recleaned prior to application of first coat. Use of dehumidification equipment shall be first reviewed by the Engineer and coatings manufacturer prior to deviating from this provision.

H. Prior to assembly, all surfaces made inaccessible after assembly shall be prepared as specified herein and shall receive the coating or paint system specified.

I. If the recoating time window stipulated by the coating manufacturer for any primer or intermediate coat is exceeded, the primer or intermediate coat shall be scarified by sweep blasting per SSPC-SP7/ NACE No. 4 to achieve the surface condition necessary to receive and properly adhere to subsequent finish coats.

3.2 SURFACE PREPARATION

A. The latest revision of the following surface preparation specifications of the Steel Structures Painting Council (SSPC) shall form a part of this specification. The summaries listed below are for informational purposes; consult the actual SSPC specification for full detail.

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods which involve a solvent or cleaning action.

2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mil scale and other detrimental foreign matter to a degree specified by hand chipping, scraping, sanding and wire-brushing.

3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mil scale and other detrimental foreign matter by power wire-brushing, power impact tools or power sanders.

4. White Metal Blast Cleaning (SSPC-SP5/NACE No. 1): Air blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.

5. Commercial Blast Cleaning (SSPC-SP6 NACE No. 3): Air blast cleaning until at least two-thirds of each element of surface area is free of all visible residues.

6. Brush-Off Blast Cleaning (SSPC-SP7 NACE No. 4): Air blast cleaning to remove loose rust, loose mil scale and other detrimental foreign matter to a degree specified.

7. Near-White Metal Blast Cleaning (SSPC-SP10 NACE No. 2): Air blast cleaning until at least 95% of each element of surface area is free of all visible residues.

8. Power Tool Cleaning to Bare Metal (SSPC-SP11): Differs from SSPC-SP3 in that it requires more thorough cleaning and a surface profile not less than 1 mil.

B. Slag, weld metal accumulation and spatters not removed by the Fabricator, Erector or Installer shall be removed by chipping and/or grinding. All sharp edges shall be peened, ground or otherwise blunted as required by the Engineer. All grinding and finishing of welds, edges, etc. shall be performed prior to solvent cleaning and abrasive blasting. Welds shall be prepared as per NACE Standard RP0178 for all interior and exterior surfaces:

1. Butt Welds: Shall be ground smooth and free of all defects, designation “D”.

2. Lap Welds: Shall be ground smooth and blended, designation “D”.

3. Fillet Welded Tee Joint: Shall be ground smooth and blended, designation “D”.

C. All recycled abrasives used in automated shop blasting shall be clean as per SSPC-AB2 “Cleanliness of Recycled Ferrous Metallic Abrasives”. All shop blasting utilizing centrifugal-type equipment shall utilize a blend of shot and grit (maximum of 80% shot). In no case, shall steel shot alone be permitted. After blast cleaning, the surface of the steel shall appear angular and irregular. Should the surface appear peened or undulating, the steel shall be reblasted to achieve the correct appearance.

D. Field blast cleaning for all surfaces shall be by dry method unless otherwise directed. Blast nozzles shall be venturi-type nozzles with a minimum pressure at the nozzle of 90 psi.

E. Particle size of abrasives used in blast cleaning shall be selected to produce the surface profile specified above or in accordance with recommendations of the manufacturer of the specified coating or paint system to be applied.

F. All shop-primed surfaces shall receive a uniform and thorough sweep-blast as per SSPC-SP7/NACE No. 4. All bare metal areas shall be abrasive blasted as per SSPC-SP10/NACE No. 2 Near-White Blast Cleaned for interior surfaces. All bare metal areas shall be abrasive blasted as per SSPC-SP6/NACE No. 3 Commercial Blast Cleaned for exterior surfaces.

G. If the profile of the blasted steel exceeds the profile specified above, the Contractor shall be required to do one or both of the following:

1. Reblast the surface using a finer aggregate in order to produce the required profile.

2. Apply a thicker prime coat, if possible given the limitations of the products being applied, in order to adequately cover the blast profile

H. Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused unless specifically approved in writing by the Engineer.

I. During blast cleaning operations, caution shall be exercised to insure that existing coatings or paint are not exposed to abrasion from blast cleaning.

J. Contractor shall keep the area of his work and the surrounding environment in a clean condition. Contractor shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the accomplishment of the work, the operation of the existing facilities or to the surrounding environment.

K. Blast cleaned surfaces shall be cleaned prior to application of specified coatings or paint. All surfaces shall be free of dust, dirt, and other residue resulting from the abrasive blasting operation. No coatings or paint shall be applied over damp or moist surfaces.

L. All welds shall be neutralized with a suitable chemical compatible with the specified coating or paint.

M. Brush-Off Blast surfaces coated with zinc-rich materials to remove any contamination prior to subsequent coats.

N. Pitted areas on the tank interior shall be repaired by welding. Metal components exhibiting excessive pitting, as determined by the NACE Inspector, shall be rejected.

O. Specific Surface Preparation: Surface preparation for the specific system shall be as noted in Articles 2.4 and 2.5.

P. Sandblasting waste shall be disposed of off-site at an approved solid waste facility, at the Contractor's expense.

3.3 NON-VISIBLE CONTAMINANTS

A. Chloride, sulfate and ferrous ions (Fe^{2+}) tests shall be performed on the interior metal portions of the tank after sandblasting but prior to the application of coatings.

1. Perform a minimum of two tests per 1,000 square feet.

2. The maximum allowable limit of these non-visible contaminants is:

a. The maximum level of chlorides is 30 milligrams per square meter or 3 micrograms per square centimeter.

b. The maximum level of sulfates is 100 milligrams per square meter or 10 micrograms per square centimeter.

c. The maximum level of ferrous ions (Fe^{2+}) is 50 milligrams per square meter or 5 micrograms per square centimeter.

B. If testing shows amounts present in the test solution to be greater than the limits listed herein, the Contractor shall clean the surface of the entire tank interior with a 5,000 psi water blast with fine entrained abrasive until the levels in the test solutions are below the maximum acceptable level. Alternate cleaning methods may be allowed with prior approval of the Engineer. Surface shall be reblasted as specified in Articles 2.4 and 2.5 at no additional cost to the Owner.

C. Contractor shall provide a written statement from paint manufacturer stating that the maximum acceptable levels are not less than those listed herein. Results of the testing shall be provided to the Engineer before any coatings are applied.

3.4 APPLICATION, GENERAL

A. Coating and paint application shall conform to the requirements of the Steel Structure Painting Council Paint Application Specification SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting".

B. Thinning shall be permitted only as recommended by the manufacturer and approved by the Engineer, and utilizing the thinners stated in Articles 2.4 and 2.5.

C. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

D. Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces which are not to be coated or painted. Report to the Engineer surfaces from which materials cannot be satisfactorily removed.

E. When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additive to act as an indicator of coverage or the two coats must be of contrasting color.

F. Film thickness per coat as specified in Articles 2.4 and 2.5 are the minimum required. If roller application is deemed necessary, the Contractor shall apply additional coats as to achieve the specified thickness.

1. Roller application shall not be used without prior written approval by Engineer.

G. Field-applied primer shall require a minimum 12-hour curing period after application in an environment maintained at between 20% and 40% humidity.

H. All material shall be as specified.

3.5 COATING SYSTEMS APPLICATION

A. After completion of surface preparation as specified for the specific system, materials shall be applied as noted in Articles 2.4 and 2.5.

B. Care shall be taken so as to eliminate overspray and dry spray on the tank interior. Where such conditions are encountered, the surface shall be cleaned of all over spray and dry spray prior to the application of the succeeding coat.

C. Areas rendered inaccessible after tank erection such as the spaces between roof plates and rafters shall receive the full coating system prior to erection and/or assembly.

D. Full prime coat may be applied directly over stripe coat while stripe coat is wet.

3.6 DISINFECTION

A. Disinfection of interior surfaces shall be performed in the presence of the Engineer in accordance with all the requirements of Section 33 13 13 - Water Storage Tank Disinfection and applicable AWWA standards and regulatory agencies.

B. Disinfection shall be performed after protective coatings have been applied to the interior surfaces and allowed to thoroughly cure.

C. Prior to disinfecting, the complete interior shall be washed down with clean water and thoroughly flushed out.

3.7 SOLVENT VAPOR REMOVAL

A. All solvent vapors shall be completely removed by suction-type exhaust fans and blowers before placing tank in operating service.

B. All solvent vapors will be exhausted both during and after coating application as per AWWA D102.

C. Ventilation shall be continued until such time as the coating has reached “full cure” as specified by the coating manufacturer.

3.8 VOC TEST

A. After the tank has reached “full cure” as specified by the coating manufacturer, VOC tests shall be performed on the tank interior coating system. Samples shall be collected for testing by the Owner or his representative. Tests shall be performed in accordance with EPA 524.2 Revision 4 Purgeable VOCs by GC/MS. Total VOCs shall not exceed 100 ppb/100 micrograms per liter for 24 hour and 72 hour intervals.

B. If the limits cited herein are exceeded, Contractor shall take all actions necessary to reduce the total VOCs to the level specified herein. This includes but is not limited to continuing forced air ventilation, steam cleaning the structure, and rinsing the structure with clean potable water.

3.9 CLEAN UP

A. Upon completion of the work, all staging, scaffolding and containers shall be removed from the site or destroyed in a manner approved by the Engineer. Coating or paint spots or oil stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired or refinished to the satisfaction of the Engineer at no cost to the Owner.

END OF SECTION

SECTION 26 42 00

SACRIFICIAL ANODE TYPE CATHODIC PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes anodes and attachment to buried metallic components and buried tanks.

B. Related Sections:

1. Section 31 23 17 - Trenching.
2. Section 31 23 23 - Backfill.
3. Section 33 16 19 - Water Storage Tanks: Metal tanks requiring cathodic protection.

1.2 REFERENCES

A. ASTM International:

1. ASTM B418 - Standard Specification for Cast and Wrought Galvanic Zinc Anodes.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 PERFORMANCE REQUIREMENTS

A. Iron and Steel Components:

1. Negative voltage of 0.85 volts measured between component and saturated reference electrode contacting earth near component.
2. Negative voltage shift of 300 millivolts measured between component and saturated reference electrode contacting earth near component.
3. Polarization voltage shift of 100 millivolts measured between component and saturated reference electrode contacting earth near component.

B. Aluminum Components:

1. Negative voltage of 1.2 volts measured between component and saturated reference electrode contacting earth near component.
2. Negative voltage shift of 150 millivolts measured between component and saturated reference electrode contacting earth near component.
3. Polarization voltage shift of 100 millivolts measured between component and saturated reference electrode contacting earth near component.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate wiring diagrams and submit calculation supporting system design.

C. Design Data: Submit design calculation.

D. Product Data: Submit data for anodes and test panels.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of anodes and test panels.

C. Operation and Maintenance Data: Include periodic test procedures.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

B. Design work by parties certified by National Association of Corrosion Engineers and licensed at place of work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum Anode: rod, coating alloy content conforming to the following:

1. Indium: 0.02 percent, maximum.

2. Zinc: 4.5 percent, maximum.

B. Anode Lead Wire: Solid copper conductor, 12 AWG, Type THW insulation.

C. Field Wiring: Stranded copper conductor, 12 AWG, Type TW insulation.

D. Conduit: Rigid galvanized steel.

2.2 ANODE BACKFILL

A. Backfill: Blended granular mixture, 100 percent passing No. 10 sieve mesh screen; composed of the following:

1. Hydrated Gypsum: 75 percent.

2. Bentonite Clay: 20 percent.

3. Sodium Sulphate: 5 percent.

2.3 ACCESSORIES

A. Enclosure: NEMA 250 Type 4X.

B. Terminal Board: One piece with screw terminals rated 15 amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fasten anode lead wire to anode rod by silver brazing. Install wire length of 20 feet. Insulate connection to 600 volts, overlapping lead wire insulation by 1/2 inch minimum.

B. Pack anode and backfill in cloth bag; center anode and firmly pack backfill with mechanical vibrator. Use backfill material of packaged weight 2.5 times unit weight of anode.

C. Provide bonding to ensure protected components are electrically continuous.

D. Connect system to metal tanks by mechanical methods.

E. Restore corrosion protective coatings and wraps damaged during installation.

F. Once installed, cathodic protection system is not to be activated until after 11th month inspection.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing surface debris.
2. Removing designated paving, curbs, and other obstructions.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Excavating topsoil.

B. Related Sections:

1. Section 02 21 32 - Surveying
2. Section 31 22 13 - Rough Grading.

1.2 QUALITY ASSURANCE

A. Perform Work in accordance with the most recent edition of the New Mexico Standard Specifications for Public Works Construction, with latest revisions.

B. Conform to applicable State of New Mexico code for environmental requirements, disposal of debris, burning debris on site, use of herbicides.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Quality Requirements: Examination of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area and/or salvage area for placing removed materials.

3.2 PREPARATION

A. Call New Mexico “One Call” at 811 and/or local utility companies at least three (3) working days before performing Work.

1. Request that underground utilities be located and marked within and surrounding construction areas.

B. Contractor shall not work in any area where the designated work area has not been staked by Surveyor. Contractor shall be wholly liable for any damage caused by working in areas that have not been staked, or by encroaching outside the staked work area.

C. Notify Engineer at least five (5) working days prior to commencing work within 100 feet of any designated restricted area or biologically or culturally sensitive area, as shown on Plans. Do not commence work unless barricades are in place and/or archaeological monitor is present, as required. Refer to Section 01 00 00 – Basic Requirements and the Drawings for site-specific requirements.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping.

C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees and shrubs within indicated areas. Remove stumps and surface rock.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site, as directed in field by Engineer.

B. Tree removal:

1. Trees larger than 3” in diameter shall be cut, de-limbed, and left in stacks on edge of ROW for public firewood gatherers. Place firewood such that the public may gather it without creating safety hazards or additional disturbance to the public, work site or the environment.

2. Trees smaller than 3” in diameter, slash, and brush shall either be chipped and spread on the ROW or hauled to appropriate disposal site. Chipped material shall be distributed so as not to interfere with successful re-vegetation efforts.

3. Tree stumps and other material that cannot be chipped or used by the public shall be hauled to an appropriate disposal facility.

C. Partially remove paving, curbs, and other obstructions as indicated on Drawings. Neatly saw cut edges at right angle to surface.

D. Remove abandoned utilities as directed by Owner and/or Engineer. Indicate removal termination point for underground utilities on Record Documents.

E. Continuously clean up and remove waste materials from site. Do not allow materials to accumulate on site.

F. The Engineer will indicate to the Contractor which obstructions are to be removed, disposed of, or salvaged, and will require special documentation.

G. All existing fences crossed by the Work, or are within the construction area, are to be removed and rebuilt to original condition or better. Fence materials resulting from such removal are to be stored or disposed of as directed by the Engineer. Fence materials suitable for reuse or salvage that are damaged, lost or destroyed due to the Contractor's negligence or carelessness are to be replaced at the Contractor's expense.

1. Refer to Section 01 00 00 for additional fence crossing requirements.

H. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

A. Excavate top 6 inches of topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials or vegetable matter for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over with same material, until disposal.

D. Remove excess topsoil not intended for reuse, from site.

E. All equipment shall be properly maintained and with proper safety devices.

F. Contractor must maintain control of dust and minimize blowing debris.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating subsoil.
2. Cutting, grading, filling, rough contouring, and compacting site for site structures and building pads.

B. Related Sections:

1. Section 02 21 32 - Surveying
2. Section 31 10 00 - Site Clearing: Excavating topsoil.
3. Section 31 23 17 - Trenching: Trenching and backfilling for utilities.
4. Section 31 23 23 - Backfill: General building area backfilling.
5. Section 33 11 13 - Public Water Transmission Systems: Pipeline Right-of-Way grading

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The following payment concepts only apply when a corresponding item is included in the Bid Schedule. If no specific item is provided, then this work shall be considered incidental to any items which require grading.

B. Topsoil Fill:

1. Basis of Payment: Includes excavating existing soil, supplying soil materials, stockpiling, scarifying substrate surface, placing where required, and compacting.

C. Subsoil Fill:

1. Basis of Payment: Includes excavating existing subsoil, supplying subsoil materials, stockpiling, scarifying substrate surface, placing where required, and compacting.

D. Structural Fill:

1. Basis of Payment: Includes excavating existing subsoil, supplying structural fill materials, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.3 REFERENCES

A. Subsurface data:

1. Geotechnical Report prepared by NV5, Inc. Refer to Exhibit A of the Contract Documents.

2. "Soil and Rock Potholing" data, as prepared by Souder, Miller & Associates. Refer to Exhibit B of the Contract Documents.
3. Note that in the event of any discrepancy or difference in requirements between the geotechnical reports referenced above and the Technical Specifications, the more stringent requirement shall apply.
4. Refer to Section 01 00 00 regarding Contractor's ability to rely on subsurface data provided by Owner.

B. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

C. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D422 - Particle -Size Analysis of Soils.
3. ASTM D653 - Terminology Relating to Soil, Rock, and Contained Fluids.
4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
5. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
6. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
7. ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.
8. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
9. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
10. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
11. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
12. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
13. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
14. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
15. ASTM D4254 - Minimum Index Density and Unit Weight of Sols and Calculation of Relative Density.
16. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

17. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
18. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
19. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
20. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
21. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
22. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
23. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
24. ASTM D5080 - Rapid Determination of Percent Compaction.
25. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures.

B. Samples: Submit, in airtight containers, 20 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

B. Perform Work in accordance with New Mexico Standard Specifications for Public Works Construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. As specified in Section 31 23 23 - Backfill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Quality Requirements: Examination of existing conditions before starting work.

B. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call New Mexico “One Call” at 811 and/or local utility companies at least three (3) days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Notify Engineer at least five (5) working days prior to commencing work within 100 feet of any designated restricted area or culturally sensitive area, as shown on Plans. Do not commence work unless barricades are in place and/or archaeological monitor is present, as required. Refer to Section 01 00 00 and the Drawings for site-specific requirements.

C. Identify required lines, levels, contours, and datum.

D. Notify utility company to remove and relocate utilities.

E. Protect remaining utilities from damage.

F. Protect plant life, lawns, and other features remaining as portion of final landscaping.

G. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, relandscaped, or regraded.

B. Do not excavate in rain or snow.

C. Do not excavate frozen materials.

D. Blasting is not allowed.

E. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

F. Remove excess subsoil not intended for reuse and dispose of in accordance with these Technical Specifications.

G. Benching Slopes: Horizontally bench existing slopes greater than 4:1 (H:V) to key placed fill material to slope to provide firm bearing.

1. Do not exceed maximum slope of 4:1 (H:V) unless otherwise noted on the Drawings or directed by the Engineer.

H. Stability: Replace damaged or displaced subsoil as specified for fill.

I. Notify Owner of any utility damage at once so emergency measures can be taken. The Contractor will pay for any required repairs.

J. Remove and exclude water, including storm water, groundwater, irrigation water, and/or other waters, from all excavations. Dewatering wells, well-points, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level below the bottom of excavations. Water shall be removed and excluded until backfilling is complete and all field soils testing have been completed.

K. Excavation Below Fills and Embankments: The subgrade areas beneath embankments shall be excavated to remove not less than the top 1 foot of native material and, where such sub-grade is sloped, the native material shall be benched. After the required excavation or over-excavation has been completed, the top 12 inches of material shall be scarified and moisture added or material dried to optimum moisture and the exposed surface shall be proof rolled.

L. Excavation under areas to be paved shall extend to the bottom of the sub-base. After the required excavation has been completed, the area shall be scarified a minimum of 12 inches below the subgrade surface and recompacted prior to the placement of the sub-base aggregate and/or base course aggregate. The finished sub-grade shall be even, self-draining, and in conformance with the slope of the finished pavement. Areas that could accumulate standing water shall be regraded to provide a self-draining subgrade.

M. Damage to existing or new facilities or work caused by the Contractor's operations shall be repaired at no additional cost to the Owner.

N. Material beyond prescribed lines which is loosened by the Contractor's operations shall be removed, replaced and/or compacted, as directed by the Engineer, at no additional cost to the Owner.

3.4 FILLING

A. See Technical Specification 31 23 23 – Backfill.

3.5 DISPOSAL OF EXCAVATED MATERIALS

A. Excess excavated material or excavated material not suitable for backfill may be disposed of on-site, provided that:

1. The finished grade substantially conforms with the drawings, or any deviation therefrom is approved by the Engineer

    a. Blend with natural terrain

    b. Minimum slope: 2%

    c. Maximum slope: 4:1 (H:V)

2. All excess excavated material spread on the right-of-way is compacted to the same specifications as final backfill, as set for in Technical Specification 31 23 23 - Backfill and the Drawings, and

3. All on-site disposal of material is approved by the Engineer.

B. Do not dispose of waste material by dumping from tops of slopes.

C. Do not dispose of excess material within 15 feet of any wash, drainage or waterway.

D. Re-seed waste material areas in accordance with Section 32 92 19 - Seeding.

3.6 TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.7 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Determine compaction characteristics of materials in accordance with ASTM D698.

C. Classify soils in accordance with ASTM D2487.

D. Field moisture content measured as specified in Section 31 23 23 - Backfill.

E. Unit weight of in-place compacted material shall be measured as specified in Section 31 23 23 - Backfill.

F. Perform in place compaction tests as specified in Section 31 23 23 - Backfill.

3.8 CORRECTION OF SUB-STANDARD WORK

A. Section 31 23 23 – Backfill: Correction of Sub-Standard Work.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities.
2. Sheeting and shoring.
3. Disposal of excavated material.

B. Related Sections:

1. Section 02 21 32 - Surveying
2. Section 03 30 00 - Cast-in-Place Concrete.
3. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
4. Section 31 23 18 - Rock Removal.
5. Section 31 23 23 - Backfill: General backfilling.
6. Section 33 11 13 - Public Water Transmission Systems.

1.2 REFERENCES

A. Sub-surface Data:

1. Geotechnical Report prepared by NV5, Inc. Refer to Exhibit A of the Contract Documents.
2. “Soil and Rock Potholing” data, as prepared by Souder, Miller & Associates. Refer to Exhibit B of the Contract Documents.
3. Note that in the event of any discrepancy or difference in requirements between the geotechnical reports referenced above and the Technical Specifications, the more stringent requirement shall apply.
4. Refer to Section 01 00 00 regarding Contractor’s ability to rely on subsurface data provided by Owner.

B. NMSSPWC

1. NMSSPWC Sections 701, 801 & 802 “Trenching, Excavation and Backfill”.

C. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

D. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D422 - Particle -Size Analysis of Soils.
3. ASTM D653 - Terminology Relating to Soil, Rock, and Contained Fluids.
4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
5. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
6. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
7. ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.
8. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
9. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
10. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
11. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
12. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
13. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
14. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
15. ASTM D4254 - Minimum Index Density and Unit Weight of Sols and Calculation of Relative Density.
16. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
17. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
18. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
19. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
20. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
21. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.

22. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
23. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
24. ASTM D5080 - Rapid Determination of Percent Compaction.
25. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported fill materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with applicable New Mexico, Jicarilla Apache Nation and JAUA standards.

B. Perform Work in accordance with applicable OSHA trench safety standards.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 COORDINATION

A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Pipe Bedding and Embedment: As specified in Section 31 23 23 - Backfill.

B. Pipe Backfill: As specified in Section 31 23 23 - Backfill.

C. Structural Fill: As specified in Section 31 23 23 - Backfill.

D. Concrete: Structural concrete, as specified in Section 03 30 00, with minimum compressive strength of 4,000 psi at 28 days. Concrete for thrust blocking with minimum compressive strength of 3,000 psi at 28 days.

PART 3 EXECUTION

3.1 PREPARATION

A. Call New Mexico "One Call" at 811 and local utilities not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Contractor shall not work in any area where the designated work area has not been staked by Owner's Surveyor. Contractor shall be wholly liable for any damage caused by working in areas that have not been staked, or by encroaching outside the staked work area.

C. Notify Engineer at least five (5) working days prior to commencing work within 100 feet of any designated restricted area or culturally sensitive area, as shown on Plans. Do not commence work unless barricades are in place and/or archaeological monitor is present, as required. Refer to Section 01 00 00 – Basic Requirements and the Drawings for site-specific requirements.

D. Identify required lines, levels, contours, and datum locations.

E. Protect plant life, lawns and other features remaining as portion of final landscaping.

F. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

G. Maintain and protect above and below grade utilities indicated to remain.

H. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.2 LINES, GRADES AND DIMENSIONS

A. Excavate trench to lines and grades indicated on Drawings.

1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required based on field conditions.

2. Deviations from horizontal and vertical pipe line and grade by Contractor: Refer to Section 33 11 13 – Public Water Transmission Systems.

3. When bottom of trench is rocky, over-excavate and fill as specified in Section 31 23 23 – Backfill.

B. Excavate trench to minimum width as indicated on Drawings.

1. Increase trench width as required to meet required clearances between pipe and trench wall, to avoid voids in the haunch areas of the pipe and to meet embedment compaction requirements or minimum soil cement slurry layer thickness. Increased trench width, if needed to meet these requirements, shall be provided at no additional cost to the Owner.

3.3 TRENCHING

A. Excavate subsoil required for utilities.

B. Remove to 6 inches of topsoil and stockpile separately. The stockpiled soil shall be free of organic material. This topsoil shall be spread on top of the reclaimed area after backfilling, prior to re-seeding.

C. Remove lumped subsoil, boulders, and rock to bottom of trench.

D. Rock removal requiring specialized equipment or procedures as defined in Section 31 23 18 - Rock Removal, will be identified, quantified and paid for in accordance with Section 31 23 18.

E. Allowable open trench: Trenches may be opened in advance of pipe placement and backfill operations under the following conditions:

1. Do not open more than ½ mile of trench at one time. Do not leave any section of trench open for more than 24 hours.

2. Do not leave any trench open at the end of the workday within 100 feet of any road, driveway parking lot or other trafficked area, whether said road or driveway is shown on the Drawings or not.

3. Do not block vehicular traffic or impede access to homes or businesses.

4. Temporary fences shall be required for all trenches left open when the Contractor is not working on-site. Temporary fencing methods and materials shall be subject to approval by the Jicarilla Apache Nation, BIA, and the Engineer. All required temporary fencing shall be provided at no additional cost to the Owner.

5. Provide security at open trenches to protect the public, livestock, wildlife and the environment.

   a. Comply with all stipulations set forth by Sandoval County, BIA Department of Transportation, the Jicarilla Apache Nation, and other land-controlling agencies and owners of existing utility lines. These stipulations are provided Appendices C, D, and E.

   b. Provide animal escape ramps and cross-overs as follows:

      1) Escape ramps or crossovers will be constructed every 500 feet, in areas where active grazing is taking place and every 1,320 feet in all other areas. Construct with a minimum 3:1 slopes for ramps and at each end of the crossover. Crossovers will be a minimum of 10 feet wide and not fenced.

      2) Established livestock and wildlife trails will be left in place as a cross over.

      3) The ends of the open trench will be sloped each night with a minimum 3:1 slope.

6. Contractor is solely responsible for safety of all open trenches and bears sole liability for any incidents or accidents arising from open trenches.

7. The Owner may further restrict the amount of open trench as needed due to safety, land use or environmental considerations.

F. Remove water or materials that interfere with Work. Remove groundwater by pumping to keep excavations dry.

G. Provide uniform and continuous bearing and support for bedding material and pipe.

H. Do not interfere with 45 degree bearing splay of foundations. Any excavation in this area shall be backfilled and compacted using the same materials and methods as structural fill for new buildings. Refer to Section 31 23 23.

I. Slope or shore trench as needed to meet safety requirements. When sidewalls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.

J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered. Backfill and compact to reach specified or directed line and grade. Refer to specifications for overexcavation backfill, as set forth in Section 31 23 23.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to specified or directed line and grade. Refer to specifications for overexcavation backfill, as set forth in Section 31 23 23.

L. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

M. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

N. Remove excess subsoil not intended for reuse from site.

O. Do not excavate in the rain or snow without approval from the Engineer.

P. Do not excavate in frozen materials without approval from the Engineer.

Q. Blasting is not allowed.

3.4 ADDITIONAL EXCAVATION

A. Perform additional excavation in trench bottom for pipe foundations as show on drawings and other additional excavations beyond specified lines as directed by the Engineer.

3.5 OVEREXCAVATION

A. When foundation material is over-excavated beyond specified or directed lines, fill the over-excavation with embedment or bedding material and compact in accordance with Section 31 23 23 - Backfill.

B. If foundation material is over-excavated by being disturbed or loosened during excavation, compact material in place or remove and replace with embedment or bedding material as determined by the Engineer and compact in accordance with Section 31 23 23 - Backfill.

3.6 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work. If the Engineer orders the sheeting to be left in place for the protection of the work, a payment will be allowed only for the actual cost of the timber left in place.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.7 BACKFILLING OF TRENCHES

A. See Section 31 23 23 – Backfill for general backfill requirements, as well as trench backfill, bedding and embedment requirements around pipelines.

3.8 DISPOSAL OF EXCAVATED MATERIALS

A. Excess excavated material or excavated material not suitable for backfill may be disposed of on-site, provided that:

1. The finished grade substantially conforms with the drawings, or any deviation therefrom is approved by the Engineer

   a. Blend with natural terrain

   b. Minimum slope: 2%

   c. Maximum slope: 4:1, unless otherwise noted on Drawings

2. All excess excavated material spread on the right-of-way is compacted to the same specifications as final backfill, as set forth in Section 31 23 23 - Backfill and the Drawings, and

3. All on-site disposal of material is approved by the Engineer.

B. Do not dispose of waste material by dumping from tops of slopes.

C. Do not dispose of excess material within 15 feet of any wash, drainage or waterway.

D. Re-seed waste material areas in accordance with Section 32 92 19 - Seeding.

3.9 TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.10 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Determine compaction characteristics of materials in accordance with ASTM D698.

C. Classify soils in accordance with ASTM D2487.

D. Field moisture content measured as specified in Section 31 23 23 - Backfill.

E. Unit weight of in-place compacted material shall be measured as specified in Section 31 23 23 - Backfill.

F. Perform in place compaction tests as specified in Section 31 23 23 - Backfill.

G. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest at no additional cost to the Owner.

3.11 PROTECTION OF FINISHED WORK

A. Section 01 00 00 - Execution Requirements: Protecting installed construction.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 23 18

ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing identified and discovered rock during excavation.

B. Related Sections:

1. Section 31 23 17 - Trenching: Trenching and backfilling for utilities.
2. Section 31 23 23 - Backfill: Backfill materials.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Trench Rock Removal:

1. Basis of Measurement:

a. By vertical linear foot (VLF) of trench excavation. Each VLF is measured as horizontal linear foot of trench multiplied by the depth of excavated rock. The depth of the excavated rock may be less than the total trench depth. The width of trench is not a factor in the VLF calculation.

2. Basis of Payment:

a. Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading and removing from trench.

b. Payment will not be made for over-excavated work beyond the required bedding depth below invert elevation of pipe as shown on Drawings, nor for replacement materials.

c. If native trench rock is processed and used as pipe bedding or backfill material, the cost of such processing will be considered incidental to the cost of trench rock removal.

d. If trench rock is hauled away from site and replaced with imported material, the costs of rock hauling and disposal, as well as the costs of obtaining and hauling imported fill material will be considered incidental to the cost of trench rock removal.

e. The cost of placing and compacting embedment and backfill material, regardless of whether it is native or imported, will be considered incidental to pipeline installation.

3. Contractor shall notify Engineer prior to commencement of rock removal work when rock is encountered and specialized equipment will be required, and await approval from Engineer before proceeding.

4. Contractor and Engineer must agree on rock quantity at the end of each day that such work was completed, and both parties must sign off on the quantity on the corresponding Engineer's daily field report.

5. Potholing data is included in Exhibit B to the Contract Documents package. This data is provided for informational purposes only and will not be used as a basis for payment. Final quantities will be determined in the field during the construction process, in coordination with the Engineer.

1.3 DEFINITIONS

A. Rock: Solid mineral material of size that cannot be removed with conventional equipment such as a track excavator or chain-driven trencher (excluding rock saw).

B. For trench excavation, a 235C Caterpillar excavator with a medium stick and a rock ripping bucket, or equivalent equipment, is considered conventional equipment, if it can excavate at a production rate of at least 30 bank cubic yards per hour.

C. If material cannot be excavated by conventional equipment, the Engineer must be immediately notified. The Contractor shall provide performance tests of the specified conventional or equivalent equipment. If the Engineer confirms in writing that the specified conventional equipment cannot perform at the production rates specified, the excavation shall be considered rock excavation.

1.4 SUBMITTALS

A. Submit type of equipment to be used for rock removal and/or processing.

B. If processed native rock is to be used for embedment and backfill, submit sieve analyses and other geotechnical data on the processed material, as required in field by Engineer.

1. Laboratory costs associated with such testing shall be reimbursable under project testing allowance. Other costs, such as sample collection and transport, are not covered under the allowance.

1.5 SCHEDULING

A. Section 01 00 00 - Administrative Requirements: Coordination.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Coordination.

B. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical methods.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for footings.

D. For utility trenches, excavate to below invert elevation of pipe as shown on Drawings to ensure adequate bedding below pipe, and provide trench width as shown on Drawings to allow for proper embedment compaction or soil cement placement on sides of pipe. Exceptions to minimum trench width will be considered by Engineer if Contractor can demonstrate proper bedding and compaction are provided.

E. Disposal of excavated materials: Removed materials may be disposed of on-site, provided all criteria under Section 31 23 17 – Trenching, Article 3.8, are met.

3.4 ROCK REMOVAL BY EXPLOSIVE METHODS

A. Not allowed.

3.5 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Request visual inspection of foundation bearing surfaces by Engineer before installing subsequent work.

END OF SECTION

SECTION 31 23 23

BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backfilling site structures to subgrade elevations.
2. Fill under slabs-on-grade.
3. Fill under paving.
4. Fill for over-excavation.
5. Pipe bedding material.

B. Related Sections:

1. Section 02 21 32 - Surveying
2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
3. Section 31 22 13 - Rough Grading: Site filling.
4. Section 31 23 17 - Trenching: Backfilling of utility trenches.
5. Section 31 23 18 - Rock Removal.
6. Section 31 23 25 - Soil Cement Slurry.
7. Section 33 11 13 - Public Water Transmission Systems.

1.2 REFERENCES

A. Sub-surface Data:

1. Geotechnical Report prepared by NV5, Inc., dated June 12, 2017. Refer to Exhibit A of the Contract Documents.
2. “Soil and Rock Potholing” data, as prepared by Souder, Miller & Associates. Refer to Exhibit B of the Contract Documents.
3. Note that in the event of any discrepancy or difference in requirements between the geotechnical reports referenced above and the Technical Specifications, the more stringent requirement shall apply.
4. Refer to Section 01 00 00 regarding Contractor’s ability to rely on subsurface data provided by Owner.

B. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

C. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse ‘‘Aggregates.
2. ASTM D422 - Particle -Size Analysis of Soils.
3. ASTM D653 - Terminology Relating to Soil, Rock, and Contained Fluids.
4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
5. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
6. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
7. ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.
8. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
9. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
10. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
11. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
12. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
13. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
14. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
15. ASTM D4254 - Minimum Index Density and Unit Weight of Sols and Calculation of Relative Density.
16. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
17. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
18. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
19. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
20. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
21. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
22. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
23. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
24. ASTM D5080 - Rapid Determination of Percent Compaction.

25. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. Bureau of Reclamation (USBR):

1. USBR EM - Earth Manual, Part 2, Third Edition (1990).

2. Procedure No. and Title:

a. USBR EM 3900 - Standard Definitions of Terms and Symbols Relating to Soil Mechanics .

b. USBR EM 5000 - Determining Unified Soil Classification (Laboratory Method).

c. USBR EM 5005 - Determining Unified Soil Classification (Visual Method).

d. USBR EM 5300 - Determining Moisture Content of Soil and Rock by the Oven Method.

e. USBR EM 5315 - Determining Moisture Content by the Microwave Method.

f. USBR EM 5325 - Performing Gradation Analysis of Gravel Size Fraction of Soils.

g. USBR EM 5330 - Performing Gradation Analysis of Fines and Sand Size Fraction of Soils, Including Hydrometer Analysis.

h. USBR EM 5335 - Performing Gradation Analysis of Soils Without Hydrometer.

i. USBR EM 5350 - Determining the Liquid Limit of Soils by the One Point Method.

j. USBR EM 5355 - Determining the Liquid Limit of Soils by the Three Point Method.

k. USBR EM 5360 - Determining the Plastic Limit and Plasticity Index of Soils.

l. USBR EM 5500 - Performing Laboratory Compaction of Soils - 5.5 lb Rammer and 18-in Drop.

m. USBR EM 5525 - Determining the Minimum Index Unit Weight of Cohesionless Soils.

n. USBR EM 5530 - Determining the Maximum Index Unit Weight of Cohesionless Soils.

o. USBR EM 5605 - Determining the Permeability and Settlement of Soils Containing Gravel.

p. USBR EM 7205 - Determining Unit Weight of Soils In-Place by the Sand-Cone Method.

q. USBR EM 7215 - Determining Unit Weight of Soils In-Place by the Sleeve Method.

r. USBR EM 7220 - Determining Unit Weight of Soils In-Place by the Sand Replacement Method in a Test Pit.

s. USBR EM 7221 - Determining Unit Weight of Soils In-Place by the Water Replacement Method in a Test Pit.

t. USBR EM 7230 - Determining Unit Weight and Moisture Content of Soils In-Place - Nuclear Moisture - Density Gauge.

u. USBR EM 7240 - Performing Rapid Method of Construction Control.

v. USBR EM 7250 - Determination of Percent Relative Density.

w. USBR EM 7255 - Determining the Percent Compaction of Earthwork for Construction Control.

1.3 DEFINITIONS

A. Percentage Compaction – Ratio, expressed as percentage, of actual density of material compared with maximum dry density based on Standard Proctor (ASTM D698).

B. Optimum Moisture Content – Based on Standard Proctor (ASTM D698).

C. Unified Soil Classification System – Based on ASTM D2487.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures.

B. Submit samples and certified test documentation of all materials to be used.

C. Materials Source: Submit name of imported fill materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Submit field soil test on material in place as backfill.

PART 2 PRODUCTS

2.1 NATIVE FILL MATERIAL

A. Native material may be used for bedding, embedment and/or backfill, provided that said material meets all specifications set forth in this section. The Contractor may screen or otherwise process the material on-site to meet the specifications.

B. No dedicated borrow area for fill material has been pre-determined for this project. Native material may be borrowed from within the designated right-of-way and hauled within the project area if needed, provided that

1. All borrow areas receive prior approval from the Engineer. Finished grades shall conform to the finished grades shown in the plans, or any deviations therefrom must receive prior approval by the Engineer.

2. Borrow areas do not encroach beyond the designated project right-of-way. Borrow areas shall not encroach on any protected culturally or biologically sensitive areas, or other restricted areas.

3. All borrow areas are sloped and dressed to minimize erosion.

4. Adequate stormwater pollution prevention measures are installed and maintained during construction. Such controls must be approved by the Engineer.

5. All borrow areas are re-seeded upon completion of the project, in accordance with Technical Specification 32 92 19, and post-construction stormwater controls are installed with approval from the Engineer.

C. All costs incurred in removing, hauling or processing native material and reclaiming borrow sites shall be considered incidental and shall be borne by the Contractor at no additional expense to the Owner.

D. The Owner makes no guarantee that native materials meeting the fill and backfill material specifications contained herein are available within the project area.

2.2 IMPORTED FILL MATERIAL

A. If imported materials are required to meet the quantity requirements of the project, it will be provided at no additional expense to the Owner.

B. If imported materials are required to backfill trenches where rock has been removed and disposed of, the cost of the imported fill material shall be included in the Contractor's bid price for rock excavation and backfill. Refer to Section 31 23 18 – Rock Removal.

2.3 TYPES OF ACCEPTABLE FILL MATERIAL

A. Structural Fill: Structural fill for use as sub-foundation material under tanks, buildings and other structures shall be provided in accordance with the Geotechnical Report provided in Exhibit A of the Contract Documents.

B. Fill for Appurtenances: Fill under and around in-line valves and structures at the same elevation as the pipe shall comply with specifications for the corresponding type of fill under or around the pipe. Fill under and around appurtenances such as valves, vaults and other structures above the top of the pipe shall comply with specifications for initial backfill material.

C. Pipe Bedding and Embedment Material: The following types of material are acceptable for use as pipe bedding and embedment material:

1. Crushed Rock: Not more that 25% passing 3/8-inch sieve and not more than 12% fines. Maximum particle size shall not exceed ½ inch for pipe bedding and ¾ inch for embedment.

2. Clean Coarse-Grained Soils: Sands and gravels with 12% or less fines. Unified Soil Classification System designation GW, GP, SW, SP or any soil beginning with one of these symbols. Maximum particle size shall not exceed ½ inch for pipe bedding and ¾ inch for embedment.

3. Coarse-Grained Soils with Fines: Sands and gravels with more than 12% fines. Unified Soil Classification System designation GC, GM, SC, SM or any soil

beginning with one of these symbols. Maximum particle size shall not exceed ½ inch for pipe bedding and ¾ inch for embedment.

4. Sandy or Gravelly Fine-Grained Soils: Fine-grained soils (LL<50) with medium to no plasticity and with 30% or more coarse-grained particles. Unified Soil Classification System designation CL, ML or CL-ML. Maximum particle size shall not exceed ½ inch for pipe bedding and ¾ inch for embedment.

5. Other: Other types of material may be considered only with prior written approval by the Engineer. The Contractor is advised that soil amendment and/or higher levels of compaction may be required if using other soil types. Any costs associated with use of other soil types shall be borne by the Contractor at no additional expense to the Owner.

D. Pipe Backfill Material:

1. Initial backfill: All material placed in the trench between the top of the embedment and 18 inches above the top of the pipe shall be free from clumps, organic material, frozen material, debris or rocks larger than ¾ inch.

2. Final backfill: All material placed in the trench more than18 inches above the top of the pipe shall be free from clumps, organic material, frozen material, debris or rocks larger than 3 inches.

E. Drainage Culvert Backfill Material:

1. All material placed in the trench for galvanized drainage culvert pipe bedding and backfill shall be acceptable fill material as listed previously, with the following additional requirements:

a. Resistivity (as per AASHTO T 288) greater than 2000 ohm-cm.

b. pH (as per AASHTO T289) greater than 6.0.

c. Volcanic ash type material for backfill shall not be used.

F. Base Course: Refer to Technical Specification 32 11 23 – Aggregate Base Course and Gravel.

G. Soil Cement Slurry: Refer to Technical Specification 31 23 25 – Soil Cement Slurry.

H. All fill material shall be free of clumps, organic material, frozen material, ice, snow, debris or organic contaminants.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 8 inches.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 USE OF ACCEPTABLE MATERIALS

Fill and Backfill materials specified in Part 2 of this Section shall be used in accordance with the following provisions:

A. Over-excavation: Backfill to specified or directed lines using Embedment or Bedding material as specified above.

B. Bedding: Use Bedding material as specified above.

C. Embedment: Use embedment material as specified above.

D. Initial backfill: For backfilling between top of embedment (0.7 of pipe O.D.) and 18" above top of pipe, use initial backfill material as specified above.

E. Final backfill: For backfilling more than 18" above top of pipe, backfill as follows:

1. Outside of surfaced roads, driveways or parking areas: Use final backfill material as specified above.

2. Under surfaced or paved roads, driveways or parking areas: Use final backfill material as specified above, topped with base course as specified above. Apply base course to same thickness as existing driving surface, or 6 inches, whichever is greater. If paved, apply pavement patch to thickness equal to or greater than existing pavement.

F. Embankments: Use final backfill material as specified above, unless otherwise indicated on the Drawings.

G. Under tanks and other structures: Use structural fill as specified above unless otherwise indicated on Drawings.

H. Soil Cement Slurry: At Contractor's option and expense, soil cement slurry may be used in lieu of bedding, embedment, initial backfill and/or final backfill materials. Soil cement slurry, if used, shall be provided at no additional expense to the Owner, and conforming to Section 31 23 25 Soil Cement Slurry.

3.4 BACKFILLING FOR STRUCTURES, SITE WORK AND APPURTENANCES

A. Refer to the Geotechnical Report in Exhibit A regarding any issues not specifically addressed in these Technical Specifications. In the event of any discrepancies or differences in requirements between the Geotechnical Report and the Technical Specifications, the more stringent requirement shall apply.

B. Backfill areas to lines and grades as indicated on the Drawings or as directed by the Engineer.

1. For demolition work, backfill to existing grade or finished grade as indicated on Drawings, or as directed by the Engineer.

C. Systematically backfill to allow maximum time for natural settlement.

D. Do not backfill over porous, wet or spongy subgrade surfaces. Do not place backfill if either the material or the surface on which it is to be placed is frozen.

E. Each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.

F. Place material in continuous, uniform layers such that all spaces around rocks and clods are filled. Thickness of such layers shall be as follows:

1. Subsoil Fill: Maximum 8 inches compacted depth.

2. Structural Fill: Maximum 6 inches compacted depth.

3. Granular Fill: Maximum 6 inches compacted depth.

G. Employ placement method that does not disturb or damage other work.

H. Slope grade away from tank minimum 4%, unless otherwise noted on the Drawings.

I. Make gradual grade changes. Blend slope into level areas.

J. Shape and drain embankments and excavations, maintain ditches and drains to provide drainage at all times. Protect graded areas against action of elements prior to acceptance of work, and reestablish grade where settlement or erosion occurs.

K. Bench hillside slopes or fills to key the embankment. Remove and re-compact a minimum of 12 inches normal to the slope of the hillside or fill as the embankment or fill is brought up in layers.

L. Spread stockpiled topsoil on areas to be reclaimed prior to re-seeding.

M. Remove surplus backfill materials from site in accordance with Technical Specification 31 22 13 – Rough Grading.

N. Leave fill material stockpile areas free of excess fill materials.

3.5 BACKFILLING OF TRENCHES

A. Place material in pipe trenches to lines and grades indicated on Drawings or as directed by Engineer.

B. Do not place material when either the material or the surface upon which it is to be placed upon are frozen.

C. When using select material for pipe bedding, place bedding material below bottom of pipe before pipe is laid. Grade bedding material parallel to bottom of pipe.

D. When using select material for pipe embedment:

1. Exercise care not to damage pipe or appurtenances when placing embedment material.

2. Ensure material is placed to equal height on both sides of pipe to avoid unequal loading and possible lateral displacement of the pipe. Elevation difference of embedment between each side of pipe shall not exceed 6 inches.
3. Place material in uniform layers.
4. Work material into pipe haunches to prevent voids and achieve specified compaction under the haunches.

E. When using soil cement slurry: See Technical Specification 31 23 25 – Soil Cement Slurry.

F. If pipe laying operations are interrupted for more than 24 hours, cover pipe laid in the trench with backfill.

G. When the bottom of the trench is rocky, the trench shall be overexcavated and backfilled by 4 inches prior to placing the bedding layer, as directed by the Engineer. Backfill of this overexcavation shall comply with the requirements for overexcavation backfill provided in these Technical Specifications.

H. When using crushed rock or gravel for embedment on stretches longer than 300 feet, install trench plugs composed on silty, non-plastic material at 300 ft intervals to prevent piping of trench water through the embedment.

3.6 COMPACTION

A. Do not place and compact soil under the following conditions:
1. Ambient air temperature below freezing
2. Rain that creates puddles in clayey or silty materials
3. Ice or snow pockets visible in material being placed.

B. Surface Preparation:
1. Prepare surface so that first compacted lift will be placed on firm, stable base. Compact surface to specified percent compaction, if necessary.
2. For water-retaining compacted fill, scarify and moisten surface to provide satisfactory bonding surface before placing first layer of material to be compacted.
3. Do not place material to be compacted on frozen surface.

C. Compact material in trenches in layers having approximately the same top elevation on both sides of the pipeline to avoid unequal loading and displacement of the pipe.

D. Placement:
1. Place soil to be compacted in horizontal layers.
2. Blend materials as needed to ensure compacted fill is homogenous and free from lenses, pockets, streaks, voids, laminations and other imperfections.

E. Compaction Procedures:
1. Silty or Clayey Material:

a. Compact with mechanical impact tampers, tamping rollers, vibrating pad foot rollers, rubber tire rollers or other suitable compaction equipment.

b. Uniformly distribute equipment passes.

c. Compact in horizontal layers to compacted thickness of 6 inches or less.

2. Cohesionless Free-Draining Material: Compact in horizontal layers to maximum compacted thickness of:

a. Tampers and rollers: 6 inches

b. Crawler-type tractors, vibrating drum rollers, surface vibrators or similar equipment: 12 inches

c. Saturation and internal vibration: Penetrating depth of vibrator.

3. When compacting pipe embedment material, exercise care not to damage the pipe or appurtenances with compaction equipment. Do not apply compaction equipment directly above the pipe.

4. Demonstration: Lift thicknesses may vary depending on equipment and methods. Field adjustments to the specified lift thicknesses may be allowed or required. Contractor shall demonstrate that proposed equipment and methods will meet required compaction for the proposed lift thickness.

5. Flooding and jetting is not allowed unless specifically approved by the Engineer.

F. Moisture Content:

1. Optimum moisture content for each soil type, whether native soil or imported material, shall be determined by the Standard Proctor method, ASTM D 698.

2. Moisture content during compaction shall be no more than 2 percentage points wet or dry of optimum moisture content.

3. Moisten or aerate material, as necessary, to provide specified moisture content. Add water to soil in increments that will permit moisture content to be uniform and homogenous through each layer after mixing.

4. Add no more than 2 percent water to fill by sprinkling just prior to compaction when fill is clayey and contains dry clods of clay.

a. If clayey soil is more than 2 percent below optimum moisture, pre-conditioning and curing may be required to obtain uniform and homogenous distribution of moisture in clods.

b. Use of disks, harrows or rakes may be required to blend moisture prior to placement and compaction.

5. For cohesionless soils, add water as necessary during compaction, as these soils are free-draining.

G. Minimum Percent Compaction:

1. Over-excavation – Backfill of overexcavation to specified or directed lines shall be compacted to same percent compaction as embedment material or undisturbed foundation material, whichever is greater. If the in-place compaction of the

undisturbed foundation material is greater than 95%, the overexcavation backfill may be compacted to 95%.

2. Embedment – Compact pipe embedment material to percent compaction as indicated on Drawings for given soil classification, pipe wall thickness diameter ratio (DR) and depth of cover. For trenches within driving surfaces of roads, driveways or parking areas (both paved and unpaved), compact to 95%.

3. Initial and Final Backfill – For trenches within the driving surfaces or prisms of roads, driveways or parking areas (both paved and unpaved), within wash or gas line crossings, and where specifically noted on drawings, compact to 95%. For trenches in other areas not referenced above, compaction of the backfill is not required, provided soil is mounded above the trench.

4. Embankments – Compact to same requirements as Final Backfill.

5. Under buildings, tanks, slabs and other structures – Compact in accordance with Geotechnical reports provided in Exhibit A.

6. Tank sites and pump station site – Compact all driving surfaces and fill slopes to 95%.

7. Note that all Percent Compaction values in these Technical Specifications and Drawings are based on Standard Proctor, ASTM D698.

H. Soil Cement Slurry may be used in trenches, at Contractor's option and expense, to replace bedding, embedment or backfill materials where it is not practical to reach minimum compaction requirements using select material.

1. If soil cement slurry is to be used in lieu of embedment material, soil cement slurry shall also replace the bedding material. Do not use soil cement slurry for embedment on top of select material bedding.

3.7 TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling within Building Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of Backfilling under Paved Areas: Plus or minus 1 inch from required elevations.

D. Percent Compaction: Shall meet minimum required compaction as set forth in these Technical Specifications

E. Moisture Content: As set forth in these Technical Specifications.

3.8 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, Adjusting, and Balancing.

B. Classification of materials to determine adequacy for use as fill or backfill shall be performed in accordance with ASTM D2487 and designated based on the Unified Soil Classification System described therein.

C. Measurement of optimum moisture content and maximum dry density for each type of material to be compacted shall be determined using the Standard Proctor method, ASTM D698.

1. All references to "optimum moisture content" or "percent compaction" in these Technical Specifications and on the Drawings are based on Standard Proctor, ASTM D698.

2. While it may not be necessary to perform a separate Proctor test for every single compaction test location, it is necessary to perform this test for every type of material to be field tested. All material tested for compaction must correspond to a representative Proctor test.

3. Exhibit A to the Contract Documents contains the geotechnical report which includes in-situ soil moisture measurements and Standard Proctor test results (including optimal moisture content) from test holes at various locations along the pipeline. Contractor is advised that test holes reveal information about only a very small area, and sub-surface conditions between the test holes may vary. Contractor is wholly responsible for any assumptions made about sub-surface conditions between the test holes. Moreover, in-situ moisture content varies with time, and the Owner makes no representation that the in-situ moisture at the time the measurements were taken will be the same at the time of construction.

   a. Contractor shall perform Proctor tests on actual fill material (whether native or imported) and shall base determination of optimum moisture content and maximum density for compaction on the Contractor's own tests.

4. Proctor tests upon which the Contractor bases determination of optimum moisture content and maximum density for calculation of percent compaction are subject to approval by the Engineer. The Engineer may require additional tests to ensure that Proctor tests are representative of the actual fill material being compacted.

D. Field moisture content shall be measured by one or more of the following methods, as determined by the Engineer:

1. ASTM D2216 (USBR EM 5300)

2. ASTM D6938 (USBR EM 7230), provided that corrections can be made of gage error for the specific soils tested. The moisture content of the total material may require adjustment for the control fraction in accordance with ASTM D4718 (USBR EM 7230, Method C).

3. ASTM D4959 or ASTM D4643 (USBR EM 5315), provided that the results have been correlated to ASTM D 2216 (USBR EM 5300) for the specific soil tested.

4. For silty or clayey soils containing more than 5% gravel: Results of water content corrected for oversized particle in accordance with ASTM D4718.

E. Unit weight of in-place compacted material shall be measured as follows:

1. Haunch area of pipe – By Drive Cylinder (ASTM D2937) or by Sand Cone (ASTM D1556 or USBR EM 7205), or as directed by the Engineer

2. Springline of pipe – By Sand Cone (ASTM D1556 or USBR EM 7205), or as directed by the Engineer
3. For cohesionless soils – By Sleeve Method (ASTM D4564 or USBR EM 7215), or as directed by the Engineer
4. Initial trench backfill – By Sand Cone (ASTM D1556 or USBR EM 7205) or by Nuclear Methods (ASTM D6938), as directed by the Engineer. Note that selection of density test will depend in part on distance from the pipe and potential for pipe interference with nuclear density measurements.
5. Final trench backfill – By Sand Cone (ASTM D1556 or USBR EM 7205) or by Nuclear Methods (ASTM D6938), as directed by the Engineer. Note that selection of density test will depend in part on distance from the pipe and potential for pipe interference with nuclear density measurements.
6. Fill outside of trenches, including embankments, structural fill and driving surfaces – By Nuclear Methods (ASTM D6938).
7. For silty or clayey soils containing more than 5% gravel: Results of unit weight corrected for oversized particle in accordance with ASTM D4718.

F. Percent compaction shall be determined by one of the following methods:

1. Comparison of in-place density of compacted material with maximum dry density of similar soil, as determined by Standard Proctor, ASTM D698.
2. Rapid Method: ASTM D5080 (USBR EM 7240)

G. Compaction testing frequency:

1. Minimum testing intervals shall be as follows:
   a. One test per compaction crew per day
   b. One test pit per 1000 LF of pipeline
   c. One test per 500 CY of structural fill or one test per lift, whichever results in greater testing frequency
2. Greater testing frequency is typically required at the beginning of new work, new personnel, new compaction methods or new equipment.
3. Additional tests may be required for areas suspected of having incomplete compaction or improper moisture content, or surfaces that may have become torn up subsequent to compaction efforts, at the direction of the Engineer.
4. Additional tests may be required for any reason at the discretion of the Engineer.

H. Contractor Support

1. At the direction of the Engineer, the Contractor shall provide inspection pits to check for voids under the haunches of the pipe and test pits to perform density and compaction testing at the springline and haunch areas of the pipe or against structure foundations.
   a. All test and inspection pits shall comply with all relevant OSHA safety requirements.

b. Contractor shall provide warning lights, flags and other safety devices as needed by testing personnel.

c. Upon completion of testing, Contractor shall backfill pits to original fill and backfill requirements.

2. When density is being measured by Sand Cone, Contractor shall cease construction activity in the immediate vicinity of testing.

3. The cost of all work associated with excavating, protecting and backfilling inspection and test pits, including implementation of safety requirements and time delays, shall be incidental to the unit price of the applicable pay item being tested, and shall be provided at no additional cost to the Owner.

4. Laboratory fees only shall be reimbursed to the Contractor from the Materials Testing Allowance bid item in accordance with Section 01 00 00 - Basic Requirements: Testing and Inspection Allowances. Other costs associated with testing, such as excavations, providing access, safety, time delays, transportation and other costs shall be considered incidental to the work.

3.9 CORRECTION OF SUB-STANDARD WORK

A. All fill and backfill represented by tests that fail to meet compaction, moisture content, soil classification or other specifications shall be uncovered as needed, replaced as needed, re-compacted and re-tested until all specifications are met, at no additional expense to the Owner.

1. Elevations, lines and grades of replaced material, as well as of pipe and other structures resting against such material, shall be re-surveyed at the direction of the Engineer, at Contractor's sole expense. Contractor shall correct elevations, lines and grades as needed, at Contractor's sole expense.

B. The cost of failed tests shall not be reimbursed by the Owner from the testing allowance.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 00 00 - Execution Requirements: Protecting Installed Construction.

B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 23 25

SOIL CEMENT SLURRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil cement slurry for:

a. Utility bedding.

b. Utility backfill.

B. Related Sections:

1. Section 31 23 17 - Trenching: Soil and aggregate backfill for utility trenches.

2. Section 31 23 23 - Backfill: Soil and aggregate backfill for structures.

3. Section 33 05 23.13 - Horizontal Directional Drilling.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Soil Cement Slurry:

1. Measurement: Volume measured in place to lines, grades, and dimensions shown on drawings or established by the Engineer.

2. Payment: Shall be considered incidental to the price of the items embedded in the slurry. No separate payment shall be made.

1.3 REFERENCES

A. ASTM International:

1. ASTM C33 - Standard Specification for Concrete Aggregates.

2. ASTM C40 - Organic Impurities in Fine Aggregates for Concrete.

3. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

4. ASTM C114 - Chemical Analysis of Hydraulic Cement.

5. ASTM C143/C143M - Slump of Hydraulic Cement Concrete.

6. ASTM C150 - Standard Specification for Portland Cement.

7. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

8. ASTM C403/C403M - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.

9. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

10. ASTM C595 - Blended Hydraulic Cements.

11. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
12. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
13. ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete In Place By Nuclear Methods.
14. ASTM C1602/C1602M - Mixing Water Used in the Production of Hydraulic Cement Concrete.
15. ASTM D558 - Standard Test Methods for Moisture-Density Relations of Soil-Cement Mixtures.
16. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
17. ASTM D6103 - Flow Consistency of Controlled Low Strength Material.

B. Bureau of Reclamation (USBR)

1. USBR Concrete Manual - Concrete Manual, Eight Edition, Revised Reprint, 1981.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Approval Data:

1. Method to prevent pipe flotation while placing Soil Cement Slurry.

C. Mix design for soil cement, to include proportions, gradation and compressive strength results at 7 days. Compressive strength testing shall be determined by testing three (3) 6-inch diameter by 12-inch high cylinders.

D. If native soils are to be used, Contractor shall provide a quality control plan to ensure proper mix proportions prior to placement. This quality control plan must be based on actual native soils to be used in the mix and past performance of soil cement slurries using similar native soils.

E. Should be required for developing mix proportions ahead of placement for soil types to be used. This plan should include prior experience with soil cement slurry using native soils.

1.5 DELIVERY, STORAGE AND HANDLING

A. Furnish batch ticket with each batch of slurry in accordance with ASTM C94. Deliver ticket to Resident Project Representative at jobsite prior to discharging material from the transport vehicle.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

A. Cementitious Materials Option:

1. Specified Portland cement plus 20 percent plus or minus 5 percent by weight specified pozzolan.

B. Portland Cement:

1. ASTM C150, Type II.
2. Meet equivalent alkalis requirements of ASTM C150 - Table 2.
3. Meet false-set requirements of ASTM C150 - Table 4.

C. Pozzolan:

1. ASTM C618, Class F, except:
   a. Sulfur trioxide, maximum: 4.0 percent.
   b. Loss on ignition, maximum: 2.5 percent.
   c. Test for effectiveness in controlling alkali-silica reaction under optional physical requirements in Table 2 of ASTM C618. Use low-alkali cement for test.
   d. Does not decrease sulfate resistance of concrete by use of pozzolan.
      1) Demonstration pozzolan will have an "R" factor less than 2.5.
      2) R = (C-5)/F
      3) C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C114.
      4) F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C114.

2.2 WATER

A. Water: ASTM C1602, including optional requirements of Table 2.

2.3 AGGREGATE

A. Aggregate: ASTM C33

1. Maximum particle size: 3/8 inch.

2.4 SOIL

A. Soil producing a color darker than the standard color when tested in accordance with ASTMC40: Not allowed.

B. Gradation:

1. Passing U.S. Standard N0. 200 sieve by weight, maximum: 20 percent.
2. Passing U.S. Standard No. 100 sieve by weight, maximum: 50 percent.

C. Select or process soil so that particles remain in suspension, i.e. no segregation occurs, when slurry is placed.

D. Plasticity: Non-plastic or low plasticity (P.I. less than 5).

E. Clay balls:

1. Maximum percent, by weight of soil: 10 percent.

2. Maximum size: 3/8 inch.

2.5 MIX

A. Contractor will design mix in accordance with USBR Concrete Manual.

B. Use specified cementitious materials option.

C. Typical cement content: 3 to 10 percent by dry weight of soil to obtain specified compressive strength. If native soil is used, adjust to meet compressive strength requirements.

D. Water content: Not to exceed that required to provide a mix that will flow and can be pumped.

E. 7-day compressive strength, ASTM D4832: Not less than 50 lb/in2 and not more than 150 lb/in2.

F. Consistency:

1. Spread, ASTM D6103: 8 to 9 inches.

2. Except, when stiffer mix required to prevent slurry from flowing down trenches on a steep slope:

a. Slump, ASTM C143: 8 to 10 inches.

2.6 SLURRY TEMPERATURE

A. Slurry temperature at time of placement: 50 degrees to 85 degrees F (10 to 30 degrees C).

PART 3 EXECUTION

3.1 BATCHING EQUIPMENT

A. Design and operation of mixers: Slurry, as discharged, is uniform in composition and consistency throughout each batch.

B. Equip truck mixer with dial or digital water meter accurate to within 1 percent of total mix water located between water supply and mixer.

C. Manufacture and deliver in accordance with ASTM C94.

1. In addition to the requirements of ASTM C94, use a water meter approved by the Resident Project Representative to measure and record mix water for each batch. Provide mix water information to Resident Project Representative.

3.2 PREPARATION

A. Place pipe on soil pads or other approved compressible material such as extruded polystyrene foam insulation.

3.3 PLACING

A. Do not place slurry during rain or on frozen ground.

B. Do not mix or place slurry when ambient temperature is below 40 degrees F. When ambient temperature is 35 degrees F or above, slurry may be placed when ambient temperature is rising with approval from Resident Project Representative.

C. Place slurry to lines, grade, and dimensions shown on drawings.

1. Initially, place slurry from one side of pipe. Where necessary, rod or vibrate slurry so that slurry flows under pipe and appears on other side.

2. Add slurry to both sides of pipe and rod or vibrate until slurry completely fills space between pipe and trench.

3. Ensure that soil cement slurry flows freely from one side of the pipe to the other.

4. Do not disturb trench or allow foreign material to become entrained in the slurry.

D. Do not allow the pipe to float or move.

1. The Engineer may limit the length of pipe that can be laid or embedded with soil cement slurry in advance of backfilling operations to prevent flotation, or may require the Contractor to place the soil cement slurry in layers to prevent flotation or movement.

2. Restrain pipe to prevent flotation or movement during and after placement of slurry.

3. Pipe that has floated or moved after surveying shall be re-surveyed at the direction of the Engineer to ensure compliance with specified lines and grades. Contractor shall correct lines and grades, and pipe shall be re-surveyed after such correction, as needed. All re-surveying shall be done at Contractors' sole expense.

4. Do not disturb pipe trench or allow foreign material to become mixed with slurry.

E. Do not place backfill material over slurry until slurry has reached initial set.

3.4 FIELD QUALITY ASSURANCE

A. The Contractor shall supply material samples to Resident Project Representative upon request for independent testing of compressive strength in accordance with ASTM D4832 or USBR Concrete Manual and spread in accordance with ASTM D6103.

3.5 PROTECTION

A. If backfill will not be placed over slurry within 8 hours after initial set, place 6-inch minimum cover of moist backfill over slurry. Maintain moisture in 6-inch soil cover until additional backfill is placed.

B. If ambient temperature is 50 degrees F or less, place 12-inch minimum additional cover of loose backfill over 6-inch moist backfill cover before end of workday. Do not allow soil cement slurry to freeze.

END OF SECTION

SECTION 31 35 27

CABLE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cable concrete mats.

B. Related Sections:

1. Section 31 22 13 - Rough Grading.
2. Section 03 30 00 Cast-In-Place Concrete.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Cable concrete mats:

1. Basis of Measurement: By square yard of cable concrete mat for horizontal surface only. Wastage will not be paid for. Area of turn-downs, where applicable are not included in quantities on Drawings and Bid Form and shall be considered incidental to the Contractor's price.
2. Basis of Payment: Includes cable concrete mat, geotextile, preparation of surface, compaction, placing of cable concrete mats, cable clamps, clips, anchors, lifting bar rental, mobilization and delivery.

B. Bid items for cable concrete mats or other specific erosion control features that appear on the Bid Form apply only to features designed and directed by the Engineer. They do not include preparation of the Storm Water Pollution Prevention Plan (SWPPP) or implementation of any Best Management Practices (BMPs) stipulated therein. Separate bid items are provided for preparation and implementation of the SWPPP. Contractor is wholly responsible to prepare and implement the SWPPP to the satisfaction of relevant governmental authorities for the prices given under the SWPPP bid items.

1.3 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Cable concrete materials.

1.4 QUALITY ASSURANCE

A. General:

1. Tests on concrete will be performed in accordance with all requirements of applicable ASTM standards for such tests, including but not limited to obtaining samples, temperature, slump, air entrainment, making and curing specimens, breaking concrete cylinders, and other as may be applicable.

2. The cost of all laboratory tests on cement, aggregates, and concrete, for the development of the mix design, will be borne by the Contractor. The laboratory must meet or exceed the requirements of ASTM C1077.

3. Test cylinders will be prepared one (1) test each day of placement for each mixture for the first 50 or less cubic yards and one (1) test for each additional 100 cubic yards of concrete.

B. Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as indicated above to ensure continued compliance with these specifications. Each set of test specimens will be a minimum of 5 cylinders.

2. Compression test specimens for concrete shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.

3. Compression tests shall be performed in accordance with ASTM C39. One test cylinder will be tested at 7 days, and 2 at 28 days. The remaining cylinders will be held to verify test results, if needed.

4. Compression testing will be paid for by the Owner.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, and as specified herein.

2. All concrete that fails to meet the ACI requirements and these specifications, is subject to removal and replacement at the cost of the Contractor.

3. Concrete delivered to the site that does not meet the requirements as herein specified may be rejected.

D. Visual Inspection:

1. A visual inspection of the mats shall be completed.

2. All mats shall be sound and free of defects that would interfere with the proper placing of the mats or impair the strength or performance of the construction.

3. Pin holes on the surface of the mats resulting from entrapped air in the wet cast procedure, surface cracks and any other incidental imperfections from the usual methods of manufacturing including surface chipping from handling the mats on the job site and in shipment and delivery, shall not be deemed grounds for rejection.

4. Cable concrete that does not meet the requirements as herein specified may be rejected.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete:

1. Minimum 28- day compressive strength: 4,000 psi.
2. Minimum density: 140 lbs/cf
3. Air entrainment- all concrete shall contain 5.5% +/- 1.5% entrained air of evenly dispersed air bubbles at the time of placement.
4. Concrete Materials: Refer to Technical Specification 03 30 00 – Cast-In-Place Concrete.
5. Blocks shall be 15.5” square at the base and 11.5” square at the top face (truncated pyramid shape), and have a height of 5.5”.
6. The blocks shall be spaced 0.5” at the base.
7. Weight: 52 lbs per square foot

B. Geotextile Fabric:

1. 8 oz. per square yard.
2. Needle punched non-woven geotextile fabric.
3. Shall be attached to the bottom of the articulated concrete mat during production.
4. An overlap of 2’ to 3’ shall be incorporated on three sides of the mat. The overlap shall provide an area for the adjoining mats to be placed upon and prevent undermining of the erosion control system.

C. Cables:

1. Cables shall be made of stainless steel aircraft cables of type 304, shall be 1 x 19 construction, with 3/16” diameter, and 4,700 lbs breaking strength.
2. Cables shall be integral (poured into) to the concrete block, and shall traverse through each block in both longitudinal and lateral directions of the mat system.

D. Clamps:

1. Stainless steel clamps shall be used to secure loops of adjoining cable concrete mats.
    a. The standard placement of clamps shall be placed on 4’ centers interlocking adjoining mats together.
    b. The clamps are required only in applications exceeding 10’ per section. In slope applications, greater than 2 to 1 where the mats are placed end to end, clips shall be placed on 4’ centers interlocking adjoining mats together.
2. Position cable clamps as close to the base of the concrete block by sliding cable clamp down to the adjacent loops before tightening securely.
3. Stainless steel Type 304 shall be used.

PART 3 EXECUTION

3.1 INSTALLATION

A. Placement shall be in accordance with Manufacturer's recommendations.

B. Do not place cable concrete mats over spongy subgrade surfaces.

C. Surface erosion control locations, dimensions, and quantities shown on Drawings are approximations only, and are subject to change based on finished grade. Final quantities, dimensions, and locations of cable concrete mats to be determined in field by Engineer after installation of pipeline and related facilities.

D. Prepared areas shall be graded to a smooth plane finish. Any roots, debris and stones must be removed and regarded. The mats shall be laid in such a manner to produce a smooth plane surface.

E. The gaps between each cable concrete mat shall not be greater than 1".

F. For at-grade installations, where approved by Engineer, the upstream and downstream edges of the mat system shall be keyed into the ground at a 45°angle for a length of 2 block rows on both the upstream and downstream edges, or as shown on Drawings.

G. For buried installations at wash crossings, the upstream edge shall be turned down vertically for 2 block rows, and the downstream edge shall be turned down vertically for 1 block row, or as shown on Drawings.

3.2 FIELD QUALITY CONTROL

A. Cracks exceeding 0.25 inches (0.635 cm) in width and/or 1.0 inch (2.54 cm) in depth, shall be deemed grounds for rejection.

B. Chipping resulting in a weight loss exceeding 10% of the average weight of the blocks shall be deemed grounds for rejection.

END OF SECTION

SECTION 31 37 00

RIPRAP AND ROCK LINING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Riprap placed loose.
2. Wire Caged Riprap.

B. Related Sections:

1. Section 31 22 13 - Rough Grading.
2. Section 31 23 23 - Backfill.
3. Section 31 23 17 - Trenching.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Check dams and riprap placed loose:

1. Basis of Measurement: By cubic yard of riprap volume, riprap only.
2. Basis of Payment: Includes preparation of surface, compaction, placing of riprap material.

B. Wire caged rip rap:

1. Riprap:
   a. Basis of Measurement: By cubic yard of riprap volume, riprap only.
   b. Basis of Payment: Includes preparation of surface, compaction, placing of riprap material.
2. Wire mesh, geotextile, tie wire, angle iron, and other appurtenances:
   a. Basis of Measurement: By square yard of riprap area encaged in completed installation. Wastage will not be paid for.
   b. Basis of Payment: Includes riprap, cutting and placement of wire mesh material both above and below the riprap, geotextile fabric, tie wires, and angle irons.

C. Bid items for riprap, rock check dams or other specific erosion control features that appear on the Bid Form apply only to features designed and directed by the Engineer. They do not include preparation of the Storm Water Pollution Prevention Plan (SWPPP) or implementation of any Best Management Practices (BMPs) stipulated therein. Separate bid items are provided for preparation and implementation of the SWPPP. Contractor is wholly responsible to prepare and implement the SWPPP to the satisfaction of relevant governmental authorities for the prices given under the SWPPP bid items.

1.3 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Gradation of rock.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with State of New Mexico Department of Transportation standard, if related to roadway construction or drainage.

C. Samples of riprap material shall be provided to the Engineer for inspection and approval for every 500 cubic yards of riprap delivered to the site.

D. Submit representative samples of riprap for testing using the Los Angeles Abrasion Test using ASTM-C131 and for Soundness Testing using ASTM C-88.

1. Loss of aggregate from abrasion test shall not exceed 40 percent. Sample results shall be provided to the Engineer for every 500 cubic yards of riprap delivered to the site.

2. Loss of aggregate for soundness test shall not exceed 15 percent. Sample results shall be provided to the Engineer for every 500 yards of riprap delivered to the site.

3. Riprap testing shall be covered under the testing allowance.

PART 2 PRODUCTS

2.1 MATERIALS

A. Furnish materials in accordance with State of New Mexico Department of Transportation standards, Section 602.

B. Riprap:

1. Shall comply with New Mexico Department of Transportation standards, Section 602.2

2. Irregular shaped rock:

a. Minimum size (as measured in the smallest dimension):

1) Class A Wire enclosed riprap:

a) At least 80% of the rock shall be a minimum of 4 inches measured in the smallest dimension. Remaining smaller rock shall not be smaller in any dimension than the smallest mesh openings.

2) Uncaged riprap and rock check dams:

a) 8” minimum rock dimension, measured in the smallest dimension.

b. Solid and nonfriable.

C. Wire mesh:

1. Non-raveling, uniform, hexagonal double-twisted galvanized wire mesh, with a diameter of at least 0.087", with 2½" x 3¼" mesh openings.

2. Shall comply with New Mexico Department of Transportation standards, Section 602.2.2.2

D. Selvedges:

1. Selvedge wire with a diameter of at least 0.150-inch.

2. Shall comply with New Mexico Department of Transportation standards, Section 602.2.2.2.3

E. Stakes:

1. 4"x4"x3/8" angle iron, per New Mexico Department of Transportation standard, Section 602.

2. Lengths per Drawings.

F. Tie Wire:

1. Soft tempered Class 3 zinc coated 0.120-inch diameter tie wire.

G. Geotextile Fabric:

1. Provide non-woven geotextile (filter fabric) Class 1, as per New Mexico Department of Transportation standards, Section 604.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Do not place riprap over frozen or spongy subgrade surfaces.

3.2 PLACEMENT

A. Riprap locations, dimensions, and quantities shown on Drawings are approximations only, and are subject to change based on finished grade. Final quantities, dimensions, and locations of riprap to be determined in field by Engineer after installation of pipeline and related facilities.

B. Filter fabric:

1. Place Class 1 non-woven geotextile (filter fabric) between the riprap and the supporting soil.

C. Installed Thickness: As shown on Drawings, or as directed in field by Engineer.

D. Wire enclosure: Where wire enclosure is to be used, enclose rock in wire mesh and anchor in place as indicated on Drawings.

E. Class A Riprap Placement

1. Shall comply with New Mexico Department of Transportation standards, Section 602
2. Enclose Class A riprap with wire mesh drawn tightly on all sides. The Contractor may connect wire mesh using approved fasteners or lacing wire. Weave adjacent edges at least once with double loops of lacing wire that is as strong and flexible as the mesh.
3. Provide continuous lacing as far as possible that passes through each mesh opening. Where splicing is necessary, overlap the lacing at least 12 inches.
4. Space galvanized wire ties connecting top and bottom mesh layers approximately 24 inches on centers. Anchor the ties to the bottom wire-fabric layer. Extend the ties through the rock layer and secure to the top wire-fabric layer. Anchor wire-enclosed riprap to slopes with steel stakes driven into the Embankment. Space stakes in accordance with the Contract.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSE AND GRAVEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate base course.
2. Clean gravel.

B. Related Sections:

1. Section 31 22 13 - Rough Grading: Preparation of site for base course.
2. Section 31 23 17 - Trenching: Compacted fill under base course.
3. Section 31 23 23 - Backfill: Compacted fill under base course.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Aggregate Base Course:

1. Basis of Measurement: By the square yard to depth indicated on Drawings.
2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing aggregate to the depths and at the locations indicated on the Drawings, and compacting.

B. Clean Gravel

1. Basis of Measurement: By the square yard to depth indicated on Drawings.
2. Basis of Payment: Includes supplying fill material, stockpiling, placing gravel to the depths and at the locations indicated on the Drawings, and compacting.

1.3 REFERENCES

A. New Mexico Department of Transportation (NMDOT) Standard Specifications for Highway and Bridge Construction.

B. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

C. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with NMDOT standards.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base Course:

1. Base course gradation shall have a percent passing sieve sizes as shown in TABLE 304, SECTION 304-BASE COURSE, New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction, latest edition.

B. Clean Gravel (Class I crushed stone):

1. Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements.

Sieve Size	Percentage Passing
3/4-inch	100
No. 4	30 – 50
No. 200	0 - 5

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

C. Subgrade surface shall be kept at all times in such manner that it will drain readily and effectively.

D. Mix aggregate material to provide a homogenous mixture of uniformly dispersed materials as placed in position for compacting.

3.3 AGGREGATE PLACEMENT

A. Spread aggregate over prepared substrate in layers that will permit the required density be obtained. Density requirements will be determined by AASHTO T-180.

B. Compact each layer of material full width with: (1) two passes of a 50 ton compression type roller, or (2) two passes of a vibratory roller having a minimum dynamic force of 40,000 pounds impact per vibration and a minimum frequency of 1,000 vibrations per minute, or (3) eight passes of a 10 ton compression-type roller, or (4) eight passes of a vibratory roller having a minimum dynamic force of 30,000 pounds impact per vibration and a minimum frequency of 1,000 vibrations per minute.

C. No displacement (pumping) of subgrade soils shall be visually observed when loaded by heavy equipment traffic.

D. Level and contour surfaces to elevations and gradients indicated.

E. Incorporate only suitable roadway excavation material into embankments. Compact material placed in all embankment layers and the material scarified in cut sections to a uniform density of not less than 95% Standard Proctor density.

F. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat Surface: 3/8 inch measured with 10-foot straight edge in any direction.

C. Maximum Variation from Thickness: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Field testing of density and moisture content of in-place material will be performed in accordance with Nuclear Method, ASTM D6938.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Tests: One test every 2,500 square feet or portion thereof, at locations directed by Engineer.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts.
4. Manual gates and related hardware.
5. Removal, relocation, salvage, and/or reconstruction of existing fence.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Fencing:

1. Basis of Measurement: By linear foot to fence height specified, based on specified post spacing.
2. Basis of Payment: Includes posts, rails, tension wire, fabric, gates, hardware, accessories, and attachments.

1.3 REFERENCES

A. ASTM International:

1. ASTM A121 - Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
6. ASTM A585 - Standard Specification for Aluminum-Coated Steel Barbed Wire.
7. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
8. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

9. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
10. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
11. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
12. ASTM F668 - Standard Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain Link Fence Fabric.
13. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
14. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
15. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
16. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
17. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Chain Link Fence Manufacturers Institute:

1. CLFMI - Product Manual.

1.4 SYSTEM DESCRIPTION

A. Fence Height: 8 feet nominal.

B. Line Post Spacing: At intervals not exceeding 10 feet.

C. Personnel Gates: 3 ft.

D. Vehicle Gates: 20 ft double-swing, consisting of two (2) 10 ft swinging sections.

1.5 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

C. Operation and Maintenance Data: Procedures for submittals.

1.7 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE AND HANDLING

A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place.

PART 2 PRODUCTS

2.1 MATERIALS

A. Framing Steel: ASTM F1083 Schedule 40 galvanized steel pipe, welded construction; coating conforming to ASTM F1043 Type A on pipe exterior and interior.

B. Fabric Wire Steel: ASTM A392 zinc coated wire fabric.

C. Barbed Wire: ASTM A121 galvanized steel or ASTM A585 aluminum coated steel; 12 gage thick wire, 3 strands, and 4-point 14 gage barbs at approximately 5 inches on-center.

D. Concrete: 3,000 psi concrete.

2.2 COMPONENTS

A. Line Posts: 2.38-inch diameter.

B. Corner and Terminal Posts: 2.88 inch.

C. Gate Posts: 4.0-inch diameter.

D. Horizontal Rail: 1.66-inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66-inch diameter for fittings and truss rod fabrication.

F. Fabric: 2-inch diamond-mesh interwoven wire, 9-gauge thick, top salvage twisted tight, bottom selvage knuckle end closed.

G. Tension Wire: 7 gauge thick steel, single strand, galvanized.

H. Tie Wire: Aluminum alloy steel wire.

2.3 ACCESSORIES

A. Caps: Cast steel, pressed steel, or malleable iron; galvanized, sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Extension Arms: Galvanized cast steel or pressed steel, to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.

D. Gate Hardware: Center gate stop and drop rod; two 180-degree gate hinges for each leaf.

2.4 GATES

A. General:

1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings or by Engineer in the field.

2. Factory-assembled gates.

3. Design gates for operation by one person.

B. Swing Gates:

1. Fabricate gates to permit 180-degree swing.

2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

3. Gate center stop: Mushroom type, galvanized cast iron, 1 3/8” slot, 4” long anchor

2.5 FINISHES

A. Components and Fabric: Galvanized to ASTM A123/A123M; ASTM A153/A153M for components; ASTM A392 for fabric; 2.0 oz/sq ft coating.

B. Hardware: Galvanized to ASTM A153/A153M, 2.0 oz/sq ft coating.

C. Accessories: Same finish as framing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Set intermediate, terminal, and gateposts plumb, in concrete footings with top of footing 1 inch above finish grade of base course and 1 inch below top of gravel. Slope top of concrete for water runoff.

C. Line Post Footing Depth below Finish Grade: ASTM F567.

D. Corner, Gate and Terminal Post Footing Depth below Finish Grade: ASTM F567.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gateposts.

F. Install top rail through line post tops and splice with 6-inch long rail sleeves.

G. Install center and bottom brace rail on corner gate leaves.

H. Place fabric on outside of posts and rails.

I. Do not stretch fabric until concrete foundation has cured 7 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 1 inch above finished base course grade.

L. Ensure final grade of gravel is 1 inch above bottom of fence material, leaving the fence fabric embedded 1 inch into the 2-inch thick gravel layer.

M. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

N. Attach fabric to end, corner, and gateposts with tension bars and tension bar clips.

O. Install bottom tension wire stretched taut between terminal posts.

P. Install support arms sloped outward and attach barbed wire; tension and secure, with barbed wire installed with lowest strand not less than 8 feet from ground level.

Q. Support gates from gateposts.

R. Install gate with fabric and barbed wire overhang to match fence. Install three hinges on each gate leaf.

S. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings, if double gates are called for on the Drawings.

1. Use mushroom-type gate center stop, set in concrete.

T. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

U. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.

V. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

W. Extend concrete footings 2 inches above grade, and trowel, forming crown to shed water.

X. Allow footings to cure minimum 7 days before installing fabric and other materials attached to posts.

3.2 REMOVING EXISTING FENCE

A. All existing fences to be removed shall be recorded photographically or by video prior to removal or modification, to document pre-existing condition.

B. Existing fences requiring removal and reconstruction shall be rebuilt to the same condition as the original fence or better.

C. The materials in existing fences to be removed and rebuilt shall be salvaged and incorporated in the rebuilt fences. Fence materials damaged beyond reuse during removal or handling must be replaced at no additional expense to the Owner.

D. The costs associated with the removal and rebuilding of existing fences at the original location is considered incidental to the construction of the utility. If the fence is relocated as instructed by the Engineer, a separate bid item will be included in the Bid Schedule.

E. Existing fence materials to be removed that will not be reused within the project shall be provided to the Owner at a location within the project area specified by the Owner. Contractor shall take reasonable care to avoid damage to removed materials, so that the Owner may reuse such materials at another location. Costs to transport and reinstall removed materials outside the project area shall be borne by the Owner.

F. Posts shall be firmly reset to the line shown on the Drawings, or as directed by the Engineer. The spacing of the posts and the material to be strung and secured to the posts is to be the same as the original fence.

G. New tie material or staples must be used to fasten the fence material to the posts.

3.3 ERECTION TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch.

C. Maximum Offset From Indicated Position: 1 inch.

D. Minimum distance from property line: 6 inches.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subsoil.
2. Placing topsoil.
3. Seeding, Hydroseeding, Seed Drilling.
4. Seed Protection, Mulching
5. Maintenance.

B. Related Sections:

1. Section 31 22 13 - Rough Grading: Rough grading of site.
2. Section 31 23 17 - Trenching: Rough grading over cut.
3. Section 31 23 23 - Backfill

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Grassed Areas:

1. Basis of Measurement: By linear foot of centerline within the disturbed area of pipeline right of way and temporary use area. Lump sum for each site within tank and pump station sites.
    a. Reseeding of additional temporary construction easement areas for pipe laydown or otherwise shall be considered incidental to the linear foot price.
2. Basis of Payment: Includes preparation of subsoil, topsoil, placing topsoil, seeding, watering and maintenance to specified time limit.

1.3 REFERENCES

A. Federal Specifications:

1. OF-241 - Fertilizers, Mixed, Commercial.
2. Farmington Field Office Bare Soil Reclamation Procedures, USBLM, January 2013.

B. ASTM International:

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

1.4 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

B. BIA - Jicarilla: Bureau of Indian Affairs – Jicarilla Agency

1.5 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, and other accessories.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Perform Work in accordance with applicable BIA-Jicarilla standards.

C. Seed mixtures must be certified. There shall be no primary or secondary noxious weeds in the seed mixtures.

D. Temporary Best Management Practices (BMPs) must be installed along areas where sediment is being transported out of the construction area. Fiber rolls (mulch socks) rip rap blankets, rip rap check dams, soil cement, soil berms, surface roughening, or other appropriate BMPs shall be used in these areas. Such BMPs shall be included in the Storm Water Pollution Prevention Plan (SWPPP) provided and implemented by the Contractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Product storage and handling requirements shall be as specified in applicable sections of these Specifications and in accordance with recommendations of the supplier.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.8 COORDINATION

A. Section 01 00 00 - Administrative Requirements: Requirements for coordination.

B. Do not commence seeding until all work that could require ground disturbance has been completed, tested, and approved.

C. Contractor shall coordinate seeding dates to coincide with the dates stipulated in any applicable BIA-Jicarilla re-vegetation requirements and stipulations.

1. Contractor shall indicate proposed re-seeding dates in project schedule, and shall notify the Engineer as early as possible of any deviations from this proposed seeding schedule.

D. Section 01 00 00 - Execution Requirements: Requirements for maintenance service.

E. The cover will be maintained by occasional mowing, spot spraying, reseeding weak areas, or by controlled burns. Maintain seeded areas for three months from Date of Substantial Completion. Maintenance shall include weekly watering.

F. After the first full season of growth (not the first year) the cover should be mowed or grazed to control annual weeds to encourage good growth. Timing of mowing should avoid nesting times of birds (indicated in Environmental Requirements, Appendix C).

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials in accordance with seed mixture provided in Appendix C.

B. In developing seed mixtures, the percentage of each included species should first be determined. This percentage, which should total 100, is then multiplied by the recommended seeding rate for the concerned species. This will give the required pounds PLS for that species in the mix.

2.2 SOIL MATERIALS

A. Topsoil: Excavated from site and free of weeds.

2.3 ACCESSORIES

A. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

B. Erosion Fabric: Jute matting, open weave.

C. Herbicide: If required, Owner and Engineer's approval must be obtained prior to use.

D. Stakes: Softwood lumber, chisel pointed.

E. String: Inorganic fiber.

F. Mulch: Shal not be used.

PART 3 EXECUTION

3.1 GENERAL

A. Seed and reclaim all disturbed areas, including temporary construction easements and any areas disturbed by construction traffic.

B. Temporary fence gates along the pipeline alignment must be kept closed to manage the livestock in the pipeline area.

3.2 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.

3.3 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas. The heel of a boot should not sink in more than ½ to 1 inch.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Topsoil removed from the right-of-way must not be mixed with sagebrush debris which may impede seed germination during the revegetation process.

D. In areas needing reseeding, the top layer of soil shall be softened by ripping and disking prior to seeding to create the soil structure necessary to allow for seed germination.

E. Scarify subsoil to depth of 6 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.4 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 6 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.5 SEEDING

A. Use seed mixture indicated in Appendix C.

B. Apply seed at rates specified by seed mix found in Appendix C.

C. Planting Season: See Article 1.8. of this Section.

D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

E. Seed placement rows on steep slopes should not be placed parallel to the down slope, but at angles to the down slope to prevent the formation of gullies and rills.

F. A seed drill followed by a drag packer shall be required unless specific exceptions are authorized in writing by the Engineer.

G. Some hand seeding may be needed along steep slopes where equipment is difficult to use.

H. Apply water with a fine spray immediately after each area has been seeded. Saturate to 4 inches of soil.

3.6 HYDROSEEDING

A. Hydroseeding shall only be allowed where it is physically unfeasible to seed drill.

B. Hydroseeding shall not be performed without prior written authorization by the Engineer.

C. Apply fertilizer and seeded slurry with hydraulic seeder at an approved rate evenly in one pass.

D. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

E. If hydroseeding is used, the specified rates of seed application shall be doubled.

3.7 SEED PROTECTION

A. Cover seeded slopes where grade is 3:1 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

1. All slopes around the perimeters of tank and pump station sites shall be covered with erosion fabric, regardless of grade.

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

F. Protection of seeded areas from traffic: Contractor shall take measures as required by the Owner, Engineer, and/or land controlling agencies to prevent traffic on re-seeded areas. Such measures may include warning signs, fence post barricades, earthen berms, and/or other measures at intersections of seeded ROW and existing roadways and driveways, and at other locations as directed by Engineer. Earthen berms shall extend the full width of the disturbed area, with dimensions as directed in field by Engineer.

G. All seed protection measures, including traffic prevention, shall be subject to approval of BLM and other land-controlling agencies.

3.8 MULCHING

A. Do not apply mulch.

3.9 MAINTENANCE

A. Immediately reseed areas showing bare spots.

B. Repair washouts or gullies.

C. Protect seeded areas with warning signs during maintenance period.

3.10 SCHEDULE

A. All utility routes, disturbed areas, vault areas, and non-traveled areas in road rights-of-way to be reseeded when Work is completed in affected areas.

END OF SECTION

SECTION 33 05 23.13

HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation for approach trenches and pits.
2. Horizontal directional drilling.
3. Pipe.

B. Related Sections:

1. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
2. Section 03 60 00 - Grout.
3. Section 31 23 17 - Trenching.
4. Section 31 23 23 - Backfill.
5. Section 33 11 13- Public Water Transmission Systems.
6. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Horizontal Directional Drilling:

1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes excavation, drilling, HDD transition couplings if needed, HDD accessories, tests, and backfill.
   a. Should the pipe manufacturer require a change in pipe pressure class/rating and/or dimension ratio to complete HDD water main installations, the cost difference to provide and install by HDD the necessary pipe material will be incidental to the bid price for this item.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).

3. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
4. ASTM D2152 - Test Method for Degree of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
5. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
9. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
10. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings.

C. American Water Works Association (AWWA):

1. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
2. AWWA M23 – PVC Pipe – Design and Installation

D. NSF International Standard / American National Standard (ANSI)

1. NSF/ANSI 61 – Drinking Water System Components – Health Effects

E. Underground Solutions

1. OB-8-273 – Recommended Cutting Procedure for Fusible PVC Pipe
2. OB-8-274 – Recommended Cold Weather Fusion Procedures for Fusible PVC Pipe
3. OB-8-275 – Recommended Intermediate Fusion Procedures for Fusible PVC Pipe
4. Operational Quick Cards
5. Operational Procedural Documents

F. National Utility Contractors Association:

1. NUCA - HDD Installation Guidelines.

1.4 DESIGN REQUIREMENTS

A. Design Criteria:

1. Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.

2. Directional Change Capability: 90 degree with 275-ft radius for 12-inch PVC, or minimum bending radius specified by manufacturer of the carrier pipe or drilling steel whichever is greater.

3. Ratio of Reaming Diameter to Pipe Outside Diameter:

   a. Nominal pipe diameter larger than 6 Inches: 1.5 maximum, submit recommended ratio and reaming procedures for review.

1.5 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Submit technical data for equipment, method of installation, proposed horizontal and vertical alignment and beginning and end points (if different than those shown on the plans), and proposed sequence of construction, including project schedule.

2. Include information pertaining to pits, dewatering, method of spoils removal, equipment size and capacity, equipment capabilities including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade and detection of surface movement, name plate data for drilling equipment and mobile spoils removal unit, design requirements per Section 1.4 of this technical specification.

C. Installer Qualifications: Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel and references for work completed.

D. Manufacturer’s technical data showing complete information on material composition, physical properties and dimensions of the new pipe and fittings. Manufacturer’s recommendations for transport, handling, and storage of pipe and fittings shall be included.

E. Submit necessary occupancy permit for installations along or under public throughways and lands, and railroad right of way, if not already obtained by the Engineer.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Contingency plans for the following potential conditions:

1. Unforeseen subsurface conditions.

2. Damage to other existing utilities.

3. Soil heaving or settlement.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of casing or tunnel liner, carrier pipe, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Record actual depth of pipe at 25 feet intervals.

E. Record actual horizontal location of installed pipe.

F. Show depth and location of abandoned bores.

G. Record depth and location of drill bits and drill stems not removed from bore.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with the following:

1. Applicable New Mexico state standards
2. NUCA HDD Installation Guidelines.
3. ASTM F1962.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

B. The Contractor must be certified by the HDD system manufacturer as a fully trained user of the HDD system. Operation of the HDD system shall be performed by trained personnel. Such training shall be conducted by a qualified representative of the HDD system manufacturer.

C. Fusible PVC pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment. Personnel directly involved with installing the new pipe shall receive training in the proper methods for joining the pipe. Such training shall be conducted by a qualified representative of the fusion equipment manufacturer. Installation of other materials shall be performed by personnel qualified by the specific product manufacturer.

D. HDD contractor shall have at least 5-years experience and have installed at least 5,000 LF within the state of New Mexico.

E. HDD contractor must have experience installing fusible PVC pipe of similar diameter to that of the proposed project.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 00 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. The Contractor shall transport, handle, and store pipe and fittings as recommended by the manufacturer.

C. New pipe and fittings that are damaged before or during installation shall be repaired or replaced, as recommended by the manufacturer or required by the Engineer. The costs of such repair or replacement shall be borne by the Contractor and be accomplished prior to proceeding with the project.

D. The Contractor shall deliver, store and handle other materials as required to prevent damage. Materials that are damaged or lost shall be repaired or replaced by the Contractor at no additional expense to the Owner.

E. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

F. Protect piping system pieces from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

G. Accept products on site in manufacturer's original containers or configuration. Inspect for damage.

H. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.

I. Support pipes with nylon slings during handling.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Section 01 00 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

C. The Contractor shall comply with all other Federal, State, and local environmental requirements including, but not limited to, storm water runoff, construction dewatering, disposal of drilling fluid, and hazardous waste management and disposal.

1.12 COORDINATION

A. Section 01 00 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with the New Mexico Department of Transportation (NMDOT), local Municipal Public Works Department (if applicable), and utilities within construction area.

PART 2 PRODUCTS

2.1 DRILLING FLUID

A. Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

2.2 CARRIER PIPE

A. Furnish materials in accordance with New Mexico state standards.

B. Fusible polyvinylchloride pipe

1. Fusible polyvinylchloride (FPVC) plastic material for pipe shall conform to AWWA C900 and ASTM D1784 cell classification 12454. Pipe sizes shall conform to AWWA C900 for CIOD pipe or ASTM D2241 for IPS pipe. Pressure class/rating and dimension ratio shall be as recommended by the pipe manufacturer for HDD water main applications.

2. Refer to Specification 33 11 13.

2.3 FILL MATERIALS

A. Excavated and reused soil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.4 WATER SOURCE

A. Water: Potable, obtained from utility source.

2.5 UNDERGROUND PIPE MARKERS

A. Tracer Wire: Magnetic detectable conductor insulated with high density polyethylene (HDPE) or UF- XHHW in accordance with physical and electrical properties per ASTM D-1248.

1. Tracer wire shall be rated for “Direct Burial”, 30 volts, and be appropriate for installation in Horizontal Directional Drill (HDD) applications,

2. Tracer wire shall be constructed of copper clad hard drawn extra high strength (EHS) tracer wire with a steel core or engineer approved equal, and

3. Tracer wire must be appropriately sized and installed to be compatible with the pullback rating of the equipment being used.

B. Splice Connectors: Model LV 9500 Blazing Snap-locking waterproof connectors pre-filled with silicone or engineer approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Locate, identify, and protect utilities indicated to remain from damage.

C. Identify required lines, levels, contours, and datum locations.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 DEWATERING

A. Intercept and divert surface drainage, precipitation, and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.

B. Develop and maintain substantially dry subgrade during drilling and pipe installation.

C. Comply with New Mexico state standards and requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.4 EXISTING WORK

A. Maintain access to existing community facilities and homes as well as other remaining active installations requiring access. Modify installation as necessary to maintain access.

3.5 EXCAVATION

A. Excavate approach trenches and pits in accordance with shop drawings and as site conditions require. Minimize number of access pits.

B. Provide sump areas to contain drilling fluids.

C. Install excavation supports as specified in Section 31 23 17.

D. Restore areas after completion of drilling and carrier pipe installation.

3.6 DRILLING

A. Drill pilot bore with vertical and horizontal alignment as indicated on Drawings.

B. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.

1. Monitor depth, pitch, and position.

2. Adjust drill head orientation to maintain correct alignment.

C. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.

D. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.

1. Provide relief holes when required to relieve excess pressure.

2. Minimize heaving during pullback.

E. Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence of Engineer before proceeding with other drilling. Excavate minimum of four test pits spaced along first 50 feet bore to verify required accuracy. When required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.

F. After completing pilot bore, remove drill bit.

G. Minimum Reamer Size: 18inch for 12-inch pipe.

H. HDD Machine shall be at least 60,000 pound machine.

3.7 DRILLING OBSTRUCTIONS

A. When obstructions are encountered during drilling, notify Engineer immediately. Do not proceed around obstruction without Engineer's approval.

B. For conditions requiring more than 12 inches deviation in horizontal or vertical alignment, notify Engineer immediately. Do not proceed around obstruction without Engineer's approval.

C. Maintain adjusted bore alignment within easement or right-of-way.

3.8 PIPE INSTALLATION

A. After completing pilot bore, remove drill bit. Install reamer and pipe pulling head.

1. Select reamer with minimum bore diameter required for pipe installation.

B. Attach pipe to pipe pulling head. Pull reamer and pipe to entry pit along pilot bore.

C. Inject drilling fluid through reamer to stabilize bore and lubricate pipe.

D. Install piping with horizontal and vertical alignment as shown on Drawings.

E. Protect and support pipe being pulled into bore so pipe moves freely and is not damaged during installation.

F. Do not exceed pipe manufacturer’s recommended maximum pullback forces.

G. Do not exceed pipe manufacturer’s recommended minimum bending radius.

H. Install trace wire continuous with each bore. Splice trace wire only at intermediate bore pits. Tape or insulate trace wire to prevent corrosion and maintain integrity of pipe detection.

1. Terminate trace wire for each pipe run at structures along pipe system.

2. Provide extra length of trace wire at each structure, so trace wire can be pulled 3 feet out top of structure for connection to detection equipment.

3. Test trace wire for continuity for each bore before acceptance.

I. Provide sufficient length of carrier pipe to extend past termination point to allow connection to other pipe sections.

J. Allow minimum of 24 hours for stabilization after installing pipe before making connections to pipe.

K. Mark location and depth of bore with spray paint on paved surfaces, and wooden stakes on non-paved surfaces at 25-foot intervals.

3.9 FPVC FUSION PROCESS

A. Refer to Section 33 11 13.

3.10 SLURRY REMOVAL AND DISPOSAL

A. Contain excess drilling fluids at entry and exit points until recycled or removed from site. Provide recovery system to remove drilling spoils from access pits.

B. Remove, transport and legally dispose of drilling spoils.

1. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
2. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.

C. When drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.

D. Complete cleanup of drilling fluid at end of each workday.

3.11 DISINFECTION AND FLUSHING

A. Disinfection and flushing shall be conducted in accordance with Section 33 13 00.

3.12 PRESSURE AND LEAKAGE TESTING

A. Pressure and leakage testing shall be conducted in accordance with Section 33 11 13 as applicable. Pipe shall be pressure and leakage tested on surface, after pipe sections have been fused, but prior to pipe HDD installation.

3.13 BACKFILL

A. Install backfill as specified in Section 31 23 17 and 31 23 23.

B. Backfill approach trenches and pits with subsoil fill to contours and elevations of surrounding existing grade.

C. Compact subsoil fill as specified in Section 31 23 23 to minimum 95 percent of maximum density.

3.14 INSTALLATION TOLERANCES

A. Section 01 00 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Horizontal Position: 12 inches.

C. Maximum Variation From Vertical Elevation: 12 inches.

D. Minimum Horizontal and Vertical Clearance from Other Utilities: 24 inches, or per utility company requirements.

E. When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, re-bore, and reinstall pipe in correct alignment.

F. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

3.15 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Compaction Testing: As specified in Section 31 23 23.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.16 MANUFACTURER'S FIELD SERVICES

A. Section 01 00 00 - Quality Requirements: Requirements for manufacturer's field services.

B. Furnish field technical assistance during following periods of casing installation:

1. Unloading of casing materials and components.

2. Prior to commencing excavation and during excavation as requested.

C. Certify that equipment for drilling has been properly set-up and is ready for drilling.

3.17 CLEAN-UP

A. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.

B. Restore approach trenches and pits to original condition.

C. Remove temporary facilities for drilling operations in accordance with Section 01 00 00.

END OF SECTION

SECTION 33 11 13

PUBLIC WATER TRANSMISSION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for public line including potable water line.
2. Tapping Sleeves and Saddles.
3. Underground and Aboveground Pipe Markers.
4. Bedding and Cover Materials.
5. Source Quality Control and Assurance.

B. Related Sections:

1. Section 02 21 13 - Surveying.
2. Section 31 23 17 - Trenching: Execution requirements for trenching.
3. Section 31 23 23 - Backfill: Requirements for backfill to be placed.
4. Section 32 92 19 - Seeding.
5. Section 33 12 16 - Water Utility Valves.
6. Section 33 13 00 - Disinfection of Water Utility Transmission Systems.

1.2 DEFINITIONS

A. Throughout the Drawings and Specifications, the terms “jointed PVC pipe” and “bell-and-spigot PVC pipe” shall be used interchangeably.

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pipe and Fittings:

1. Basis of Measurement: By the linear foot.
2. Basis of Payment: Includes hand trimming, excavation, trenching, piping and fittings, all valves and appurtenances not listed separately on the Bid Form, bedding, backfill, compaction, tracer wire, detectable warning tape, above ground pipe marker posts, concrete thrust restraints (where applicable), mechanical joint restraints, connection to public utility water source (if not separately listed on Bid Form). Excavation requiring specialized equipment for rock removal, as defined in Section 31 23 18 - Rock Removal, will be paid for separately per Article 1.2 of same said Section 31 23 18. Backfill required to replace removed rock, whether imported or processed on-site to meet the project specifications, will be incidental to the cost of pipe installation. Similarly, soil cement, if used, shall be considered incidental to the cost of the pipe installation.
    a. Fusible PVC pipe, where required, shall be included in the same bid item and paid on the same basis as bell-and-spigot PVC pipe. All materials,

labor, and equipment required to fuse, install, and test fusible PVC pipe shall be included in this same pay item.

3. The actual laboratory cost of compaction, concrete, and destructive fusible PVC joint testing shall be reimbursed to the Contractor, upon submittal of invoices. Work performed by Contractor or Sub-Contractor related to such testing, or any other work performed by laboratory personnel outside of actual compaction, concrete, and PVC joint testing, shall be considered incidental and shall not be reimbursable from testing allowance. Work shall be coordinated and directed by Engineer. Contractor shall pay for all failed tests.

4. The cost of work associated with hydrostatic pressure testing for main pipeline (incl. wash crossings) shall be paid via a separate bid item. The cost of work associated with hydrostatic pressure testing for all other facilities (including site piping, control valve assemblies, tanks, etc.) for which a separate bid item is not provided shall be considered incidental to their respective bid items.

5. The cost of work associated with disinfection and bacteriological testing for main pipeline (incl. wash crossings) shall be paid via a separate bid item. The cost of Contractor's work associated with disinfection and bacteriological testing for all other facilities (including site piping, etc.) for which a separate bid item is not provided shall be considered incidental to their respective bid items.

    a. Laboratory costs associated with bacteriological testing shall be considered incidental and are not eligible for reimbursement under the testing allowance.

1.4 REFERENCES

A. Contractor shall refer to the latest revision of all standards listed herein.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

C. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

D. American Society for Testing and Materials International (ASTM):

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

4. ASTM A139 – Standard Specification for Electric Fusion (Arc) Welded Steel Pipe.

5. ASTM A283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

6. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
7. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
8. ASTM F594 – Standard Specification for Stainless Steel Nuts.
9. ASTM A1011 – Standard Specification for Steel, sheet and strip, Hot Rolled, Carbon, Structural, High Strength Low Allow, High Strength Low Alloy with Improved Formability, and Ultra High Strength.
10. ASTM A1018 – Standard Specification for Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Commercial, Drawing, Structural, High Strength Low Alloy, High Strength Low Allow with Improved Formability, and Ultra High Strength.
11. ASTM D653 - Terminology Relating to Soil, Rock, and Contained Fluids.
12. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
13. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
14. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
15. ASTM D2152 - Test Method for Degree of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion.
16. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
17. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
18. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
19. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test.
20. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
21. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate Zinc Rich Primers by Solvent Rub ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
22. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
23. ASTM E165 – Standard Practice for Liquid Penetrant Examination for General Industry.
24. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

25. ASTM F1057 - Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique

E. American Water Works Association (AWWA):

1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110/ ANSI A21.10 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (76 mm through 1,219 mm), for Water.
4. AWWA C111/ ANSI A21.11 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
7. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
8. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
9. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
10. AWWA C206 - Field Welding of Steel Water Pipe.
11. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In. (100 mm through 3,600 mm).
12. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
13. AWWA C209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
14. AWWA C210 – Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
15. AWWA C219 – Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe.
16. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances.
17. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
18. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1,500 mm).
19. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/2 In. through 3 In. (13 mm through 76 mm), for Water Service.
20. AWWA M11 – Steel Pipe: A Guide for Design and Installation.
21. AWWA M23 – PVC Pipe – Design and Installation.

F. NACE International (NACE)

1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
2. SP0274 – High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.

G. Manufacturer's Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

H. Society for Protective Coatings:

1. SSPC-SP5 White Metal Blast Cleaning.

I. National Fire Protection Agency

1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

J. NSF International Standard / American National Standard (ANSI)

1. NSF/ANSI 61 – Drinking Water System Components – Health Effects.

K. National Association of Pipe Fabricators

1. NAPF 500 – Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.

L. American Welding Society

1. AWS D1.1 – Structural Welding Code.

M. Underground Solutions

1. OB-8-273 – Recommended Cutting Procedure for Fusible PVC Pipe
2. OB-8-274 – Recommended Cold Weather Fusion Procedures for Fusible PVC Pipe
3. OB-8-275 – Recommended Intermediate Fusion Procedures for Fusible PVC Pipe
4. Operational Quick Cards
5. Operational Procedural Documents

1.5 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, and accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. In addition to the submittal requirements listed above, Contractor shall also submit:

1. Pipe restraint plan indicating all locations where restrained pipe joints, including all fusible PVC joints, will be used to comply with the Drawings and Specifications. The plan shall be in tabular form indicating beginning and ending station of every restrained section, as well as in graphic form with restrained sections indicated

graphically with written station numbers. Locations of any bell ends fabricated as part of the fusible PVC pipe shall be noted. Locations of all appurtenances, including air valves and flush valves, shall be noted on the graphic and tabular plans with corresponding station numbers. The pipe restraint plan must be submitted and approved by the Engineer before any submittals for pipe, fittings, restraints, or casing will be approved.

2. Shop drawings for any custom-fabricated steel fittings which clearly show compliance with AWWA M11, AWWA C207 and AWWA C208. Include design calculations, as applicable.

3. Submittal for all coatings which demonstrate compliance with relevant AWWA and NACE standards.

4. As-built drawings and any Contractor-provided survey data. Refer to Sections 01 00 00 – Basic Requirements and 02 21 13 - Surveying.

5. Shop drawings, with dimensions, of fusible PVC sweeps (if applicable).

1.6 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Refer to Sections 01 00 00 – Basic Requirements and 02 21 13 – Surveying.

1. All fusible PVC joint fusion documentation and fusion machine data logs shall be submitted to Engineer with project record documents, in addition to ongoing data log and analysis submittals during construction process.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Block individual and stockpiled pipe lengths to prevent moving.

C. Do not place pipe or pipe materials on private property without prior authorization, or in areas obstructing pedestrian or vehicular traffic.

D. Store PVC materials out of sunlight. Contractor shall, at Contractor’s expense, provide and maintain tarps, temporary shelters, or other such measures as necessary to protect PVC materials from sunlight. Such tarps or shelters must be adequately vented to prevent excess heat accumulation

1. Any PVC materials judged by the Engineer to be sun-damaged, including tan to brown discoloration, blistering, roughening or cracking of surface, or embrittlement, prior to installation shall be rejected.

E. Coated pipe shall be shipped on bunks and secured with nylon belt tie down straps or padded banding over braces, and shall be stored on padded skids or other suitable means to prevent damage to coating.

F. Coated pipe and other components shall be handled with wide belt slings, padded forks or other means to prevent damage to coating. Chains, cables or other equipment likely to damage coating or pipe shall not be used.

G. PVC pipe shall be bundled or stacked throughout the shipping, storage and handling process in accordance with AWWA M23 and pipe supplier's recommendations, whichever is most stringent. Excessive bundling or stacking that results in bends, kinks, gashes or uncorrectable ovality shall be rejected. Transport and handle pipe in accordance with AWWA M23 and pipe supplier's recommendations, whichever is most stringent. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

1. Any pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no fracture can be seen, shall be rejected.

2. Any pipe with a scratch or gouge greater than 10% of the wall thickness will be rejected.

H. Prior to shipment and again prior to installation, all materials shall be visually inspected for damage, including coatings and surfaces. Any damaged materials shall be repaired to original standards or replaced.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Polyvinyl Chloride (PVC):

1. All PVC pipe, whether jointed or fusible, shall conform to AWWA C900, on all PVC pipe 4" diameter and greater, and ASTM D1785, Schedule 80, on all PVC pipe less than 4" diameter. Testing shall be in accordance with the referenced AWWA standard for all pipe types.

2. All piping shall be made from PVC compound conforming to cell classification 12454 per ASTM D1784.

3. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

4. Pipe shall be blue in color for potable water use.

5. Nominal laying length:

a. Jointed PVC pipe: 20 feet.

b. Fusible PVC pipe: 40 feet, or custom lengths as required on Drawings.

6. Gasketed Joints:

a. Joints per ASTM D3139.

b. Use rubber gaskets manufactured and tested in accordance with ASTM F477.

c. For all PVC pipe at petroleum line crossings or where otherwise indicated on Drawings, use petroleum-resistant gaskets within 200-ft radius of petroleum line in accordance with ASTM F477 or fusible PVC pipe joints, per drawings.

7. Fusible PVC Pipe:

a. Manufacturers:

1) Underground Solutions, Inc.

2) Substitutions: Not allowed.

b. Fusible polyvinylchloride pipe shall be extruded with plain ends. The fused ends shall be square to the pipe and free of any bevel or chamfer. Bell ends with gaskets, if required, shall be extruded with the pipe.

1) Any bell ends shall be noted on the Contractor's pipe restraint submittal for Engineer's approval prior to extrusion.

8. Fittings:

a. Ductile iron on all PVC pipe 4" diameter and greater.

1) Refer to specifications for ductile iron fittings in this section, below.

b. All PVC pipe and fittings less than 4" diameter shall be solvent welded Schedule 80.

c. Solvent-weld joints are not permitted on pipe 4" diameter and greater.

9. Mechanical Joint Restraints:

a. Refer to specifications for ductile iron joint restraints in this section, below.

10. Fusible PVC Sweeps:

a. Fusible PVC sweep may be used in lieu of DI MJ Fittings at the Contractor's expense.

b. Fusible polyvinyl chloride sweeps shall conform to the same sizing convention, diameter, dimensional tolerances and pressure class of the pipe being joined using the sweep or bend.

c. Fusible polyvinyl chloride sweeps shall be manufactured from the same fusible polyvinyl chloride pipe being used for the installation, and shall have at least 2 feet of straight section on either end of the sweep or bend to allow for fusion of the sweep to the pipe installation. There shall be no gasketed connections utilized with a fusible polyvinyl chloride sweep.

d. Standard fusible polyvinyl chloride sweep angles shall not be greater than 22.5 degrees.

11. Mechanical bell harnesses shall not be allowed. All PVC pipe joint restraints shall be provided using fusible PVC pipe.

12. Substitutions: Contractor has option of using Fusible PVC where Bell and Spigot PVC is specified at the Contractor's expense. Fusible PVC is considered a restrained pipe system.

B. Ductile Iron Pipe, Joints, and Fittings:

1. Manufacturers:

   a. US Pipe

   b. American Pipe

   c. Substitutions: Approved Equal

2. Ductile iron pipe:

   a. Ductile iron pipe is to be used at altitude valve vault and at tank site drain outfalls specifically identified as ductile iron on the drawings. Do not use ductile iron pipe at any other location without Engineer's prior written approval.

   b. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover.

   c. 350 psi working pressure.

   d. Cement Mortar Lining: AWWA C104, standard thickness.

   e. Exterior coating:

      1) Buried service (site piping only, excluding chlorination building if applicable)): Bituminous coating, per AWWA C151.

      2) Inside and underneath chlorination building: TNEMEC N140 Pota-Pox Plus, rated for use in corrosive environments.

   f. Encasement: Encase in polyethylene jacket as described in this section.

3. Fittings: Ductile iron.

   a. Compact MJ fittings conforming to AWWA C153 or AWWA C110, unless otherwise noted on Drawings.

   b. Flanged fittings shall conform to AWWA C110. Do not use flanged fittings for buried installations unless otherwise noted on Drawings.

      1) Contractor responsible to ensure that all mating flanges have compatible diameters, bolt sizes and drill patterns. Overdrill bolt holes as necessary, provided such overdrilling is within manufacturer's recommended tolerances.

   c. Pressure rating of MJ joints, fittings and gaskets shall be at least 350 psi.

   d. Pressure rating of flanged fittings and gaskets shall at least match that of the attached pipe.

   e. Marked with pressure rating, nominal diameter of opening, manufacturers' identification, country where cast, and degree of bend.

f. Coatings:

1) Exterior: Bituminous Coating: AWWA C110.

2) Interior: Cement Mortar Lining: AWWA C104, standard thickness.

3) Inside and underneath chlorination building (if applicable):

a) Exterior coating: 2-part polyamide epoxy, rated for use in corrosive environments.

b) Interior: Cement Mortar Lining: AWWA C104, standard thickness.

g. Encasement: Encase in polyethylene jackets as described in this section.

4. Joints:

a. Mechanical and Push-On Joints: AWWA C111. Only use where expressly allowed on the Drawings. No DI pipe joints shall be allowed underneath or within 5 feet of any structure.

1) All push-on joints shall be fully restrained

2) TR Flex restrained pipe joints

3) TR Flex lockers shall be ductile iron. Redwood or other materials shall not be allowed.

b. Flanged Joints: AWWA C115; ASME B16.1.

5. Mechanical Joint Restraints:

a. Mechanical joint restraints for all fittings and appurtenances, unless otherwise noted on Drawings.

b. Mechanical joint restraints shall be “EBAA Iron, Megalug®” Series 2000PV and 2200, Romac Romagrip, Smith-Blair Cam-Lock, or approved equal, for all pipe 4” diameter and greater.

c. Wedge assemblies and glands shall be fusion bonded epoxy coating in accordance with AWWA C116 or Mega-Bond coated, interior and exterior.

d. Stainless steel 304 bolts, nuts and washers for all buried applications, provided by manufacturer especially for use with their respective components. If fitting manufacturer cannot supply stainless steel bolts contractor may provide bolts from another source; however, contractor is solely responsible to ensure fit and compatibility of said bolts.

6. Jackets:

a. AWWA C105 polyethylene jacket, Installation Method “A”.

b. Double-wrap all ductile iron components.

c. Inner PE jacket shall be V-Bio enhanced, minimum thickness: 8 mil.

d. Outer PE jacket shall be standard polyethylene, minimum thickness: 8 mil.

e. Secure PE jackets with ultra-high molecular weight (UHMW) polyethylene film tape, 10 mil thickness.

1) Do not use duct tape to tape the PE jackets.

C. Steel Pipe and Fittings:

1. Pipe fabrication:

a. For pipe 26" diameter and greater, fabricate arc-welded spiral seam steel pipe: ASTM A139, Grade B, C, D or E. For pipe 26" diameter or less, fabricate pipe per ASTM A-53 B.

b. Fabricated in accordance with AWWA C200, except:

1) Steel plate: ASTM A283, Grade C or D, or ASTM A36.

2) Steel sheet: ASTM A1011, Designation SS, Grade 40, 45 or 50; or ASTM A1018, Designation SS, Grade 40.

3) Standard wall thickness, unless otherwise indicated on Drawings.

2. Fittings and Special Sections:

a. Steel for fittings: ASTM A283, Grade C or D, or ASTM A36 for carbon steel.

b. Welding: Per AWS D1.1. All welding must be completed prior to application of lining and coatings, unless otherwise permitted by the Engineer. In no case shall any welding damage lining or coatings.

c. Dimensions in accordance with AWWA C208.

d. Custom fabricated fittings shall be designed and fabricated in accordance with AWWA M11, with outlet reinforcements per AWWA M11. All other standards and specifications for steel, welds, coatings, flanges and dimensions of component fittings provided herein shall apply equally to custom fabricated fittings.

e. No custom-made fittings shall be used without prior written approval by the Engineer.

3. Coatings: Interior and exterior surfaces of all non-stainless steel pipe and fittings shall be coated as follows:

a. Flush valve galvanized piping: Refer to Section 33 12 16 – Water Utility Valves.

b. Pipes underneath welded steel tanks: Refer to Section 33 16 19 – Welded Steel Water Storage Tank and Section 09 97 14 – Water Storage Tank Painting.

c. All other non-stainless steel pipe and fittings:

1) Interior: AWWA C205, cement mortar lining.

2) Exterior: Coal tar epoxy coating, min. 10 mil DFT

d. All coatings shall be NSF 61-approved.

e. All surfaces shall be ground smooth (SSPC-SP6 Near-White Blast).

f. All weld splatter and other defects shall be removed prior to blasting.

g. All wetted surfaces of pipe interior shall be coated. All exposed surfaces of pipe exterior shall be coated.

h. Do not apply coating to mating surfaces of flanges.

i. Typical water temperature: Less than 140 degrees Fahrenheit.

4. Additional Coatings:

a. Exterior surfaces of all buried non-stainless steel pipe and welded fittings shall include cold-applied tape coating, manufactured and installed in accordance with AWWA C209, applied with a minimum overlap width of 1-inch and a total coating thickness shall be a minimum of 80 mils. Such tape coating shall be applied in addition to galvanized coatings and bituminous coatings specified above.

5. Flanges:

a. Flange class as noted on Drawings.

b. Pressure rating of flanges and gaskets shall meet or exceed surge pressure rating of attached pipe.

c. Coatings and linings shall be continuous to the ends of pipe and backs of flanges.

d. Do not apply coatings to mating surfaces of flanges.

e. Gaskets shall be ring-type, per AWWA C207, unless the flanged connection is between PVC and steel, in which case full face type gaskets with outer diameter equal to that of the flange shall be used.

f. Retainers shall be fabricated of phenolic or other suitable material as recommended by manufacturer and conforming to NSF 61, with minimum thickness of 1/8 inch and minimum dielectric strength of 500 volts/mil.

g. Nitrile sealing rings.

h. Steel washers shall be 1/8-inch thick.

i. All bolts, nuts and washers shall be stainless steel 304, unless otherwise noted. All bolts shall be provided by manufacturer especially for use with their respective fittings. If manufacturer cannot supply stainless steel bolts, Contractor may provide bolts from another source; however, Contractor is solely responsible to ensure fit and compatibility of said bolts.

j. Bolt shall be long enough to protrude through the assembled nut at least two threads but not more than ½-inch.

k. Contractor is responsible to ensure that all pipe flanges that connect to valve body flanges have the same dimensions, drill pattern, bolt hole

diameter and equal or higher pressure rating as the valves to which they are connected.

1) Overdrill bolt holes as necessary, provided such overdrilling is within manufacturer's recommended tolerances.

l. Contractor shall be responsible to verify compatibility of all flange bolt patterns prior to purchasing materials and shall notify the Engineer if alternate bolt patterns are required to mate flanges.

6. Field Welding Materials:

a. Pipe: AWWA C206.

7. Stainless Steel Pipe and Fittings

a. Use where called-out on Drawings as Stainless Steel

b. Stainless Steel 304

c. Pressure rating: Not less than 235 psi Cold Working Pressure

2.2 TAPPING SLEEVES AND SADDLES,

A. Tapping Sleeves (if applicable):

1. Manufacturers:

a. Mueller Co.

b. Romac Industries, Inc

c. JCM Industries

d. Ford Meter Box Company, Inc

e. Smith-Blair, Inc

f. Substitutions: Approved equal.

2. Tapping sleeves shall be used for all taps larger than 2-inches.

3. Shall be fusion-bonded epoxy-coated steel sleeves.

4. All sleeves shall be specifically designed for use on the type of pipe that is being tapped.

5. All bands, straps, bolts, nuts and washers shall be SS 304. All bolts shall be provided by manufacturer especially for use with their respective components.

6. Sleeve Working pressure rating: 250 psi

7. Tapping sleeves shall be used on non-fusible PVC, unrestrained bell-and-spigot PVC, and DI pipe only. All taps on fusible PVC pipe or restrained PVC pipe shall be performed using MJ reducing tees.

8. Tapped Outlet: FNPT or MJ, as indicated on Drawings

9. All pipe taps shall be made with an engineer approved tapping machine.

10. Threadolets, where called for on Drawings, shall be welded to the pipe, ground, and blasted (if possible) prior to applying fusion-bonded epoxy coating to the pipe.

B. Tapping Saddles:

1. Tapping saddles shall be used for taps 2-inches or smaller.
2. All saddles shall be specifically designed for use on the type of pipe that is being tapped.
3. All bands, straps, bolts, nuts and washers shall be SS 304. All bolts shall be provided by manufacturer especially for use with their respective components.
4. Tapping saddles shall be used on non-fusible PVC, unrestrained bell-and-spigot PVC, and DI pipe only. All taps on fusible PVC pipe or restrained PVC pipe shall be performed using MJ reducing tees, with the following exception:

a. Stainless steel tapping saddle shall be used for the control valve sensor line tap of 12" restrained PVC waterline at the tank site.

5. All pipe taps shall be made with an engineer approved tapping machine.
6. Threadolets, where called for on Drawings, shall be welded to the pipe, ground, and blasted (if possible) prior to applying fusion-bonded epoxy coating to the pipe.
7. Nylon coated ductile iron with dual stainless steel band tapping saddles:
   a. Manufacturers:
      1) Romac Industries, Inc. Model 202-NS
      2) Substitutions: Approved equal.
   b. Nylon coated ductile iron tapping saddles with stainless steel dual compression straps.
   c. Saddle Working pressure rating: 350 psi, or the maximum working pressure of the pipe, whichever is less.
   d. Tapped Outlet: FNPT or MJ, as indicated on Drawings
8. Stainless Steel Tapping Saddles
   a. Manufacturers:
      1) Romac Industries, Inc. Model 304
      2) Substitutions: Approved equal.
   b. Stainless steel tapping saddle with stainless steel shell, outlet, sidebars, lugs, nuts, lifter bars, and washers.
   c. Working pressure rating: 150 psi.
   d. Tapped Outlet: FNPT

2.3 UNDERGROUND PIPE MARKERS

A. Furnish materials in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

B. Tracer Wire: 12 AWG, Solid Copper, Single Conductor, 600V, UF-XHHW wire or equal, for underground installation.

C. Metal-backed detectable water marker tape: Bright colored, metallized for detection by above-ground metal detector, continuously printed, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service, imprinted with "BURIED WATER SERVICE" in large letters.

2.4 ABOVE-GROUND PIPE MARKERS

A. Carsonite marker posts, blue, with Jicarilla Apache Utility Authority (JAUA) decals. Decals to be specified by JAUA and provided by the Contractor. Place markers as specified on the Drawings.

2.5 PIPE SUPPORTS AND ANCHORING

A. Metal for pipe support brackets: ASTM A123/A123M, galvanized structural steel thoroughly coated with bituminous paint.

B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24 thoroughly coated with bituminous paint.

2.6 BEDDING AND BACKFILL MATERIALS

A. As specified in Section 31 23 23.

2.7 ACCESSORIES

A. Steel rods, bolt, lugs and brackets

1. For applications not in contact with soil: ASTM A36/A36M or ASTM A307 carbon steel.

2. For buried applications: Stainless steel 304.

2.8 SOURCE QUALITY CONTROL

A. Pipe:

1. Polyvinyl chloride (PVC): Factory test all PVC pipe, both jointed and fusible types, in accordance with AWWA C900.

a. Fusible PVC: In addition to standard AWWA C900 testing, the pipe supplier shall perform third party quality assurance for the pipe lot to be provided for the project. Testing shall be per the pipe supplier protocol and include the following tests as a minimum:

1) Heat reversion testing per ASTM F1057

2) Acetone immersion testing per ASTM D2152

3) Flattening testing per AWWA C905

2. Ductile iron: Factory test in accordance with AWWA C151 and AWWA C104.

3. Steel: Factory test in accordance with AWWA C200, ASTM A53, or ASTM A139.

a. Hydrostatic test: Factory test per AWWA C200 to stress steel to 23,000 psi for at least 15 minutes, or longer as needed to allow for thorough

inspection. Conduct test after all formed and welded ends have been completed and attached.

b. Repair defects and re-test prior to applying lining and coating.

B. Fittings:

1. Ductile iron (DI): Factory test in accordance with AWWA C153 and AWWA C110, as applicable.

2. Steel:

a. Steel plate fittings: Factory test fittings fabricated from steel plate to stress steel under hydrostatic pressure to 23,000 psi for at least 15 minutes, or longer as needed to allow for thorough inspection.

b. Steel pipe fittings: Fittings fabricated from tested steel pipe do not require hydrostatic testing if girth butt welds are complete penetration welds. Perform dye penetrant test on welds in accordance with ASTM E165.

c. Pipe should conform to ASTM A53, ASTM A139 or AWWA C200.

d. Remove all defects disclosed during testing, re-weld and re-test the fitting.

3. Fusible PVC Sweeps (if applicable):

a. In addition to the factory testing of the fusible PVC pipe stipulated above prior to bending, every individual fusible PVC sweep shall be inspected for quality at the factory after bending, as follows:

1) Visual inspection for heat damage, kinks, ovality, and other irregularities.

2) OD measurements parallel and perpendicular to the plane of the bend, at not less than five (5) locations evenly spaced along the length of the sweep.

C. Coatings:

1. All fusion-bonded epoxy coatings shall be holiday-free.

2. Cure testing for fusion bonded or liquid epoxy coatings: ASTM D4752 and ASTM D3363, Every 1000 sq. ft. of epoxy coating.

3. Holiday testing, if directed by Owner in field shall be completed as follows:

a. Perform testing in accordance with NACE Standard SP0274, using electrical holiday tester. Use test voltage below:

Total Coating Thickness (Mils)	Test Voltage (Volts)
20 or less	6000
30	7500
50	9000
70	11500
80 or more	12000

b. Large holidays or coating damage clearly visible to the human eye will require repair and testing, without initial test per the method above.

c. All holidays shall be repaired and re-tested.

4. Engineer reserves right to require holiday testing of any and all coated components that are suspected of having holidays in the field prior to installation. Costs of repairs and failed tests shall be borne by the Contractor; costs of passed additional tests shall be reimbursable from the Testing Allowance.

5. Touch up and repair of Fusion Bonded Epoxy Coatings

a. Applies to all FBE coated valves for field repair of minor holidays, scratches, breaks or other damage to FBE coating.

b. Does not include repair or touch up of systemic or large area holidays in FBE coating. Repair of systematic holidays or damaged areas larger than three (3) sq. in. will require the damaged coating be ground off and the valve be newly shop-coated.

c. Materials and application:

1) NSF/ ANSI 61 certified, two-part, 100% solids, liquid epoxy coating meeting the requirements of AWWA C210.

a) Manufacturer: 3M Scotchkote Epoxy Coating 323, OAE.

b) If temperature is below 55 degrees Fahrenheit, the metal substrate shall be pre-heated in accordance with coating manufacturer's recommendations prior to applying the coating.

d. Prepare surface and apply per coating manufacturer's instructions for use as a field repair material.

D. All shop welding shall be performed by certified welders.

E. All shop welds shall be tested by ultrasonic or radiographic methods in accordance with AWS D1.1.

2.9 SOURCE QUALITY ASSURANCE

A. Acceptance of materials will be based on compliance with relevant AWWA, ASTM and other relevant standards. Materials must pass all relevant tests prior to acceptance.

B. Compliance with standards will be determined based on:

1. Documentation of factory testing. Such tests must be completed in accordance with relevant AWWA, ASTM, AWS or other applicable standards. All testing must be completed and documented by qualified personnel. The Engineer reserves the right to observe the testing while in process and to demand all testing documentation at any time.
2. Inspection by the Engineer. The Engineer reserves the right to inspect all materials both during and after manufacture.

C. The Engineer reserves the right to demand evidence of certification of all personnel performing shop or field welding on steel pipe and fittings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing utility water main size, location, and invert, are as indicated on Drawings.

3.2 PREPARATION

A. Pre-Construction Site Photos:

1. Prior to beginning construction, take photographs or videotape along centerline of proposed pipe trench. The photos or video must include coverage of all areas and adjacent features that may potentially be impacted by the impending construction work.
2. Photographs shall be taken at a minimum of one for each 200 feet of pipe trench. Videos shall cover a maximum of 2,000 feet per video file.
3. Video or photographs shall be taken after Station markers or stakes are in place for the section of pipeline or site(s) to be recorded. Video or photos must include sufficient close-ups of stakes to clearly indicate the location.
4. Prior to groundbreaking on any section of pipeline or site work, video or photographs must be submitted to the Engineer for review and approved. Video or photo documentation must be approved as sufficient by Engineer before groundbreaking may proceed.
5. Show station markers, mailboxes, fences, structures, driveways, signs, culverts, and other existing site features.
6. Include project description, applicable stations or sites, and date taken in the file name of every photograph or video, using the following filename convention: "<project name>_<begin station>_to_<end station>_<date>".
7. Video or photo submittals may be rejected because of failure to include or document any of the items above, a lack of visual or audio clarity, or for any other deficiency that prevents the Owner / Engineer from easily viewing and documenting the pre-construction conditions of the pipeline and sites.
8. If using video, Contractor must submit two (2) copies of the video documentation on DVD format as part of the submittal process. If using photographs, Contractor

must submit 2 copies of digital photograph files in DVD format as part of the submittal process.

B. Construction staking:

1. Refer to Section 02 21 13 – Surveying.

C. Restricted Areas and Biologically or Culturally Sensitive Areas:

1. Contractor shall notify Engineer prior to work within 100 feet of any restricted area as designated on the Drawings; refer to Section 01 00 00.

2. The Surveyor will erect barricades at the limits of any truncated temporary construction easements.

3. Contractor shall maintain all flags, stakes and barricades in place until the end of construction. Contractor shall notify Engineer in the event of damage or removal of said markers. Re-marking due to negligence by Contractor shall be subject to charge-backs to the Contractor.

4. No work shall be performed within 100 feet of any restricted area or truncated TCE unless barricades and/or flags are up.

5. No work shall be performed within 100 feet of any restricted area designated on the Drawings as requiring archaeological or biological monitoring unless the Owner's archaeologist or biologist, as applicable is physically present at the site.

3.3 TRENCHING

A. In accordance with Section 31 23 17.

3.4 BEDDING

A. In accordance with Section 31 23 23.

3.5 INSTALLATION – PIPE

A. Install bell-and-spigot PVC pipe in accordance with AWWA C605, AWWA M23 and pipe manufacturer's instructions, whichever is most stringent.

1. Use only lubricants supplied by the pipe manufacturer and apply to both bell and spigot ends of the joint, in accordance with manufacturer's recommendations.

2. Clean the gasket, bell, groove and spigot immediately prior to connecting pipe joints.

3. Do not over-insert pipe joints. Any over-inserted pipe joints shall be removed and the pipe bell and gasket inspected for damage. Any damaged bells or gaskets shall be discarded and replaced.

4. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

B. Install fusible PVC pipe in accordance with AWWA C605, AWWA M23 and pipe supplier's instructions, whichever is most stringent.

1. If ambient temperature drops below 40 degrees Fahrenheit refer to Underground Solutions Operational Bulletin for Cold Weather Installation (OB-8-274 012411).
2. When pulling fusible PVC pipe, do not exceed the supplier's maximum recommended safe pulling force.
3. Fused lengths of pipe shall be installed by lowering into the trench or excavation, using approved strapping per the pipe supplier's guidelines. The lowering operation, once initiated shall proceed until the entire length of the fused section of pipe is installed.
    a. Coordination of lifting equipment shall ensure that the fused pipe does not exceed the bending and buckling limitations of the pipe, per the pipe supplier's guidelines.
    b. Equipment shall be utilized and staged per the pipe supplier's guidelines.
    c. Under no circumstances will the pipe be "dropped" or "rolled" into the trench or excavation.
4. If the length of the fused pipe is longer than what the available equipment can lower into the trench or excavation at one time, equipment shall be staged so that lowering shall begin at one end of the installation, and proceed along the trench or excavation, so that the entire fused length is installed without exceeding the minimum bend radius of the fused pipe.
5. Pipe may also be installed by pulling it into the end of the trench via a sloped section that is constructed so as not to exceed the minimum bending radius of the pipe. Pipe may be pulled by the use of a pull head and winch or piece of equipment as recommended by the pipe supplier.
6. Initial lengths of installed fused polyvinylchloride pipe shall be bedded and backfilled before any connections are made between adjacent lengths.
7. Initial lengths of installed fused PVC pipe shall be allowed to come to thermal equilibrium with the ground temperature at burial depth, by waiting at least 24 hours after installation prior to making connections such as air valves, isolation valves, or flush valves.
8. Where fusible PVC is to be installed inside a casing, remove the exterior weld bead prior to installation in the casing.
9. Connection between fusible PVC and jointed PVC pipe:
    a. Connections between fusible PVC and jointed PVC pipe shall be bell-and-spigot joints in accordance with this Section.
    b. Bevel the spigot end prior to insertion into the bell.
    c. Contractor shall coordinate to ensure bell/spigot pipe ends match up where fusible PVC pipe connects to jointed PVC pipe.
10. Fusible PVC pipe shall be used:
    a. For all restrained pipe
    b. At all cased road and pipeline crossings

c. At any location where required bending radius is shorter than the minimum bending radius allowable using bell-and-spigot joint deflection

d. At all locations where PVC pipe slope exceeds 20%

e. At all other locations indicated on the Drawings

f. At any other locations at Contractor's option and expense

C. Install ductile iron piping and fittings according to AWWA C600.

1. Encase all ductile iron pipe and fittings, except for riser pipes under chlorination buildings, in polyethylene, per AWWA C105, Method "A".

a. Use two (2) separate polyethylene jackets.

1) Inner jacket: V-bio enhanced polyethylene

2) Outer jacket: standard polyethylene

b. No tears, cuts, rips or other breaks in the polyethylene encasement shall be acceptable. No dirt, water or debris inside the encasement shall be acceptable.

c. When installing ductile iron pipe floor penetrations under buildings and concrete slabs other than chlorination buildings, bring both layers of polyethylene into the slab inside the roof felt isolation joint. Trim and tape the PE at the mid-point of the slab thickness (e.g. 6" below the floor for a 12" slab). Wrap two layers of 30# roof felt outside both layers of polyethylene, extending 4" above and 4" below the slab. Trim the felt to 2" above the floor and seal with silicone. Extend PE encasement to PVC transition beyond building foundation.

d. When installing ductile iron pipe floor penetrations under chlorination building only, apply AWWA C-209 cold-applied tape coating per specifications to the riser pipe from the top of the floor to the buried ell. Wrap two layers of 30# roof felt outside both layers of polyethylene, extending 4" above and 4" below the slab. Trim the felt to 2" above the floor and seal with silicone. Encase the ell and horizontal pipe to the PVC transitions beyond the foundation in PE, per specifications.

e. When installing ductile iron floor drain lines other than at chlorination building, bring both layers of polyethylene into the slab, trim, and tape to pipe just below the inset floor drain.

f. When installing ductile iron floor drains for chlorination buildings only, apply AWWA C-209 cold-applied tape coating per specifications to the riser pipe from the inset floor drain to the buried ell. Encase the ell and horizontal pipe to the PVC transitions beyond the foundation in PE, specifications.

g. Use only 10-mil UHMW polyethylene film to tape the PE jackets. Do not use duct tape.

2. All push-on joints, where allowed on Drawings, shall be installed using TR Flex restrained joints. Install restrained joints in accordance with manufacturer's recommendations.

D. Install steel pipe in accordance with AWWA M11. Field weld and test steel pipe, as needed, in accordance with AWWA C206, except as follows:

1. Test field welds by ultrasonic or radiographic method, in accordance with AWS D1.1.
2. Do not field weld pipe without permission from the Engineer.
3. In addition to FBE or bituminous coatings, all non-stainless steel pipe shall be tape-wrapped per this section.

Any damaged shop-applied coatings shall be repaired in accordance with this Section. In the event, that field repair is required due to damage of shop-applied coating, Contractor shall notify Engineer prior to making the repair.

E. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings. Inspect each pipe and fitting prior to lowering into trench to ensure there is no damage to the pipe, fitting or coatings. Repair any damage prior to installation. Clean ends of pipe and remove foreign material from inside of pipe and fittings.

F. Maintain 10 ft horizontal separation of water main from sewer piping in accordance with local code.

G. Lay pipe in straight line and center pipe within trench. Re-lay pipe that is out of alignment.

H. Horizontal and vertical pipe bending, angles and joint deflections

1. All ells shall be one of the following standard angles: 11.25, 22.5, 45, 60 or 90 degrees. No other ell angles shall be allowed.
2. Actual horizontal and vertical angles required in the field shall be accomplished by a combination of allowable DI ells, fusible PVC sweeps (if applicable), and/or pipe deflection (i.e. pipe bending or joint deflection, as specified below).
    a. Horizontal bends: At most locations, the plan and profile sheets show horizontal bends without specifying whether the horizontal bend is to be accomplished by DI ells, fusible PVC sweeps, bending of fusible PVC pipe, or joint deflection of jointed PVC pipe. At such locations, the method of bending is at Contractor's option, provided all design requirements set forth in the Drawings and Specifications are met.
    b. Vertical bends: At most locations, the plan and profile sheets show horizontal bends without specifying whether the horizontal bend is to be accomplished by DI ells or fusible PVC sweeps. At such locations, either DI ells or fusible PVC sweeps may be used at the Contractor's option, provided all design requirements set forth in the Drawings and Specifications are met. The plan and profile sheets may show vertical fusible PVC sweeps in some locations. Where fusible PVC sweeps are shown, they must be used.
        1) Alternative methods, such as fusible pipe bending, may be considered on a case-by-case basis in the field at the Engineer's sole discretion, but the Contractor remains wholly responsible

for meeting all design requirements set forth in the Drawings and Specifications.

c. If the Contractor chooses to use DI ells or fusible PVC sweeps at any given location, the required length of restrained (fusible PVC) pipe must be used on both sides of the bend, whether the restraint length is shown on the plan and profile sheet, or not.

1) The plan and profile sheets assume that bends greater than 18° will be made using ells, that bends less than 9° will be made by pipe deflection ("roping"), and that angles in between could be made using either method. The fusible PVC call-outs at these locations on the plan and profile sheets are based on these assumptions. However, in some cases the Contractor may differ from these assumed methods. In such cases, it is the responsibility of the Contractor to provide adequate restraint length for all fittings, regardless of whether the plan and profile sheets indicate restrained pipe, or not. Refer to restraint detail sheet, DT-3.

3. Lateral pipe bending forces shall be isolated from all fittings.

4. PVC pipe deflections may be made either at joints or by pipe bending, as allowed by AWWA C605.

a. For jointed PVC pipes 12-inch diameter or smaller, pipe bending shall be allowed, provided that such bending complies with AWWA C605 and/or pipe manufacturer's minimum allowable bending radius, whichever is more stringent.

b. For jointed PVC pipes 14-inch diameter or larger, deflections shall be made at the pipe joints only.

c. For all pipe diameters, jointed PVC pipe joint deflection shall not exceed 1 degree per joint, of manufacturer's maximum allowable joint deflection, whichever is more stringent.

d. For fusible PVC pipe, deflection shall be accomplished by pipe bending. The pipe bending radius shall not be less than the minimum bending radius recommended by the pipe supplier.

1) If the ambient temperature is less than 40 degrees Fahrenheit, consult the pipe supplier for bending radius adjustments.

5. Steel and ductile iron pipe deflections shall be made at joints, provided pipe manufacturer's allowable deflection limits are not exceeded.

6. Mechanical Joints: Contractor shall abide by manufacturer's recommended maximum allowable deflection.

I. Horizontal and vertical pipe line and grade

1. The horizontal and vertical lines and grades shown on the Drawings indicate the intent of the design. Actual horizontal and vertical lines and grades in the field may deviate from those shown on the Drawings, provided all of the following conditions are met:

a. Actual minimum slope of pipe shall not be less than 0.00100 ft/ft.

b. Actual maximum slope of pipe shall not be greater than 0.40000 ft/ft, except where otherwise noted on the Drawings.

c. Direction of pipe slope shall not differ from that shown on Drawings.

d. Minimum pipe cover of 4 feet shall be maintained throughout the project.

e. Additional minimum cover or specific minimum vertical clearances called out on the Drawings at specific locations, such as wash crossings, road crossings or pipeline crossings, shall be maintained.

f. In the case of horizontal bends, the outer wall of the pipe must remain at least 12 horizontal feet within the permanent right-of-way boundaries, except where otherwise noted on the Drawings.

g. At bends near casings, pipe bending and/or off-set from centerline shall be done on the far side of the PI from the casing, to maximize the length of straight pipe in the sleeve on each side of the casing.

h. All other specifications shall be met.

i. All deviations from the Drawings shall be documented by the Contractor and must be approved in advance by the Engineer.

1) In certain locations, the pipe elevation and/or slope must remain as shown on drawings to facilitate pipe draining, maintain pressures, or other performance criteria. In such cases, deviation from the Drawings may not be allowed.

j. Any exceptions to the foregoing conditions must receive prior written approval by the Engineer.

2. No high points of any magnitude shall be allowed without an approved air valve assembly. If the As-Built survey of the pipeline reveals high points not shown on the Drawings, Contractor shall correct the pipe grade or install additional air valve assemblies, as directed by Engineer.

a. Additional air valve assemblies required due to unforeseen field conditions not the fault of the Contractor shall be paid for at the prices established in the Bid.

b. Additional air valve assemblies or pipe re-installation required due to high points caused through fault of the Contractor shall be provided at no additional cost to the Owner. This includes failure of Contractor to meet lines and grades set forth in the Drawings or failure to meet minimum pipe slope.

1) If the required air valve assembly is located on a fusible or restrained section of main line, a reducing tee is required in lieu of tapping saddle.

J. Install pipe to bear on the trench bottom along entire length of pipe. For jointed pipe, excavate bell holes in the bottom of the trench to prevent the bell from coming into contact with the sub-grade.

K. Do not lay pipe in wet or frozen trench.

L. Direction of pipe bells may be reversed for ease of installation, provided that all pipe material and installation meets applicable AWWA, ASTM, JAUA and material manufacturer's standards. On grades greater than 10%, install jointed pipe uphill.

M. Pipe expansion and contraction

1. Install pipe to allow for expansion and contraction without stressing pipe or joints.

N. Do not allow trench water, dirt, debris or other foreign material to enter the pipe during or after installation.

1. Keep pipe ends sealed after joining pipes, both while pipe string is laying on top of ground and after pipe is lowered into trench.

2. Close pipe openings with watertight plugs during work stoppages.

O. Clean inside of pipe by "pigging" immediately prior to connecting pipe ends to elbows or other fittings that do not allow the pig to pass through. Seal all exposed pipe ends to prevent contamination after pigging.

1. Flanged ends shall be temporarily sealed using approved blind flanges. Straight pipe ends shall be temporarily sealed using approved pipe covers.

2. Pigging system shall be submitted to Engineer for approval prior to use.

P. Install tracer wire continuous, taped to top of pipeline; coordinate with Sections 31 23 17 and 31 23 23.

Q. Install metal-backed detectable water marker tape continuous over top of pipe, buried 18 inches above pipe; coordinate with Section 31 23 17 and 31 23 23.

R. Install thrust blocks at locations indicated on Drawings, if applicable. Installation of thrust blocks shall not relieve the Contractor of responsibility to provide pipe restraints as indicated on Drawings and Specifications.

S. Flanged Joints: Not to be used in underground installations except within accessible structures or as shown on Drawings.

T. All pipes, fittings and appurtenances must remain within designated permanent rights-of-way unless otherwise noted on Drawings. All construction activities must remain within the right-of-way or temporary construction easement. Do not encroach on adjacent properties, culturally or biologically sensitive areas, or other restricted areas.

U. Embed pipe within 100 feet behind pipe-laying operations, unless otherwise permitted by the Engineer.

V. Do not backfill pipe prior to as-built surveying; refer to Section 02 21 13 - Surveying.

3.6 JOINING FUSIBLE PVC

A. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

B. If ambient temperature drops below 40 degrees Fahrenheit refer to Underground Solutions Operational Bulletin for Cold Weather Fusion (OB-8-274 012411).

C. Do not perform fusions during adverse weather conditions, including high wind, any amount of blowing dust or precipitation events. Protect exposed pipe faces after facing and surface preparation from blowing dust. Engineer shall have the right to shut down fusing operations if weather conditions are not suitable or if weld quality is suspect. Contractor shall not be entitled to additional compensation for any such additional testing or shut-downs; however, shut-downs required by the Engineer through no fault of the Contractor (i.e. due to weather) shall be considered excused weather delays.

1. In the event of inclement weather, a tent, shelter, or weld screen may be used to protect the fusion environment from dust, precipitation and heater plate variance. Any such enclosures must be approved by the Engineer. Engineer reserves the right to reject such enclosures and shut down operations if the enclosures do not adequately protect the pipe faces or fusion environment.

D. Protect fusible PVC at all times during handling, storage, transport, cutting and fusion from oil contamination.

1. Clean or wipe blades of facing equipment in accordance with equipment manufacturer's recommendations. Unless otherwise indicated by the manufacturer, do not use solvents for cleaning, as these can leave residues that can weaken the fusion joints and cause failures.

E. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

1. Heat Plate – Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

2. Carriage – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

3. General Machine – Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

4. Data Logging Device – An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

F. Other equipment specifically required for the fusion process shall include the following:

1. Pipe rollers shall be used for support of pipe to either side of the machine.

2. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations.

3. An infrared (IR) pyrometer for checking pipe and heat plate temperatures.

4. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
5. Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.

3.7 INSTALLATION - TAPPING SLEEVES AND SADDLES

A. Install tapping sleeves and saddles in accordance with Drawings and in accordance with manufacturer's instructions.

B. For dry taps, after drilling into the pipeline, remove all pipe shavings and debris from inside the pipe using a vacuum or other method approved by the Engineer.

C. Do not install tapping sleeves or saddles on fusible or restrained PVC pipe. All taps on fusible or restrained PVC main lines must use MJ reducing tees.

D. Do not allow non-stainless components of tapping saddles or sleeves to come in contact with soil.

3.8 INSTALLATION – BOLTS

A. Apply heavy duty anti-seize to lubricate all stainless steel bolts.

B. Anti-seize compound shall be recommended by manufacturer for use with stainless steel.

3.9 INSTALLATION – STAINLESS STEEL THREADED PIPES AND APPURTENANCES

A. All threaded stainless steel pipes, valves, and fittings shall be wrapped with Teflon graphite tape and/or coated with anti-seize compound approved by manufacturer specifically for use with stainless steel threads.

3.10 THRUST RESTRAINT

A. All restrained PVC pipe joints shall consist of fusible PVC. Bell restraint harnesses are not allowed.

B. Install restrained fittings in accordance with Drawings and in accordance with manufacturer's instruction.

C. Joint restraint lengths:

1. Minimum joint restraint lengths shall be as provided in the Drawings for each appurtenance.
2. For adjacent appurtenances where the required joint restraint lengths overlap each other, refer to the Plans for total required restraint length. In the event of adjacent fitting restraints that are not noted in Plans, consult the Engineer for required restraint length.
3. Lengths of pipe not in contact with soil (i.e. inside casings) shall not be counted toward the restraint length requirement.

D. All thrust blocks, if applicable, shall bear against undisturbed earth.

3.11 BACKFILLING

A. In accordance with Section 31 23 23.

3.12 PIPELINE RIGHT-OF-WAY GRADING

A. Mound spoils over pipe as indicated on Drawings. Provide a level 5 ft break in earthen mound every 50 ft to prevent surface runoff from accumulating on the uphill side of the mound.

B. Establish finished grade to provide a minimum of four (4) foot of cover over the pipe. Measure depth of cover from final surface grade to top of pipe barrel.

1. At certain locations, such as wash crossings, road crossings, utility line crossings or to prevent high points, the Drawings indicate greater than 4 ft minimum cover. At such locations, Contractor shall maintain the site-specific minimum cover.

C. Do not place fill material or raise the finished grade above existing grade in the flow lines of washes or surface water drainages, regardless of size.

D. Finished grade along pipeline right-of-way and temporary construction easement shall have a maximum longitudinal slope of 4:1 and maximum side slope of 4:1, unless otherwise noted on Drawings.

E. The pipeline right-of-way shall be leveled from side-to-side to slow down surface run-off from causing erosion rills perpendicular to the pipeline, as well as to make the ROW accessible to the Owner for future maintenance.

1. The entire right-of-way shall be re-seeded and reclaimed after construction. Do not build any new roads. Refer to Section 32 92 19 – Seeding for re-seeding requirements.

2. The right-of-way shall not be open to the general public and shall have minimal impact on the environment. Upon completion of construction, the right-of-way shall be reclaimed to visually blend in with the surrounding environment and minimize its visual impact.

F. All construction activities, including clearing and grading, must remain within the designated right-of-way and temporary construction easement. Do not encroach on adjacent properties or, biologically or culturally sensitive areas.

3.13 TAPPING EXISTING WATER DISTRIBUTION FACILITIES

A. Tapping NGWSP Reach 24.1 JAN at Station 0+00 of JAN-Cutter Intertie:

1. See Section 01 00 00 “Basic Requirements” for requirements pertaining to tapping of NTUA facilities.

B. Tapping JAUA facilities at Teepee Junction (if applicable):

1. See Section 01 00 00 “Basic Requirements” for requirements pertaining to tapping of JAUA facilities.

C. Perform all work in conformance with tapping permits and all written and verbal instructions from JAUA and NTUA personnel, including notification and coordination with the JAUA and NTUA, maximum water usage rates, time and duration of shut-offs, and disinfection requirements.

D. Wet taps of existing facilities shall not be permitted.

E. Minimize shut-off time during connections to existing facilities. Contractor shall have all tools and materials for actual field conditions as well as foreseeable problems on hand in order to minimize shut-off time.

F. All new materials shall be thoroughly cleaned and disinfected with a strong (200 ppm) chlorine solution prior to connecting to existing facilities.

G. Prevent contamination of existing facilities with trench water, mud, debris, chemicals or other substances.

3.14 INITIAL FILLING OF PIPELINE

A. "Initial filling" refers to first introduction of water and evacuation of air in the pipeline.

B. The pipeline will be filled from NGWSP Reach 24.1 JAN that is operated by NTUA.

C. Initial filling of pipeline shall not exceed maximum instantaneous flow rate (in gpm) or maximum daily fill rate (in gpd) set forth by NTUA and the Engineer in the field.

D. Unless otherwise directed by the Engineer, the maximum allowable instantaneous flow rate shall be 420 gpm. Note that actual allowable maximum fill rate based on availability of water from NTUA's existing facilities may be significantly less than this amount. Contractor shall schedule sufficient time for filling and flushing to account for actual water availability from NTUA.

3.15 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.16 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. The Contractor shall be required to hydrostatic pressure test all water mains, appurtenances and plumbing trains.

1. Perform testing in accordance with applicable standards:

a. PVC pipe: Simultaneous hydrostatic pressure and leakage test. The system shall be pressure tested in accordance with AWWA C605 and M23, with the exceptions noted below:

1) Test pressure: In accordance with test pressure summary table provided in Appendix H to Contract Documents.

2) In no case shall the test pressure exceed the manufacturers' recommended maximum safe test pressure for the pipe, fittings or appurtenances.

3) Test duration: 2 hours minimum.

a) Engineer may require longer duration test (up to 24 hours) if there is any doubt as to integrity of a particular section of pipe or appurtenances.

b. Ductile iron pipe: AWWA C600

c. Steel pipe: AWWA C200

2. Hydrostatic pressure testing of main line shall be performed in sections between each pair of adjacent isolation valves. Do not skip any isolation valves in delineating test sections, without express written permission by Engineer.

3. No observable leakage is allowed. Measurable leakage must be within the maximum allowable limits set forth by applicable AWWA and ASTM standards.

4. Any leaks detected during testing shall be repaired. After repairs are completed, another full duration test shall be performed on the section of the pipeline to which the repairs were made.

5. All air must be vented from the pipeline prior to pressurization.

6. The pipeline must be fully restrained prior to pressurization, including permanently installed items and any temporary appurtenances used for testing.

7. All hydrostatic pressure tests must be witnessed by either the Resident Project Representative or JAUA. Contractor is responsible for coordination of testing schedule with to allow the Resident Project Representative and JAUA's representative to be present.

C. Qualifications of fusible PVC fusion personnel:

1. All fusion technicians shall be fully qualified by the pipe supplier to install fusible polyvinylchloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

2. The entity certifying an operator's qualifications shall retain the ability to revoke an operator's qualification if it is determined that there is a specific reason to question the operator's ability to make joints that meet project specifications.

D. Fusible PVC pipe fusion monitoring and recording:

1. All fusible PVC pipe fusion machines shall be equipped with data loggers connected to the fusion machine to record, at a minimum, joint temperature, pressure, time, and any other parameters required by the pipe supplier.

2. Data loggers shall be used during all joint fusions.

3. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

4. Provide fusion documentation to the Engineer. Documentation shall contain, at a minimum, the following information for every individual fusion:

a. Data logger device reports

b. Pipe Size and Thickness

c. Machine Size

d. Fusion Technician Identification

e. Job Identification

f. Fusion Joint Number

g. Fusion, Heating, and Drag Pressure Settings

h. Heat Plate Temperature

i. Time Stamp

j. Heating and Cool Down Time of Fusion

k. Ambient Temperature

5. Contractor shall submit fusion documentation to the Engineer at least weekly while pipe fusing is taking place. Contractor shall not bury any fused pipe until the documentation on the fusion has been reviewed and approved by the Engineer.

   a. Any fusion that is buried prior to Engineer's review and is subsequently rejected shall be removed at Contractor's sole expense.

   b. All fusion documentation shall be reviewed and approved by the pipe supplier's quality assurance manager prior to, or concurrent with, submittal to the Engineer.

E. Fusion Quality Testing on fusible PVC pipe: The Contractor shall verify field fusion quality by making and testing a trial fusion as follows:

1. Frequency: Minimum of one trial fusion with destructive test per crew or per fusion machine, whichever is greater, prior to starting production. Changes in weather, including increase in wind velocity or blowing dust, precipitation events or severe changes in temperature, changes to fusion machine, or changes in fusion personnel may require additional tests, up to a maximum of 5% of welds, at the discretion of the Engineer.

2. Procedure: The trial fusion shall be allowed to cool completely; then test coupons shall be cut out and tested in using the Standard Test Method for Tensile Properties of Plastics in accordance with ASTM D638, with the following modification: The sample coupon shall be the full wall and fusion bead thickness, rather than be machined down to the maximum thickness specified by ASTM D638.

   a. For convenience, Contractor may use other, non-ASTM field tests to gather immediate general information regarding weld quality; however, such tests shall not replace the ASTM D638 test. Only the ASTM D638 test shall be used by the Engineer as a basis of whether to accept or reject any destructively tested fusion joints.

F. Rejection of fusible PVC fusion joints:

1. Engineer reserves the right to reject, or require destructive testing on, any joint that does not meet pipe supplier's recommended fusion parameters, as evidenced by the fusion machine data log.

2. Engineer reserves the right to reject, or require destructive testing on, any joint for which adequate fusion data is not available to verify that the fusion was performed properly.

3. If any tested joint fails the laboratory test, all field fusions represented by that joint shall be rejected.

a. Any joint that exhibits a yield point less than 95% of that of the unfused pipe or that fails in a brittle mode shall be considered to have failed the tensile test.

4. The Contractor shall make all necessary corrections to equipment, set-up, operation, and fusion procedure, and shall re-make the rejected fusions, at no additional cost to the Owner.

5. In the event that a rejected joint is already installed, the Contractor shall remove, re-fuse, and re-install all pipe represented by that joint at no additional cost to the Owner.

G. Testing of field welds on steel pipe and fittings shall be by ultrasonic or radiographic method in accordance with AWS D1.1.

1. The Engineer reserves the right to demand evidence of welder's certification for all personnel performing field welding of steel pipe and fittings.

H. Thermal contraction and expansion of fusible PVC pipe:

1. Engineer reserves the right to unbolt any flange or mechanical joint attached to fusible PVC pipe (including isolation valve assemblies) to check for tensile or compressive loading due to thermal contraction or expansion of the fusible PVC pipe. Excessive tension, indicated by pull-back of the fusible PVC end, or excessive compression of the flange / mechanical joint shall be cause for the Contractor to excavate the fusible pipe, lengthen or shorten the pipe as necessary, and re-bury. Refer to Section 33 12 16 – Water Utility Valves.

I. Compaction Testing: Refer to Section 31 23 23 – Backfill.

J. All tracer wire must be field checked for continuity after all excavation is completed, but prior to Final Completion of the project. All breaks in continuity shall be corrected.

K. When tests indicate that Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.

3.17 TOLERANCES

A. Line and grade surveying tolerances:

1. See Section 02 21 13 – Surveying.

B. Flange alignment tolerances as specified in AWWA C207 and AWWA M11.

END OF SECTION

SECTION 33 12 16

WATER UTILITY VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Altitude Valve Assembly.
2. Gate Valves.
3. Ball Valves.
4. Air Valves.
5. Check Valves.
6. Flush Valve Assemblies.
7. Valve boxes.
8. Pipe Supports.
9. Valve vaults.
10. Meter cans & pits.
11. Accessories.

B. Related Sections:

1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 23 - Backfill.
4. Section 33 11 13 - Public Water Transmission Systems.
5. Section 33 13 00 - Disinfection of Water Utility Transmission Systems.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Altitude Valve Assembly:

1. Basis of Measurement: Lump Sum.
2. Basis of Payment: Includes excavation, altitude valve, dismantling joint, check valve, ball and gate valves, air valves, pilot system, concrete vault (incl. ladder, cover, hatch, and valve box covers), saddles, fittings, accessories and backfill.

B. Vacuum Breaker and Air Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, vacuum breaker / air valve assembly, plastic (meter) pit, cover, fittings, accessories and backfill.

C. Gate Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, gate valves, adaptors, fittings, valve boxes, meter cans (where applicable), identification and warning placards where required per drawings, collars, accessories, and backfill.

D. Flush Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, 2-inch piping, 2-inch gate valve assembly as shown on plans, orifice plate (where applicable), above-grade discharge pipe, gravel pack at weep hole, accessories and backfill.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M 306-10 - Standard Specification for Drainage, Sewer, Utility and Related Castings

B. ASTM International (ASTM)

1. ASTM A48 – Standard Specification for Gray Iron Castings
2. ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
3. ASTM A536 – Standard Specification for Ductile Iron Castings
4. ASTM A564 – Standard Specification for Hot Rolled and Cold Finished Age Hardening Stainless Steel Bars and Shapes
5. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings
6. ASTM B148 – Standard Specification for Aluminum Bronze Sand Castings
7. ASTM C478 – Precast Reinforced Concrete Manhole Sections
8. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
9. ASTM F594 – Standard Specification for Stainless Steel Nuts.
10. ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipe
11. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test
12. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate Zinc Rich Primers by Solvent Rub
13. ASTM D638 – Standard Test Method for Tensile Properties of Plastics

C. American Water Works Association (AWWA):

1. AWWA C207 – Standard for Steel Pipe Flanges for Waterworks Service
2. AWWA C507 - Ball Valves 6 inch through 48 inch

3. AWWA C508 – Swing-Check Valves for Waterworks Service, 2- through 24-in.
4. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
5. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
6. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
7. AWWA M11 – Steel Pipe: A Guide for Design and Installation
8. AWWA M23 – PVC Pipe – Design and Installation

D. American National Standards Institute

1. ANSI B16.1 Gray Iron Pipe Flanges and Flanged Fittings

E. NACE International (NACE)

1. SP0274 – High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.

F. NSF International/ American National Standard (ANSI):

1. NSF/ANSI Standard 61 - Drinking Water Components - Health Effects.

G. Society for Protective Coatings:

1. SSPC-SP1 – Solvent Cleaning
2. SSPC-SP2 – Hand Tool Cleaning

1.4 SUBMITTALS

A. Design Data: Submit manufacturer's latest published literature. Include illustrations, installation instructions, maintenance instructions and parts lists.

B. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

C. Submit proofs on all signs, placards, and tags prior to fabrication.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Provide Operation and Maintenance Data for each type of valve installed.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with applicable New Mexico Standards and the National Fire Protection Act (NFPA).

B. Valves: Mark valve body with manufacturer's name and pressure rating.

C. Altitude valve (control valve)

1. The control valve shall be tested prior to shipment. The standard test shall include a functional stroke test and pressure and leak test of valve body, seat and fitted pilots and accessories.
2. All control valve maintenance and repairs shall be possible without removing the Main Valve body from the line, when installed in accordance with manufacturer's recommendations.
3. Start up and Training Services shall be provided by factory trained location representative. Representative shall have inventory of valves, pilots, and accessories, and have capability of providing maintenance, repairs, and modifications to add functionality to existing valves.

1.7 DELIVERY, STORAGE AND HANDLING

A. Prepare valves and accessories for shipment according to AWWA Standards and seal valve ends to prevent entry of foreign matter into product body.

B. Deliver and store valves in shipping containers with labeling in place.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior and exterior surfaces.

D. Coated valves and appurtenances shall be shipped on bunks and secured with nylon belt tie down straps or padded banding over braces, and shall be stored on padded skids or other suitable means to prevent damage to coatings.

E. Coated valves shall be handled with wide belt slings, padded forks or other means to prevent damage to coatings. Chains, cables or other equipment likely to damage coatings or valves shall not be used.

1.8 COORDINATION

A. Contractor shall coordinate with the altitude valve supplier regarding start-up services to be provided by the supplier and ensure required Contractor's personnel and equipment are available.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 MAINTENANCE MATERIALS

A. Furnish two (2) tee wrenches to Owner (required length) for each valve type.

PART 2

PART 2 PRODUCTS

2.1 GENERAL

A. All valves shall be American made, unless otherwise specified.

B. All non-stainless steel and iron valves and appurtenances shall be fusion bonded epoxy coated, interior and exterior, conforming to AWWA C550 and NSF 61.

C. All valves and coatings shall be NSF 61-certified.

D. All bolts, nuts, and washers (where required) shall be stainless steel 304, unless otherwise specified, and shall be provided by the valve or fitting manufacturer especially for use with their respective valves or fittings. If manufacturer cannot supply stainless steel bolts for the MJ or flange connection, Contractor may provide bolts from another source; however, Contractor is solely responsible to ensure fit and compatibility of said bolts.

2.2 ALTITUDE VALVE ASSEMBLY

A. Location and purpose: Specifications for the altitude valve at the JAN Border Tank Site. The valve assembly will have the following primary functions:

1. Altitude Level Control: Regulate the level of the JAN Border Tank.

B. Altitude Valve Assembly Design Criteria

Altitude Valve Setting Full JAN Tank	30 FT
Operational Range	20 FT below Full Tank
Flow Range	840-966 GPM
Altitude Valve Max. Static Inlet Pressure	124.8 PSI
Alt. Valve Assembly Max. Anticipated Upsurge Pressure	< 200psi
Altitude Valve Opening/Closing Speed	min 180 sec open / min 180 sec close
Alt. Valve Assembly Test Pressure Rating	Min. 200 PSI
Operating Elevation	7,044 ft. MSL

C. Altitude Valve:

1. Manufacturers:
   a. Cla-Val, Combination Altitude Valve, Cla-Val Model NO 210-03 - KO
   b. Substitutions: Not allowed.
2. Working Pressure: 250 psi.
3. Main valve Size: 6”
4. Equipped with Anti-Cavitation Trim
5. Equipped with appropriate pilot and accessories for Delayed Opening
6. Equipped with appropriate pilot and accessories for One Way Flow
7. Valve Ends: Flanged connections shall be ANSI/ASME B16.42 Class 150.
8. Globe Style valve with single diaphragm-actuated configuration, full port model.
9. Body and bonnet shall be constructed of ductile iron conforming to ASTM A536 Grade 65-45-12.
10. The valve stem shall be a 316 stainless steel Dura-Kleen stem.

11. The main valve elastomers: diaphragm, resilient disc and seals, shall be of Buna-N or EPDM.
12. The main valve internal and external fasteners: bolts, nuts, studs, cap screws and washers shall be supplied as 304 Stainless Steel.
13. The main valve shall include Cla-Val NSF and AWWA approved fusion bonded epoxy coating.
14. Altitude Valve Pilots: The pilots shall be a normally open Cla-Val CDS6A Altitude Control, OAE.
    a. The adjustable pilot spring ranges shall be 5 to 40 feet. The pilot shall be factory preset as follows and to be fine-tuned in field by manufacturer's representative during start-up.
        1) Valve closes at 30 feet
        2) Valve opens at 10 feet (delayed open)
    b. Pilot body shall be constructed of low lead bronze. Pilot trim shall be 303 stainless steel.
15. Altitude Pilot System Appurtenances:
    a. Pilot System inlet strainer shall be a Cla-Val X43 wye strainer.
    b. Opening speed control shall be a Cla-Val Model CV flow control comprised of low lead bronze components.
        1) The opening speed shall be 180 seconds or greater.
        2) The speed adjustment shall be locked or secured to prevent unauthorized changes.
    c. Closing speed control shall be a Cla-Val Model CV flow control comprised of stainless steel components.
        1) The closing speed shall be 180 seconds or greater.
        2) The speed adjustment shall be locked or secured to prevent unauthorized changes.
    d. All pilot system control tubing and control fittings shall be 304 stainless steel.
    e. Isolation ball valve(s) shall be comprised of stainless steel components.
    f. All pilot elastomers: diaphragm, inner valve and seals, shall be of Buna-N or EPDM.
16. Visual Position Indicator- The control valve shall be supplied with a Cla-Val Model X101 Valve Position Indicator, OAE. The valve position indicator shall provide a visual reference to the Main Valve open position. The housing shall be stainless steel.
17. Pressure Gauges- the main valve shall be supplied with pressure gauges: 0 – 200 psi on the upstream side and 0 – 60 psi on the downstream sides of the valves.

D. Strainer

1. Manufacturers:
    a. Cla-Val, H Style Strainer, Cla-Val Model X43H
    b. Substitutions: Not allowed.
2. Valve Ends: Flanged connections shall be ANSI/ASME B16.42 Class 150.
3. Working Pressure: 250 psi.
4. Fusion bonded epoxy coated ductile iron body.

5. Integral drain/blow off connection with stainless steel plug.

E. Dismantling joint

1. Manufacturer:
   a. ROMAC, Model DJ400
   b. Substitutions: Approved Equal
2. Flanges: AWWA C207 Class E, compatible with ANSI Class 125/150 bolt circles.
3. NSF 61 Certified fusion bonded epoxy coating
4. Color: Blue
5. NBR gasket
6. Integral Tie Rods
7. 316 stainless steel fasteners
8. Working pressure: 275 psi

F. Swing check valve

1. Manufacturer:
   a. Valmatic Surge Buster, Series 7200.
   b. Substitutions: Approved Equal.
2. Flanges: NSI B16.1, Class 125.
3. ANSI/AWWA C508 certified.
4. Materials of construction:
   a. Body and cover: ASTM A536 Grade 65-45-12 ductile iron.
   b. Disc: Buna-N.
   c. Disc accelerator: Type 302 stainless steel.
   d. Coating: Interior and exterior shall be coated with fusion bonded epoxy.
5. Provide with screw-type backflow actuator with stainless steel T-handle for operation.
6. Provide with mechanical indicator to indicate disc position.

G. 6-inch Gate Valve within vault
   a. In addition to standard 2” operating nut, provide with 12” handwheel with maximum rim pull not exceeding 80 lbs.
   b. See Gate Valves, this Section, for additional requirements.

H. 6-inch Ball Valve within vault
1. Manufacturers:
   a. Val-Matic Series 4000

b. Actuator: AUMA GS100.3
c. Substitutions: Approved Equal.

2. Full port, double seated, AWWA C507 Ball Valve
3. Working pressure: Not less than 150psi
4. Inlet/Outlet: ANSI Class 125 flanges
5. Interior/exterior AWWA C550 fusion bonded epoxy coatings
6. Manual actuation
   a. Worm gear actuator with 126:1 ratio
   b. 31.5 turns to close
   c. In addition to standard 2" operating nut, provide with 12" handwheel with maximum rim pull not exceeding 80 lbs.

I. Vault
   1. See Valve Vaults this Section.

2.3 RESILIENT WEDGE GATE VALVES

A. Manufacturers:

1. Mueller Company
   a. A-2361
2. Substitutions: Approved Equal

B. Resilient Wedge Gate Valves: AWWA C515, NSF 61, American-made; ductile iron.

1. Resilient seats.
2. Stem: Non-rising bronze stem.
3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
4. Gearing:
   a. Bevel geared for horizontal installation.
   b. Spur geared for vertical installation.
5. Valve Ends:
   a. Mechanical joint or flanged, as indicated on Drawings.
   b. Flanged ends shall be drilled in accordance with ANSI Class 125/150 bolt pattern, unless otherwise noted on Drawings.
   c. Pressure rating not less than that of valve body.
6. Working pressure rating: 350 psi.
7. Pressure testing: Seat test – 525 psi for 15 seconds, test seat from each side of valve separately per UL262. Shell test pressure: 700 psi.
8. Inside and outside of valve fully coated with Fusion Bonded Epoxy, 10 mils nominal, conforming to AWWA C550 and NSF 61 requirements.

C. Where waterline is buried at a depth greater than 4 feet, provide valve stem extensions, complete with extension stem stabilizers, until depth of extension nut matches depth of operating nuts on valves installed at four-foot depth.

2.4 BALL VALVES

A. Stainless steel ball valves for air and vacuum breaker valve assemblies
   1. Size: ¼-inch, 1-inch, or 2-inch, as shown on Drawings
   2. May be imported or domestic
   3. Manufacturers:
      a. Milwaukee Valve.
      b. Apollo
      c. Red White Valve Corp.
      d. Stockham
      e. AUMA (gearbox actuator)
      f. Substitutions: Approved Equal.
   4. Working Pressure: Not less than 250 psi.
   5. Hydrostatic test pressure rating: 1.5 times working pressure.
   6. Inlet/Outlet: FNPT
   7. All stainless steel construction, including body, tailpiece, ball, ball retainer, stem, handle, handle nut, packing nut, and lock washer
   8. Actuators:
      a. Valves shown on Drawings with hand-levers shall come equipped with lever-type handle, one-quarter turn to open and close. Handle length and range of motion shall allow handle to be located in the most accessible location without interference with any other object.
      b. Valves shown on Drawings with 2” operating nuts shall come equipped with gearbox actuator.

2.5 AIR VALVES

A. 2-inch vacuum breaker valve with air release valve:
   1. Manufacturer:
      a. Val-Matic Valve and Manufacturing Corporation.
         1) Dual-body Type
         2) Vacuum breaker Model : 1802VB.1
         3) Air release valve Model: 38SV
      b. Substitutions: Approved Equal.
   2. Working pressure: Vacuum breaker valve: 200 psi; Air release valve: 150 psi
   3. Hydrostatic test pressure rating: 1.5 times working pressure.
   4. Outlets:
      a. Vacuum breaker: 2”, flanged, ANSI Class 125
      b. Air release valve: 1” threaded
   5. Cast iron or ductile iron body, cover and baffle
   6. Stainless steel trim, float, and fasteners.

7. Seat: Resilient Buna N.
8. Valve assembly to perform functions of both air release and vacuum breaker.
    a. Vacuum breaker orifice: 2”
    b. Air release orifice: 3/16”
        1) Air release valve to be mounted adjacent to vacuum breaker valve.
9. Stainless steel 304 piping, valve, and fittings between vacuum relief valve and air valve bodies.
10. Internal and external coatings shall be fusion bonded epoxy conforming to NSF-61 requirements.
11. Meshed hood required for vacuum breaker valve.

2.6 RUBBER CHECK VALVES:

1. Manufacturers:
    a. Tideflex Series 35
    b. Proco Series 710
    c. Approved Equal
2. End: Flanged

2.7 FLUSH VALVE ASSEMBLIES

A. Components of flush valve assembly shall be as provided elsewhere in project specifications.

B. 2” Diameter Resilient Wedge Gate Valves

1. Manufacturers:
    a. Mueller A-2360
    b. Substitutions: Approved Equal.
2. Working pressure: 250psi
3. Connections: Threaded, complying with ANSI B2.1
4. Iron body with 10 mils interior and exterior fusion bonded epoxy coating.
5. Iron wedge, symmetrical and fully encapsulated with molded rubber; no exposed iron.
6. Meets or exceeds ANSI/AWWA C509 and ANSI/AWWA C550.
7. Supplied with non-rising stem, triple O-ring seal stuffing box, 2” square wrench nut, and stainless fasteners.

C. Flanges for orifice plate assembly:

1. Dimensions per drawings

2. Flat-faced
3. Stainless Steel 304
4. ANSI Class 150
5. Steel-hub companion flanges

D. Orifice plates:
1. Stainless steel 304
2. Thickness 3/8” or as shown on plans
3. Orifice shall be beveled 1/8” deep on upstream side.
4. Fabrication:
a. Orifice plates shall be fabricated and drilled with a single concentric hole of the proper diameter for each installation as indicated on the Drawings. Both faces of the plate shall be machined smooth to remove all burrs, ridges and other imperfection in the flow area. Mating edges shall be machined to the same tolerances as flange mating faces (see Section 33 11 13). The orifice holes shall be machined to a tolerance of +/- 15 mils.

2.8 VALVE BOXES

A. 12-inch diameter Valves and Smaller: Domestic cast iron, two-piece, slip type.

B. Where waterline is buried at a depth greater than 4 feet, provide valve box extensions as required.

C. Cast iron lid marked “Water”.

D. Heavy duty, traffic rated.

E. Valve boxes with warning placards shall have locking lids with standard pentagon nut, which shall be installed below grade in heavy-duty traffic-rated meter cans.

F. Valve boxes without warning placards shall have non-locking lids.

2.9 PIPE SUPPORTS

A. Manufacturer:

1. Standon, S8900 Series
2. Substitutions: Approved Equal

B. 304 stainless steel

C. Size per drawings

D. 8”x8”x3/8” thick base plate bolted to chamber floor

2.10 VALVE VAULTS

A. Concrete manhole sections conforming to ASTM C478.

1. Bell and spigot joints.
2. Symmetrical reinforcement only.
3. Soil-tight gasket conforming to ASTM C-990.

B. Concrete shall conform to Section 03 30 00 – Cast-in-Place Concrete.

C. Manufactured or cut to lengths to provide interior dimensions shown on Drawings.

D. Reinforcement to be designed by manufacturer.

E. Safety Ladder

1. 6005T5 aluminum construction.
2. 5086 H116 Aluminum bracket.
3. Stainless steel bolts.
4. Shall be supplied with a locking and retractable safety post.
5. 10 ft tall, cut to suit application

F. "Mouse hole" or circular cut-outs to accommodate main line pipe inside vaults, if needed, shall be pre-cast.

G. Provide with circular cut-outs and locking cast iron valve box lids positioned over isolation valve nuts, per Drawings.

H. Pre-fabricated reinforced flat, slab-type lids.

I. Square access covers, where indicated on Drawings:

1. Manufacturers:
    a. Halliday Products, Series W1S
    b. MSU Mississauga Ltd series M-CL625
    c. Substitutions: None
2. Dimensions as shown on Drawings.
3. Load Rating: 300 lbs
4. Gasketed lid with channel system to divert water
5. Assisted opening with slam prevention system
6. Bituminous coating
7. Stainless Steel Hardware
8. Recessed Lockable Hasp and lifting handle

J. Foam insulation.

1. 2" minimum thickness
2. Spray Foam Insulation.
    a. 2-lb closed cell, two-component, rigid polyurethane.
    b. R Value per inch of 6.6 or greater (K factor 0.15 or less).
    c. Suitable for application to low temperature substrates (15°F).
    d. Waterproof mixture in sealant.

3. Sheet insulation may be considered by the Engineer as a substitute if demonstrated to meet or exceed the properties of spray foam insulation, including resistance to moisture build up or condensation behind the insulation. The burden to demonstrate the properties of any substitute shall be borne by the Contractor.
4. Factory or shop install insulation on underside of square access covers and shallow well manhole covers. Do not field insulate such covers.

K. Shallow well manhole covers, if indicated on Drawings, shall be 24" diameter, as provided by Four Corners Precast, OAE. Steel pipe used for shallow well covers may be domestic or import.

L. Two-way draft damper
1. Manufacturers:
a. Val-Matic, Frost Safe, VM-1504
b. Substitutions: Approved Equal
2. Field replaceable disc that opens fully to provide full flow area in both directions without requiring annular clearance with the body.
3. Contains no hinges or seats subject to freezing

M. Two-way draft damper
1. Manufacturers:
a. Val-Matic, Frost Safe, VM-1504
b. Substitutions: Approved Equal
2. Field replaceable disc that opens fully to provide full flow area in both directions without requiring annular clearance with the body.
3. Contains no hinges or seats subject to freezing

2.11 METER CANS & PITS

A. Frame and cover for locking gate valves:
1. Traffic-rated to H20 proof load of 20,000 lbs applied on a 9" x 9" steel plate in center of cover for one minute.
2. Reversible ring, ASTM A48 CL35B gray iron, undipped
a. Shall fit the 18-inch CMP meter can specified below.
b. 15-inch minimum opening size.
3. Cast iron lid shall have non-skid machined surface with "WATER" inscribed on the top.
4. Type 2 Non-penetrating pick hole
5. Pentagon Nut Lockable lid
6. Frost proof design

B. Meter Can for locking gate valves:
1. 18" inner diameter, 20 gauge corrugated metal pipe, length per detail drawing.
2. Maximum wall deflection shall not exceed $^1/_8$" at any one point when subtracted from earth pressures or forces created during backfilling.

C. Frame and cover for Vacuum Breaker / Air Release Valves:
   1. Monitor style lid
   2. Cast iron lid shall have non-skid machined surface with "WATER" inscribed on the top
   3. Ring, ASTM A48 CL35B gray iron, undipped
      a. Shall fit the 36-inch plastic meter pit specified below.
      b. 20-inch minimum opening size.
   4. Pentagon Nut Lockable lid
   5. Frost proof design with inner frost lid

D. Meter Pit for Vacuum Breaker / Air Release Valves:
   1. Body material LLDPE
   2. 36” inner diameter, 3/8” wall thickness, length per detail drawing.
   3. Crush Resistant Ribbing
      a. Maximum wall deflection shall not exceed $^1/_8$” at any one point when subtracted from earth pressures or forces created during backfilling.

E. Contractor responsible to ensure compatibility between meter pit / box, flange, ring, and cover.

F. Two-way draft damper for Vacuum Breaker / Air Release Valves:
   1. Manufacturers:
      a. Val-Matic, Frost Safe, VM-1504
      b. Substitutions: Approved Equal
   2. Field replaceable disc that opens fully to provide full flow area in both directions without requiring annular clearance with the body.
   3. Contains no hinges or seats subject to freezing

2.12 WARNING PLACARDS FOR GATE VALVE BOX LIDS

A. Rectangular aluminum plate with four (4) #30 (0.1285”) pre-drilled holes to accommodate 1/8” dia. rivets, and 1 7/8” pre-drilled center hole.
   1. Contractor responsible to verify diameter of center hole to correspond to outer diameter of key to locking nut of lockable valve box lid.

B. Dimensions: 4½”w x 4½”h x 0.04”t

C. White enamel-coated aluminum placard

D. Printed on 3.75 mil, 5 yr outdoor-rated calendared gloss vinyl with permanent solvent adhesive, printed with ECO-Solvent permanent ink.

E. Laminated with 2.5 mil calendared gloss over-laminate rated for 4 yr outdoor use.

F. White background with red and black lettering as shown on Drawings.

G. Arial font with 0.25” minimum height lettering, or as permitted by placard dimensions and pre-drilled holes.

H. Warning placards shall be affixed to lockable valve box lids with four 1/8” dia. X ¼” grip aluminum pop rivets.

I. Submit a proof to Engineer for approval before producing placards. Proof shall include placement of placard on the valve box cover to ensure proper fit and clearances.

2.13 VALVE IDENTIFICATION PLACARDS (FOR SITE VALVES ONLY)

A. Rectangular stainless steel 430 plate with 4 x ¼” pre-drilled holes

B. Dimensions: 8”w x 6”h x 0.029”t

C. Laser-etched lettering using Cermak LMM6000 laser marking promoter with 150 watt CO2 laser.

D. Arial font with 3/8” letter height, or as permitted by placard dimensions and pre-drilled holes, centered horizontally and vertically on placard.

E. Valve identification placards shall be affixed to concrete with four aluminum 3/16” dia. x 7/8” length hammer drive/metal-hit concrete anchors.

F. Submit a proof to Engineer for approval before producing placards.

2.14 VALVE IDENTIFICATION PLACARDS (FOR VACUUM BREAKER VALVES)

A. Square stainless steel 430 plate with four (4) #30 (0.1285”) pre-drilled holes to accommodate 1/8” dia. rivets.

B. Dimensions: 6”w x 6”h x 0.029”t

C. Laser-etched lettering using Cermak LMM6000 laser marking promoter with 150 watt CO2 laser.

D. Arial font with 3/8” letter height, or as permitted by placard dimensions and pre-drilled holes, centered horizontally and vertically on placard.

E. Valve identification placards shall be affixed to lockable monitor-style meter pit lids with four 1/8” dia. X ¼” grip aluminum pop rivets.

F. Submit a proof to Engineer for approval before producing placards.

2.15 VALVE IDENTIFICATION TAGS (FOR VACUUM BREAKER VALVES)

A. Identification tag:

1. Photosensitive anodized aluminum tag

a. Manufacturer: Metalphoto, OAE

b. Natural aluminum color lettering with black background

c. 0.09” thick aluminum sheet

d. Includes pre-cut hole for fastener. Contractor responsible for assuring pre-cut hole is properly sized for fastener.

e. Minimum letter/font height: 0.1”, or larger depending on available printing space for each tag

f. Wording as indicated on drawings.

B. Fastener:

1. Stainless Steel #6 Beaded Chain

C. Submit a proof to Engineer for approval before producing tags.

2.16 ACCESSORIES

A. Concrete for blocks and collars: Concrete type specified in Section 03 30 00.

2.17 STEEL PIPES AND FITTINGS

A. All steel pipes and fittings shall be Stainless Steel 304, unless otherwise noted.

B. Pressure rating: At least 235 psi Cold Working Pressure, unless otherwise noted.

2.18 STAINLESS STEEL THREAD PROTECTION

A. All stainless steel threads shall be protected with Teflon graphite tape and/or anti-seize compound approved by manufacturer specifically for use with stainless steel threads.

2.19 SOURCE QUALITY CONTROL

A. Coatings:

1. Cure testing for fusion bonded or liquid epoxy coatings: ASTM D4752 and ASTM D3363, Every 1000 sq. ft. of epoxy coating.

2. Holiday testing for epoxy coatings:

a. All fusion-bonded epoxy coatings on all valves shall be holiday tested prior to installation, at Contractor’s expense.

b. Perform testing in accordance with NACE Standard SP0274, using electrical holiday tester. Use test voltage below:

Total Coating Thickness (Mils)	Test Voltage (Volts)
20 or less	6000
30	7500
50	9000
70	11500
80 or more	12000

c. All holidays shall be repaired and re-tested, at no additional cost to the Owner.

3. Touch up and repair of Fusion Bonded Epoxy Coatings

a. Applies to all FBE coated valves for field repair of minor holidays, scratches, breaks or other damage to FBE coating.

b. Does not include repair or touch up of systemic or large area holidays in FBE coating. Repair of systematic holidays or damaged areas larger than three (3) sq. in. will require the damaged coating be ground off and the valve be newly shop-coated.

c. Materials and application:

1) NSF/ ANSI 61 certified, two-part, 100% solids, liquid epoxy coating meeting the requirements of AWWA C210.

a) Manufacturer: 3M Scotchkote Epoxy Coating 323, OAE.

b) If temperature is below 55 degrees Fahrenheit, the metal substrate shall be pre-heated in accordance with coating manufacturer's recommendations prior to applying the coating.

d. Prepare surface and apply per coating manufacturer's instructions for use as a field repair material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.

B. Verify invert elevations prior to excavation and installation of valves.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission or without making arrangements to provide temporary utility services.

1. Notify Engineer not less than 48 hours in advance of proposed utility interruption.

2. Do not proceed without written permission from the Engineer.

D. Perform trench excavation, backfilling and compaction in accordance with Sections 31 23 17 and 31 23 23.

E. Altitude Valve Assembly pre-start-up preparation

1. Close upstream gate valve to vault prior to flooding adjacent main pipeline(s).
2. Flush the main line upstream of the vault thoroughly using the flush valve upstream of the vault prior to opening the PRVs and pressure relief valves. This precaution is necessary to prevent construction debris from entering the control valves.
3. Once the main line has been thoroughly flushed and cleared, open the gate valve to flood the control valves.

3.3 INSTALLATION

A. Valve scribing: All valve collars and vaults shall be scribed with the valve data.

1. Gate valve collars shall be scribed neatly before the concrete has cured. If scribing of wet concrete is not possible, valve collars may be etched using a 4-inch grinder, with Engineer's approval in field.

2. All valve collars and vault lids outside fenced sites ("main line valves") shall be etched with the following valve data:

   a. Flow directional arrows

   b. Station number in standard "STA XXX+XX" format, including the abbreviation "STA" in front of the number

   c. Pipe size (if different from valve size) and material

   d. Valve size and type (i.e. ARV, VB, GV, BFV)

3. All valve collars and vault lids inside fenced areas ("site valves") shall be etched with:

   a. Flow direction arrows

   b. Valve type

   c. Valve size

   d. Pipe material

4. All valve collars and vault lids inside fenced areas ("site valves") shall be further labeled with a laser etched 8" x 6" stainless steel placard, as specified above.

   a. Follow anchor manufacturer guidelines for proper installation.

   b. Contractor responsible for verifying anchor and anchor head diameters are compatible with holes in aluminum plate.

   c. Valve identification placards shall contain the following valve data:

      1) Valve number, as provided on site valve numbering plans

      2) Valve size

      3) Valve type (i.e. BFV, GV, etc.)

      4) Description of valve function, as provided on site valve numbering plans

5. Vacuum breaker / ARV valve meter pit lids shall be labeled with a laser etched 6" x 6" stainless steel placard, as specified above.

   a. Follow anchor manufacturer guidelines for proper installation.

   b. Contractor responsible for verifying anchor and anchor head diameters are compatible with holes in aluminum plate.

   c. Valve identification placards shall contain the following valve data:

      1) Valve station

2) Valve type (i.e. 2" VB / 1" ARV, etc.)

3) Tapped pipe size and type

6. Contractor shall verify all data on the site valve numbering plans with Engineer prior to scribing of valve collars or fabrication of placards. Contractor shall be responsible for replacement of any incorrect placards or valve collars if this data is not verified by Engineer.

B. Valve box security and warning placards:

1. Affix warning placard, as specified above, to the top of valve box lid at locations indicated on Drawings.

a. Ensure placards centered within valve box lids and center hole aligned with locking nut. Do not allow corners of placard to overhang the lid.

b. Pre-drill holes in valve box lids and install rivets, per manufacturer's instructions. Ensure rivets grip properly into the lid.

2. All valves indicated as requiring warning placards shall be installed below grade inside meter cans, as shown on Drawings.

C. Valve Vaults

1. Thoroughly clean vault section ends with wire brush prior to joining sections.

2. Place vault sections with bell down.

3. Seal all vault sections with sealant approved by Engineer.

4. Grout lids as directed by Engineer.

5. Field apply foam insulation in accordance with manufacturer's instructions and recommendations. Personnel applying spray foam insulation shall be sufficiently trained by the manufacturer, the Center for the Polyurethane Industry, the Spray Polyurethane Foam Alliance, or similarly competent certifying body.

D. Apply heavy duty anti-seize to lubricate all stainless steel bolts. Anti-seize compound shall be recommended by manufacturer for use with stainless steel bolts.

E. Air Valve Assemblies

1. Install in accordance with AWWA standards and manufacturer's recommendations

2. After drilling into the main line, remove all pipe cuttings and other debris with a vacuum or other method approved by the engineer prior to installing the valve assembly.

3. Install vacuum and air valve assemblies in vertical position.

4. Where indicated at high points in pipe on Drawings, install at actual high points, as determined by as-built pipeline survey data.

5. Secure assemblies to Unistruts as shown on Drawings to prevent lateral movement or stresses.

6. Air valve assemblies installed on restrained or fusible PVC main line shall have FBE-coated DI reducing tees in lieu of tapping sleeves. Reducing tees located in corrosive soil zones shall be cathodically protected.
7. Galvanized steel air vents shall be painted blue as follows:
    a. Minimum surface preparation: SSPC-SP1
    b. Primer: 1 coat Sherwin Williams Galvite HS, OAE
        1) 3.0-4.5 mils dry film thickness
    c. Finish: Two coats Sherwin Williams Industrial Enamel (B54 Series), OAE
        1) 2.0-4.0 mils dry film thickness
    d. Follow all other paint manufacturer recommendations for preparation and application.

F. Gate Valves:
1. Install in accordance with AWWA standards and manufacturer's recommendations
2. Install valves in conjunction with pipe laying; set valves plumb.
3. Assemble complete valve assembly and place in open excavation at proper line and grade.
4. Provide buried valves with valve boxes installed flush with finished grade.
    a. Any valve box lids or collars that do not meet grade requirements shown on Drawings shall be removed and replaced.
5. Install valve stem risers, collars and valve box extensions as required to match finished grade.
6. Gate valves shall require the same joint restraint lengths as dead-ends of similar size and pipe material.

G. Flush Valves
1. Above grade discharges:
    a. All buried steel pipes and fittings shall be cold-applied tape-wrapped in accordance with Section 33 11 13 – Public Water Transmission Systems.
    b. Above-ground piping shall be painted blue, in accordance with this Section.

H. Check Valves
1. Install in accordance with AWWA standards and manufacturer's recommendations.

I. Altitude Valves
1. Install in accordance with AWWA standards and manufacturer's recommendations.

2. Ensure sensor line has constant upward slope toward air release valve or tank.

3. Bleed air from sensor line and valve bonnet.

J. Assemble steel flanged joints in accordance with AWWA M11 and AWWA C207.

K. No high points in the pipe of any magnitude shall be allowed without an appropriate air valve assembly. If the As-Built survey of the pipeline reveals high points not shown on the Drawings, Contractor shall correct the pipe grade or install additional air valves, as directed by Engineer.

1. Additional air valves required due to unforeseen field conditions not the fault of the Contractor shall be paid for at the prices established in the Bid. Contractor shall promptly report such conditions to the Engineer.

2. Additional air valves required due to high points caused through fault of the Contractor shall be provided at no additional cost to the Owner. This includes failure of Contractor to meet lines and grades set forth in the Drawings or failure to meet minimum pipe slope.

a. If the required air valve is located on a fusible or restrained section of main line, a reducing tee is required in lieu of tapping sleeve.

3. Engineer shall determine which type of air valve is required at a given location.

L. Tracer wire:

1. For direct buried valves with surface valve box lids, tape tracer wire to outside of valve box up to last section of box. Bring tracer wire into the valve box above the operating nut. Coil 18" tracer wire inside valve box under the lid.

2. For all valve vaults, coil min. 24" tracer wire against wall on each side of vault.

M. All shallow well manhole covers, valve box lids, meter can lids, and other cast iron appurtenances visible from surface shall be painted blue as follows.

1. Minimum surface preparation: SSPC-SP2

2. Primer: Sherwin Williams Kem Kromik Universal Metal Primer, OAE

a. One coat, 3.0-4.0 mils dry film thickness

3. Finish: Sherwin Williams Industrial Enamel (B54 Series), OAE

a. Two coats, 2.0-4.0 mils dry film thickness

4. Follow all other paint manufacturer recommendations for preparation and application.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform pressure test on domestic site water transmission system in accordance with AWWA C605.

C. All valves, including gate valves, ball valves, control valves, check valves and air valves shall be manually actuated through their full cycle to ensure proper operation prior to installation.

1. The Contractor shall provide the Engineer the opportunity to witness all valve actuations prior to valve installation.

D. Inspect coatings of all valves immediately prior to installation and repair all damaged coatings.

E. Properly align all pipes, valves and fittings prior to making connections. Do not install any pipes or fittings with internal longitudinal or shear stresses. Engineer reserves the right to disassemble any flange, joint, or union to check for internal stresses. Contractor shall correct any connection with internal stress at no additional cost to the Owner.

F. All tracer wire must be field checked for continuity after all excavation is completed, but prior to Final Completion of the project.

3.6 START-UP SERVICES

A. Altitude Valve (control valve):

1. Provide at least one (1) full 8-hour day of service from manufacturer's representative to approve the control valve station installation and advise the Contractor during startup, testing, and final adjustment of control valve station. In addition to this day, one additional one (1) full 8-hour day shall be provided in a separate trip to instruct the Owner's personnel in the operation and maintenance of the control valve station.
2. Start-up service shall include but not be limited to final adjustments of pressure, flow rate, and speed settings and testing of valves.
3. The Contractor shall provide necessary personnel during start-up and training to facilitate this work and to address any problems or defects which may arise during this work.
4. The control valve manufacturer's start-up service technician shall prepare a service report following start-up and distributed as follows:
   a. Manufacturer's File
   b. Engineer's File
   c. Contractor's File
   d. Owner's File

3.7 WARRANTIES

A. Altitude Valve Assembly

1. The altitude valve shall be covered by a minimum three (3) year warranty against defects in materials and workmanship. The 316 stainless steel seat ring shall be covered by lifetime warranty.
2. Unless otherwise specified, the altitude valve assembly interior equipment, valves, piping, and apparatus shall be warranted for a period of one (1) year, excepting only those items normally consumed in service, such as oil, grease, gaskets, or O-rings.

B. Unless otherwise specified, all other valves and associated work covered in this Section shall be warranted for a period of one (1) year.

END OF SECTION

SECTION 33 13 00

DISINFECTION OF WATER UTILITY TRANSMISSION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water transmission system; and testing and reporting results.

B. Related Sections:

1. Section 33 11 13 - Public Water Transmission Systems: Product and Execution requirements for installation, testing, of site domestic water transmission system piping.

2. Section 33 12 16 - Water Utility Valves.

1.2 MEASUREMENT AND BASIS OF PAYMENT

A. Basis of Measurement: By the linear foot for pipeline. Incidental to work for all other facilities (incl. site piping).

B. Basis of Payment: Payment for pipeline disinfection will be made based on linear footage, upon successfully passing bacteriological testing.

1. This includes all costs incidental to disinfection and testing, including chlorination, flushing, water for flushing, de-chlorination, sampling, sample transport, laboratory testing fees, and any other costs incidental to flushing, disinfection, and bacteriological testing activities.

2. This does not include any costs for disinfection of water storage tanks. See Section 33 13 13 for water storage tank disinfection.

3. Bacteriological testing costs shall not be allowed under the Testing Allowance.

1.3 REFERENCES

A. American Water Works Association (AWWA):

1. AWWA B300 - Hypochlorites.

2. AWWA B301 - Liquid Chlorine.

3. AWWA B302 - Ammonium Sulfate.

4. AWWA B303 - Sodium Chlorite.

5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

6. AWWA C651 - Disinfecting Water Mains.

B. New Mexico Administrative Code (NMAC) - Title 20, Chapter 7, Part 10:

1. Section 201: Application for Public Water System Project Approval.

2. Section 400: General Operating Requirements.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water transmission system meets or exceeds specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Requirements for submittals.

B. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological Report:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certify water conforms, or fails to conform, to bacterial standards of authority having jurisdiction.

D. Water Quality Certificate: Certify water conforms to quality standards of authority having jurisdiction, suitable for human consumption.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

1.7 QUALIFICATIONS

A. Testing Firm: Company specializing in testing potable water systems, certified by State of New Mexico.

B. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system has been cleaned, inspected, and pressure tested.

C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Coordinate with JAUA, NTUA (if using water from the NTUA system), and the Engineer prior to filling, flushing or disinfecting the pipeline. Refer to Section 01 00 00 – Basic Requirements for coordination requirements.

B. Prior to disinfection, thoroughly flush the system with potable, disinfected water. A minimum flow velocity of 3 feet per second (fps) is required, or as otherwise approved by Engineer.

C. Provide and attach required equipment to perform the Work of this section.

D. Introduce treatment into piping system and perform disinfection in accordance with AWWA C651. A minimum chlorine concentration of 50 ppm shall be measurable throughout all parts of the system.

1. Measure chlorine concentration at all sampling ports provided on the Drawings, including air valve vaults.

E. Maintain disinfectant in system for 24 hours, or 48 hours if the temperature is less than 41 degrees Fahrenheit.

F. Flush, circulate, and clean using domestic water.

1. Contractor shall coordinate with JAUA, NTUA, and Engineer prior to using domestic water, to avoid interruption of service to existing customers. Contract shall not exceed maximum allowable instantaneous flow (gpm) or daily flow (gpd), as specified in the field by JAUA, NTUA and Engineer.

2. Neutralize residual chlorine to levels normally associated with potable water prior to discharging water to the environment.

G. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Disinfection, Flushing, and Sampling:

1. Disinfect and test pipeline installation in accordance with AWWA C651.
2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that of the water used for flushing or 0.4 ppm, whichever is greater.
3. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory, approved by the Engineer, to sample, test and certify water quality suitable for human consumption, in accordance with AWWA C651.
    a. At least one set of bacteriological samples shall be collected from every 1,200 LF of new waterline, plus one set at each end of the line, unless otherwise approved by JAUA and the Engineer.
    b. Contractor shall install testing saddles, if needed to comply with spacing requirements for bacteriological testing under AWWA C-651 and JAUA's requirements. Such testing saddles are not shown on the plans, but shall be considered incidental to the project.
    c. The number and locations of specific sampling sites shall be submitted by the Contractor and must be approved by the Engineer prior to sampling.
    d. Bacteriological tests are typically only valid for 30 days. Two consecutive passing test results at every sample location must therefore be obtained within 30 days of Final Completion and Transfer of completed project to JAUA. Contractor is solely responsible for coordination with JAUA. If punch list inspection and Final Completion, and JAUA Transfer cannot be completed within 30 days of all bacteriological tests, regardless of the reason for delay, Contractor shall be responsible for re-testing at Contractor's expense.
4. Contractor shall not connect to existing system until all testing and disinfection is complete and shall obtain written permission from the Engineer to proceed with connection to the existing system.

C. Re-Disinfection:

1. In the event the performed water quality testing fails, the Contractor will disinfect the affected portions of the system again, and the approved testing laboratory shall sample, test and certify water quality as described in these specifications. Re-disinfection shall be performed at no additional cost to the Owner.

END OF SECTION

SECTION 33 13 13

WATER STORAGE TANK DISINFECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water tank disinfection.
2. Bacteriological testing.

B. Related Sections:

1. Section 09 97 14 - Water Storage Tank Painting.
2. Section 33 16 19 - Welded Steel Water Storage Tank.

1.2 REFERENCES

A. American Water Works Association:

1. AWWA C652 - Disinfection of Water Storage Facilities.

1.3 MEASUREMENT AND BASIS OF PAYMENT

A. Basis of Measurement: Lump sum for each tank.

B. Basis of Payment: Via separate bid item on the Bid Form. Bid item price shall include all work performed by Contractor and testing laboratory related to disinfection, testing and analysis.

C. The cost of laboratory testing for bacteriological testing shall not be allowed under the Testing Allowance.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal procedures.

B. Disinfection Procedure: Submit procedure description including type of disinfectant to and calculations indicating quantities of disinfectants required to produce specified chlorine concentration in accordance with Section 3 and 4 of AWWA C652.

C. Test Reports: Indicate results of bacteriological and residual chlorine laboratory test reports.

D. Manufacturer's Certificate:

1. Certify products meet or exceed specified requirements.
2. Certify disinfectants meet or exceed AWWA Standards requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C652.

B. Perform Work in accordance with State of New Mexico Environment Department standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store disinfectants in cool, dry place away from combustibles such as wood, rags, oils and grease.

B. Handle disinfectants with caution; protect skin and eyes from contact; avoid breathing vapors; wear gloves, aprons, goggles, and vapor masks.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Furnish personnel working inside tank during disinfection with equipment to comply with Federal and State regulations for work conducted in hazardous atmosphere.

B. Neutralize disinfectant solution before disposal.

C. Legally dispose of disinfection solution off Project site.

D. Repair damage caused by disinfectant solution and disinfection procedures.

PART 2 PRODUCTS

2.1 DISINFECTANTS

A. Chlorine Forms: In accordance with AWWA C652, Section 4.2.

PART 3 EXECUTION

3.1 EXAMINATION

A. Conduct inspection of tank interior before beginning disinfection.

1. Verify tank is clean and free of polluting materials.

2. Verify tank pipe and vent connections are properly made and clear of obstructions.

3. Verify paint is thoroughly cured in accordance with paint manufacturer's instructions.

3.2 PREPARATION

A. Protect aquatic life and vegetation from damage from disinfectant solution purged from tank.

3.3 APPLICATION

A. Use Chlorination Method 2 for disinfecting tank as specified in Section 4.3 of AWWA C652.

3.4 FIELD QUALITY CONTROL

A. Section 01 00 00 - Testing, adjusting and balancing requirements.

B. Collect samples of water from filled tank for bacteriological analysis in accordance with Section 5.1 of AWWA C652; take inlet and outlet water samples.

C. Test water samples for bacterial contamination, residual chlorine, in accordance with State Health Standards for potable water.

D. When water samples fail to meet State Health Standards for potable water perform the following corrective measures until water quality conforms to State Health Standards:

1. Inlet and Outlet Water Sample Failure: Eliminate source of contamination in water supply, repeat disinfection, and retest water quality.

2. Outlet Water Sample Failure: Repeat disinfection, and retest water quality.

END OF SECTION

SECTION 33 16 19

WELDED STEEL WATER STORAGE TANKS

PART 1 GENERAL

1.1 SUMMARY

A. The work covered by this section of the specifications consists of furnishing all plant, labor, equipment and materials in performing all operations in connection with the manufacture, delivery and erection of factory epoxy primed and field epoxy coated welded steel water storage tanks to the height and capacity specified, complete with foundation design and construction, and appurtenances, subject to the terms and conditions of the contract, and in strict accordance with this section of the specifications and the applicable drawings.

Section Includes:

1. Welded steel water storage tanks.
2. Tank foundations.
3. Corrosion control.
    a. Sacrificial anode cathodic protection

B. Related Sections:

1. Information Available to Bidders: Exhibit A – Subsurface (Geotechnical) Investigation Report.
2. Section 03 30 00 - Basic Concrete Materials and Methods.
3. Section 09 97 14 - Water Storage Tank Painting.
4. Section 26 42 00 – Sacrificial Anode Type Cathodic Protection.
5. Section 31 23 17 - Trenching.
6. Section 31 23 23 - Backfill.
7. Section 33 11 13 - Public Water Transmission Systems.
8. Section 33 13 13 - Water Storage Tank Disinfection.

1.2 REFERENCES

A. American Concrete Institute:

1. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

C. American Society of Mechanical Engineers:

1. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

D. American Water Works Association:

1. AWWA D100 (latest revision) - Welded Steel Tanks for Water Storage. All references in this Section to AWWA D100 shall be understood to mean AWWA D100 (latest revision).

1.3 DEFINITIONS

A. PURCHASER used in AWWA D100 means Owner.

1.4 SYSTEM DESCRIPTION

A. Design, fabricate, and erect one (1) 150,000 gallon welded steel water storage tank and accessories. Design and construct steel retaining ring or reinforced concrete ring wall foundation, and cathodic protection system, complete in place.

1.5 DESIGN REQUIREMENTS

A. Design in conformance with requirements listed in AWWA D100 as noted, supplemented, or modified below:

1. Approximate dimensions as indicated on Drawings. Exact dimensions may be adjusted provided the constructed tank dimensions are within the following tolerances and minimum requirements:

a. Capacity: Equal to or greater than nominal volume specified on drawings. Volume measured from tank base to weir overflow elevation.

b. Tank base & overflow elevations: Equal to or greater than specified on drawings.

c. Tank overflow height (distance from tank base to weir overflow): Within 2% of height specified on drawings.

d. Tank height and diameter: Within 5% of nominal values specified on drawings.

e. These tolerances and requirements are intended to provide flexibility for the Contractor to design and construct the tank efficiently. Contractor is advised that minor adjustments in site piping, grading, and other site work as a result of variations in constructed tank dimensions per this section is incidental to the work.

2. The tank wall plate thickness shall be a minimum of ¼".

3. The carbon steel tank shall have the dimensions shown in the Drawings. Vendor to quote on the nearest standard size welded tanks of manufacture.

4. Bottom capacity level (BCL) and top capacity level (TCL) above top of column foundations.

5. Roof: Welded conical roof with rafter support

6. Diameter and Type of Riser: 12 feet Blk Steel.

7. Location of Site: As indicated on Drawings.

8. Nearest Town: Site is near Teepee Junction, the intersection of US 550 and NM 537 north of the Village of Cuba, Sandoval County, New Mexico.
9. Access Roads: As indicated on Drawings.
10. Snow Loading: AWWA D100, (latest revision)(minimum 35 psf).
11. Special Wind Load Requirements: AWWA D100, (latest revision). Standard wind pressure of 18 psf on the projected surface area of the tank, based on 90 mph wind load.
12. Earthquake Design:
    a. Fixed percentage method as specified in AWWA D100, (latest revision). The project is located in seismic zone 2B. The load producing the higher stresses comparing wind and seismic will control the dynamic portion of design.
    b. The Contractor shall be required to include minimum slosh wave calculations as part of his or her PE-sealed design submittals, and size the height of the tank accordingly.
13. Tank low level is defined as level when emptied through specified discharge fittings unless otherwise indicated on Drawings.
14. Cathodic protection to be passive sacrificial anode type. Refer to Section 26 42 00 – Sacrificial Anode Type Cathodic Protection.

B. Design and construct foundation based upon data and recommendations provided in Subsurface (Geotechnical) Investigation Report. Foundation shall be either steel retaining ring or reinforced concrete ring wall foundation.

1.6 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures.

B. All required parts of the tank submittal indicated in this section shall be submitted in a single complete bound package. Each separate part of the package shall be sectionalized and tabbed.

C. Construction shall be governed by the Drawings showing general dimensions and construction details. After approval by the Engineer of detailed erection drawings prepared by the Contractor, there shall be no deviation from these drawings and specifications except upon written order or approval from the Engineer.

D. Shop Drawings: Signed and sealed by professional engineer licensed in the State of New Mexico. Indicate the following:

1. Tank Shop Drawings:
    a. Complete plan, elevation, and sectional drawings showing critical dimensions.
    b. Structural plate and support member sizes and thickness.
    c. Weld types and sizes.
    d. Water supply and overflow piping details including fittings, expansion joints, and pipe support methods.

e. Exterior ladder safety device details.

f. Handrail details.

g. Access hatch details.

h. Level indicator details.

i. Vent details.

j. Other appurtenances as indicated on plans or as provided by manufacturer.

k. Cathodic protection details.

2. Tank Foundation Shop Drawings:

a. Submit specification for foundation describing all material to be used, configuration, compaction requirements, etc. prepared by professional engineer licensed in the State of New Mexico.

b. If proposed foundation is constructed of concrete, indicate the following:

1) Ingredients, reinforcement, air content, slump, placement and consolidation, curing and finishing.

2) Submit concrete design mix including ingredient proportions, minimum cement content, and water/cement ratio.

3) Submit drawings of reinforcing bars including bar lists.

E. Product Data:

1. Submit data for expansion joint fittings and other pipe specialty fittings.

2. Submit data for ladders and ladder safety devices.

3. Submit data for cathodic protection components.

F. Design Data: Submit structural calculations for tank, tank foundation, and cathodic protection, signed and sealed by professional engineer licensed in the State of New Mexico.

G. Test Reports: Submit radiographic films, identified to shell plate diagrams, at completion of the Work.

H. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

I. Certificates:

1. Submit names and qualifications of welders, welding operators and tackers before performing welding.

2. All certifications must be valid at the time the work is to be performed.

J. Manufacturer's Field Reports: Certify foundation, anchor bolts, and tank have been properly installed and leveled.

K. The intent of these specifications is to provide the Owner with a water storage tank of the dimensions stated, requiring minimum maintenance. Alternative submittals will be accepted, provided the installation offered can be shown to be “equal” to the specified standard of quality, beyond reasonable doubt.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual location layout and final configuration of elevated tank and accessories.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA D100.

1.9 QUALIFICATIONS

A. Fabricator: Company specializing in performing work of this section with minimum five years experience.

B. Installer: Company specializing in performing work of this section with minimum five years experience, approved by Engineer.

C. Welders, Welding Operators, and Tackers: ASME Section IX qualified within previous 12 months. American Welding Society (AWS) certification must be valid as defined by AWS, with certification maintenance forms submitted every six months as per the AWS Code of Acceptance.

D. AWWA D100, (latest revision)- Welders Credentials: Refer to AWWA D100, (latest revision).

E. Design ground supported water tank and foundations under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of New Mexico.

1.10 PRE-INSTALLATION MEETINGS

A. Section 01 00 00 - Pre-Construction Conference.

B. Convene minimum one week prior to commencing work of this section.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Contractor responsible to field survey tank overflow weir and ensure that the weir elevation is no more than 1 inch below and no more than 6 inches above the overflow elevation specified in the drawings.

1.12 COORDINATION

A. Section 01 00 00 - Basic Requirements: Coordination requirements.

B. Section 02 21 13 – Surveying: Coordination requirements.

C. Coordinate work with connecting to water transmission system.

1.13 MAINTENANCE MATERIALS

A. Section 01 00 00 - Basic Requirements: Operation and maintenance data requirements.

B. Furnish two safety harnesses for ladder safety rail system.

PART 2 PRODUCTS

2.1 WATER STORAGE TANK

A. Furnish materials complying with this specification and standards specified in AWWA D100, (latest revision).

2.2 TANK CONSTRUCTION

A. In conformance with requirements listed in AWWA D100, (latest revision) as noted, supplemented, or modified below:

1. The tank wall plate thickness shall be a minimum of ¼".

2. Carbon Steel:

a. Sheet. Carbon steel sheets shall conform to, or be at least equal to, hot-rolled quality per ASTM A570 Grade 40 with a minimum yield strength of 40,000 psi.

b. Plate. Carbon steel plates shall conform to, or at least be equal to, the requirements of ASTM A36 with a minimum yield strength of 36,000 psi.

c. Structural Shapes. Carbon steel structural shapes shall conform to ASTM A36.

3. Aluminum: 5052-H32, 6061-T6 typical grades (limited size).

4. Stainless Steel: 304, 316, 316L, 317 typical grades.

5. All carbon steel plates, supports, members and miscellaneous parts, except bolts, shall be coated in accordance with Section 09 97 14. Bolts shall be stainless steel.

6. Pipe and Fittings for Fluid Conductors: AWWA D100, (latest revision)- Steel Pipe for Fluid Conductors: Modify to indicate only welded joints for conductors are acceptable.

7. Balcony: AWWA D100, (latest revision).

8. Manways, Ladders and Other Accessories: AWWA D100, (latest revision):

a. Section 5.1 - Steel Riser: Provide two manways as shown on Drawings. Both manways shall have a minimum I.D. of 30" and shall be located as indicated on Drawings.

b. Section 5.4 - Ladders: Provide tower, outside and roof ladders.

9. Pipe and Pipe Connections:

a. AWWA D100, (latest revision):

1) Provide inlet pipe with diameter as indicated on Drawings. Extend pipe through bottom of tank.

2) Provide removable steel silt stop with same coating as tank interior and mechanical joint gland.

b. Provide other accessories as indicated on Drawings.

10. Removable Silt Stop: AWWA D100, (latest revision) Provide removable silt stops where indicated on drawings.

11. Overflow: AWWA D100, (latest revision)- Overflow. Provide welded joint steel overflow pipe as indicated on Drawings suitably supported and extending to grade level; diameter of overflow as indicated on Drawings. Provide overflow weir box designed to handle flow as follows:
    a. JAN Border Tank 2.9 cfs (1,300 gpm) at high water level.

12. Roof Ladder: As indicated on Drawings and designed to meet OSHA Standards, and AWWA D100, (latest revision). Ladder must extend to 2' off the ground.

13. Safety Cages, Rest Platforms, Roof-Ladder Handrails or Other Safety Devices: AWWA D100, (latest revision).

    a. Safety Devices: Provide safety cable, complying with OSHA Standards, along entire ladder length.

    b. Provide anchor points for operator to connect lanyards, "pelicans" or similar personal safety devices, complying with OSHA standards, at three points along roof of tank: near top of ladder, between center of tank and roof hatch, and near center of tank.

    c. Ladder shall be secured with a side opening security door.

14. Special Vent Required for Screening of Tank Vent: AWWA D100, (latest revision) - Vent. Mushroom vent above maximum water level of sufficient size to accommodate maximum inlet and outlet water flow. The overflow pipe shall not be considered a tank vent. Provide aluminum, fiberglass, or bronze insect screen, 24-mesh. Vent shall be frost proof. Maximum water flow as follows:

    a. JAN Border Tank 2.9 cfs (1,300 gpm) at high water level.

15. Hatch: Provide tank roof hatch with curbed, upward opening 24" or 36" square manway. The curb shall extend at least 4 inches above the tank. The hatch cover lip shall be hinged and provisions made for locking. The hatch cover lip should extend for a distance of 2 inches down on the outside of the curb.

16. Water Level Indicator: A water level indicator shall be furnished including target, cable, floats, channel, guides, etc., as required for complete assembly.

17. Target cables shall be provided with guides to prevent cables from tangling with target.

18. Additional Accessories: AWWA D100, (latest revision) - Additional Accessories.

19. Butt-Joint Welds: AWWA D100, (latest revision) - Welding. Modify to indicate lap welds tack welded on one side are not permitted. Seal welding is required.

20. Written Report Certifying Work: Prepare and submit as specified in AWWA D100, (latest revision).

21. Submit radiographic film and test segments.

22. Complete-Joint-Penetration Welded Shell Butt-Joints: Inspection as specified in AWWA D100, (latest revision).

23. Surface Preparation: Refer to Section 09 97 14.
24. Seal Welding: AWWA D100, (latest revision). Provide seal welds for lap joints in wet areas including interior roof surfaces.
25. Soil Investigation and Foundation: AWWA D100, (latest revision). Soil data available for review.
26. Pile-Supported Foundation: AWWA D100, (latest revision). When required, in accordance with manufacturer's design.
27. Effect of Buoyancy on Foundation Design: AWWA D100, (latest revision).
28. Concrete: ACI 318.
29. Vertical Distance from Finished Ground Level to Crown of Inlet and Outlet Pipes at Tank Foundation: AWWA D100, (latest revision). As indicated on Drawings.
30. Specification Sheet for Seismic Data: AWWA D100, (latest revision).
31. Vertical Acceleration: AWWA D100, (latest revision).
32. AWWA D100, (latest revision)
    a. Reinforcing Steel: Modify to use only Grade 60.

2.3 REINFORCEMENT

A. Reinforcing Steel Bars: ASTM A615/A615M, Grade 60, ACI 318, in accordance with Section 03 20 00, as applicable.

2.4 CONCRETE

A. The tank foundation shall be designed by the tank manufacturer based upon the recommendations of a geotechnical engineer to safely sustain the structure and its live loads. The tank foundation design shall be stamped by the tank manufacturer's New Mexico licensed Professional Engineer.

B. Concrete: ACI 318, minimum compressive strength 4,000 psi at 28 days, in accordance with Section 03 30 00, as applicable.

2.5 INLET AND OUTLET PIPE

A. Inlet, outlet, and overflow connections shall conform to sizes and locations specified on Drawings.

B. Inlet and Outlet Pipe: ASTM A53/A53M, Grade B, Schedule 40, steel pipe, welded joints.

C. Coatings: Refer to Section 33 11 13 – Public Water Transmission Systems.

2.6 OVERFLOW PIPE

A. Overflow Pipe: ASTM A53/A53M, Grade B, Schedule 40, steel pipe, welded joints.

B. Coatings: Shall match interior and exterior coatings of the tank.

2.7 OTHER MATERIALS

A. Furnish other materials in accordance with AWWA D100, (latest revision) to complete installation.

2.8 FABRICATION

A. AWWA D100, (latest revision)- Shop Fabrication: No changes or modification to this Section.

2.9 DELIVERY

A. All tanks, structures and miscellaneous parts shall be packaged for shipment in such a manner as to prevent abrasion or scratching.

B. Delivery will be accomplished on specially designed, self-loading trailers featuring air-ride suspension. Silos will be unloaded by vendor and left in a horizontal position.

C. Final location of water storage tank shall be verified onsite by Owner.

2.10 SOURCE QUALITY CONTROL

A. Section 01 00 00 - Quality control requirements.

B. Inspect and test welds as follows:

1. Examine weld joints in accordance with AWWA D100, (latest revision).

2. Comply with procedure requirements of AWWA D100, (latest revision) prior to proceeding with radiographic work.

3. Immediately notify Engineer of weld locations failing to meet standards of AWWA D100, (latest revision).

4. Repair and reinspect defective welds until acceptable.

5. Tank weld testing is not covered by the testing allowance. All weld testing shall be incidental to the cost of the tank.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify elevations and grading for tank and location of tank.

C. Refer to Section 31 22 13 for rough grading and Section 31 23 23 for backfill requirements.

3.2 INSTALLATION

A. Install tank and tank foundations in accordance with AWWA D100 and the following:

1. AWWA D100, (latest revision)- Erection:

a. Section 10.9: Delay grouting of column and riser bases until the following is accomplished:

1) Measure differential settlement of foundations before and after incremental loading. When differential settlement exceeds 1 inch between column and riser pipe foundations, re-level tank prior to adding next incremental loading.

2. AWWA D100, (latest revision) - Field Painting and Disinfecting:

a. Field paint. Refer to Section 09 97 14.

b. Areas rendered inaccessible after tank erection such as the spaces between roof plates and rafters shall receive the full coating system prior to erection and/or assembly.

3.3 FIELD QUALITY CONTROL

A. Section 01 00 00 - Testing, adjusting and balancing requirements.

B. Inspection and Testing:

1. Hydrostatic Testing:

a. Test completed and cleaned tank for liquid tightness by filling tank to its overflow elevation with water provided by Owner.

b. Correct leaks disclosed by this test.

c. Drain and legally dispose test water off site.

2. Field Welds: Tested and inspected in accordance with AWWA D100, (latest revision) - Field Inspection.

3. Concrete testing for foundation in accordance with Section 03 30 00, if applicable.

4. Independent NACE inspection of coatings in accordance with Section 09 97 14.

C. Cathodic protection system installed but not to be activated until after 11th month inspection.

3.4 MANUFACTURER'S FIELD SERVICES

A. Furnish field representative experienced in installation of tank to supervise installation.

1. Furnish Installation Certificate attesting tank, tank foundation, and anchor bolts are properly installed and leveled.

3.5 GUARANTEE

A. The water storage tank furnished under these specifications shall be guaranteed for a period of one year from the date of final acceptance thereof against defective material, design or workmanship, which guaranty shall include a rust-free condition of the structure for the same period. In the event of failure of any part or parts during the guaranty period due to the above causes, the affected part or parts shall be replaced promptly, upon notice by the Owner, with new parts, at the site of installation, by and at the expense of the Contractor. The labor incidental to installing replacement or repair portions shall be furnished by the Contractor. The Bidder shall submit with his bid a complete and comprehensive outline of all applicable warranty information for the product they intend to use.

3.6 CLEANING

A. Section 01 00 00 - Final cleaning requirements.

B. Clean interior and exterior of tank to remove debris, construction items, and equipment.

C. Disinfect tank in accordance with Section 33 13 13.

END OF SECTION