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 G 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 30’ wide permanent right-of-way (ROW) or Tribal Access Authorization (TAA) easement, hereinafter referred to as ROW, is established along the proposed waterline and backwash discharge line alignments, 15’ to each side of the centerline. The Contractor must limit all construction activities, staging, and construction traffic to this corridor and other existing access roads and established NTUA ROW.

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

C. 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 limit Staking:

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

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 water treatment site:

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) Building foundations

b) Valves (center of valve)

c) Site piping and appurtenances

d) Fencing

e) 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 surge tank building.

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 building foundations after completion of the foundations, but prior to construction of structures on the foundations.

b. Owner's Surveyor shall survey all valves, vaults, fence corners, culverts, key drainage features, drain pipe outfalls, and other features within the sites.

c. Owners' Surveyor shall survey pressure pipes and drain pipes within the water treatment sites 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, water, or sewer 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

a) For valves within sites, survey operating nut as well as center of valve

3) Centerline of all fittings, such as tees, wyes and ells

4) For flush valves, centerline of all valves and discharge

c. Structures:

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

2) Center of rims for all manholes and vaults

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 available from the Engineer on request.

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. Owner's Surveyor will stake the entire project ROW limits for project in a single mobilization upon Contractor's request, unless otherwise agreed.

3. Contractor shall request a minimum of one-half (1/2) mile of pipe centerline staking at a time, unless otherwise agreed. 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".

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.
3. Section 03 29 00 – Joints in 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 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 29 00

JOINTS IN CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall construct all construction joints, expansion joints and control joints in concrete at the locations shown and formed in accordance with the details shown in the drawings.

B. Related Sections:

1. Section 03 10 00 - Concrete Forms and Accessories.
2. Section 03 20 00 - Concrete Reinforcement.
3. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

A. Federal Specifications:

1.	TSS-S-00227E(3)	Sealing Compound, elastomeric type, multi-component (for Caulking, Sealing, Glazing Buildings and Other Structures)
2.	CRD-C 572	U.S. Army Corp of Engineers Specifications for PVC Waterstop

B. Commercial Standards:

1.	ASTM C 920-86	Specification for Elastomeric Joint Sealants
2.	ASTM D 624-81	Test Method for Rubber Property - Tear Resistance
3.	ASTM D 1752-84	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.3 QUALITY ASSURANCE

A. Construction Joint Sealant: The Contractor shall prepare adhesion and cohesion test specimens as specified herein from each shipment of material received at the jobsite. Sealant shall be stored at room temperature and shall not be stored longer than seventy-five percent (75%) of the manufacturer's stated shelf life.

B. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure:

1. Sealant specimen shall be prepared between two concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1/2-inch. Coated spacers (2-inch by 1-1/2 inch by 1/2-inch) shall be used to ensure sealant cross-sections of 1/2-inch by 2-inches with a width of 1/2-inch.

2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall not exceed twenty-four (24) hours.

3. Following curing period, the gap between blocks shall be widened to 1-inch. Spacers shall be used to maintain this gap for twenty-four (24) hours prior to inspection for failure.

PART 2 PRODUCTS

2.1 Not used.

PART 3 EXECUTION

3.1 JOINT CONSTRUCTION

A. Joint Location: Construction joints, expansion joints and control joints shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. The location of all joints shall be submitted for acceptance by the Engineer.

B. Special care shall be used in preparing concrete surfaces at joints where bonding between two (2) sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls and wall to slab joints. Surfaces shall be prepared by sandblasting and washing for removal of latence or any objectionable material. Joints shall be kept clean until the concrete is placed. Vertical joints shall be clean and free of concrete fins, rock pockets or any objectionable material.

C. Sealant grooves shall be formed as shown on the drawings and shall be protected from damage until final application of the sealant. Care shall be taken to prevent chipping of the sealant grove during removal of forms.

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. Section 03 10 00 - Concrete Forms and Accessories.

2. Section 03 20 00 - Concrete Reinforcement.

3. Section 03 29 00 - Joints in Concrete.

4. Section 03 60 00 - Grout.

5. Section 31 23 23 - Backfill.

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

7. 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 alkalis, 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.

2.8 UNIT MASONRY GROUT

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

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 laitance, 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 the 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 at 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.

2. Section 04 20 00 – Unit Masonry

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 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes split face and smooth face concrete masonry units; fire brick and reinforcement, anchorage, and accessories.

B. The Contractor shall furnish all materials and construct the brick masonry work for the project, complete, including the furnishing, fabrication and placing of reinforcing steel, clips, ties, anchors and the setting of embedded items all in accordance with the requirements of the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. 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 Society for Testing and Materials (ASTM)

1. ASTM C90.
2. ASTM C404 - Standard Specifications for Aggregates for Masonry Grout.
3. ASTM A615 - Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
5. ASTM A92 - Standard Specification for Steel Wire, Plain for Concrete Reinforcement.
6. ASTM C144 - Standard Specification for Aggregates for Masonry Mortar.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C207 - Standard Specification for Hydrated Lime for Masonry.

1.3 CONTRACTOR SUBMITTALS

A. Submit full-sized samples of concrete masonry units of each type, color and texture required. Also submit certification that the product meets ASTM C90, Type I moisture controlled, Grade N units.

B. Submit color chart for mortar.

C. The Contractor shall prepare in accordance with IBC Section 2105a set of five (5) masonry prisms using a representative test batch of mortar and masonry materials to be used in the structure. These prisms shall be tested by a certified testing laboratory. Samples of the trial batch mortar used in preparing the prisms shall also be taken in accordance with IBC Section 2105 and tested by a certified testing laboratory. The prism and mortar test reports shall be submitted to the Engineer prior to beginning masonry

construction. All costs for these preliminary tests shall be paid for by the Contractor, and reimbursed from the Testing Allowance.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with MSJC Code (ACI 530/ASCE 5/TMS 402) and MSJC Specification (ACI 530.1/ASCE 6/TMS 602).

B. The size, color and texture of the masonry units shall be as specified herein under Part 2, Products. The color of the mortar shall be determined in the field, prior to construction, as best matches masonry and approved by the Engineer.

C. During construction, a set of three (3) masonry prisms shall be built and tested in accordance with IBC Section 2105 for each 5,000 square feet of wall area, but not less than one (1) set of three (3) masonry prisms per individual structure. The costs of sampling, testing and test reports shall be paid for by the Contractor, and reimbursed from the Testing Allowance. The compressive strength of masonry determined in accordance with IBC Section 2105 for each set of prisms shall equal or exceed the minimum strengths specified herein.

D. During masonry construction, filling grout shall be sampled and tested in accordance with IBC Section 2105. The following schedule shall be followed:

1. During grouting operations one (1) test shall be taken per lift. The tests shall consist of three (3) specimens which are made in accordance with IBC Section 2105. Grout compressive strength shall equal or exceed the minimum strengths specified herein.

E. All prism, mortar and grout testing shall be performed by a certified testing laboratory that shall be subject to the approval of the Engineer. All costs of sampling, testing and reporting shall be paid for by the Contractor, and reimbursed from the Testing Allowance. Additional tests requested by the Engineer will be paid for by the Owner, except that tests indicating non-compliance with the Contract Documents shall be paid for by the Contractor.

F. Masonry construction shall be inspected in accordance to IBC Section 1704 by an approved agency as described in Section 1704.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Hot and Cold Weather Requirements: MSJC Specification.

PART 2 PRODUCTS

2.1 UNIT MASONRY ASSEMBLIES

A. Concrete Brick Units: Split face or smooth face, as shown on Drawings, ASTM C55, Grade N, Type I, normal weight, Color TBD by Owner.

B. The minimum masonry assemblage compressive strength, f'm, at age of 28 days shall be 1500 psi.

C. Integrally colored to match Engineer's sample for walls on exterior of building.

D. Concrete Masonry Unit Size and Shape: Nominal modular size of 8 x 16 x 8 inches. Furnish special units for 90 degree corners, bond beams, and lintels.

2.2 ACCESSORIES

A. Reinforcing steel and metal accessories for all reinforced hollow clay masonry:

1. Reinforcing bars: Grade 60, conforming to the requirements of ASTM A615-86 for deformed billet steel for concrete reinforcement.

2. Joint reinforcement manufactured with wire conforming to IBC Section 2105 Joint reinforcement wire formed from wire that has been zinc coated in accordance with the referenced standards, Class I.

B. Mortar: Type S Portland Cement Lime bay proportion with a minimum 28-day 1500 psi. The color of mortar to match adjacent CMU color as selected by Engineer from manufacturer's full range of colors.

C. Grout: Minimum 28-day compressive strength of 2000 psi. Proportions shall be one (1) part Portland Cement, two to three (2-3) parts sand, and not more than one (1) part pea gravel. Grout shall have a slump of 9-inches plus or minus 1-inch. Transit-mixed grout may be used and shall be continually rotated at idle speed from the time the water is added until the grout is discharged.

2.3 MISCELLANEOUS MATERIALS

A. Portland Cement shall be Type I or II, low alkali, conforming to IBC Section 2103 (ASTM C90). Masonry cements or plastic cements will not be permitted.

B. Hydrated lime shall be Type N conforming to IBC Section 2103.

C. Mortar aggregates shall conform to IBC Section 2103 (ASTM C270). Grout aggregate shall conform to Section 2103 (ASTM C404).

D. Water for mixing into mortar or grout shall be clear, potable water.

E. Admixtures other than coloring for use in mortar and grout shall not be used unless approved by the engineer. Coloring admixture for mortar shall be pure mineral oxide pigments delivered in sealed packages providing accurate measured amounts for uniform mix proportioning and color shall be approved by the Engineer.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive Work.

B. All masonry work shall be performed only under weather conditions and in conformance with IBC Section 2104 and subject to the approval of the Engineer.

3.2 PREPARATION

A. Coordinate placement of anchors supplied by other sections.

B. Prior to laying the first course of masonry, the concrete foundation surface shall be clean and free of latence, loose aggregate, grease and curing materials. This surface preparation shall be accomplished by sandblasting or high pressure washing. The surface shall be rough to provide a good bond between foundation concrete, mortar and grout.

C. The foundation shall be sufficiently level such that the bed joint thickness is not less than 1/4-inch nor more than 5/8-inch. The foundation face shall be sufficiently true to line so that the masonry face projects no more than 1/4-inch.

3.3 MATERIAL HANDLING, STORAGE AND PREPARATION

A. Cement, lime and other calcareous materials delivered to the site shall be properly stored and protected from the weather in unbroken bags, barrels or other approved containers which are plainly marked and labeled with the manufacturers' names and brands. Materials shall be stored and handled in a manner which will prevent the intrusion of foreign materials and damage by water or dampness.

B. Masonry units shall be handled with care to avoid chipping and breakage and shall be protected from contact with the earth and exposure to the weather and shall be kept dry and clean until used. Materials stored on newly constructed floors shall be stacked in such a manner that the uniformly-distributed loading does not exceed 30 psf.

C. Reinforcing steel and all embedded items shall be stored off the ground and shall be protected from mud, oil, concrete, mortar, grout and weather conditions that will cause excessive rusting.

3.4 INSTALLATION

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Coursing of Concrete Masonry Units:

1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal eight [8] inches.

3. Mortar Joints: Concave.

C. Placing and Bonding:

1. Masonry units shall be placed in the pattern and per the details called for on the Drawings. All work shall be plumb, level and true to line with all corners and angles square unless otherwise indicated on the Drawings. Interlock intersections and external corners.

2. Isolate masonry partitions from vertical structural framing members with movement joint as indicated on Drawings.

3. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

4. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges.

5. Vertical and horizontal mortar joints shall be 3/8-inch and tooled to a concave pattern.

D. Set or embed all required anchors, bolts, reglets, sleeves, conduits and other items as called for in the Drawings. Protect all adjoining work including door jams and corners from damage or disturbance during the masonry work. Protect all sills, ledges and offsets from droppings of mortar.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

F. Reinforcing Steel:

1. Reinforcement bar details to conform to ACI 530/ASCE 5-05/TMS 402 and placed as shown on the Drawings. All dowels shall be in proper location prior to start of the work. Secure reinforcing bars in their proper position.

2. Horizontal joint reinforcement to conform to ACI 530/ASCE 5-05/TMS 402 and placed as shown on the Drawings.

3. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum of 16 inches on each side of opening. Place joint reinforcement continuous in first and second joint below top of walls. Lap joint reinforcement ends minimum of 6 inches.

G. Grouting:

1. Grouting operations and conditions to conform to ACI 530 Section 3.5. Only low lift grouting to a maximum height of 5-feet will be permitted during any twenty-four (24) hour period.

2. Grout placed in a continuous pour, consolidated by puddling or mechanical vibrating during placing, and reconsolidated after excess moisture has been absorbed, but before plasticity has been lost.

H. Pointing and Cleaning:

1. At the completion of the work all holes or defective mortar joints in exposed masonry shall be pointed. Defective joints shall be cut out and repointed.

2. Exposed masonry shall be protected against staining from wall grouting or other sources and excess mortar shall be cleaned off the surfaces as the work progresses.

3. At the completion of the work, all exposed masonry shall be cleaned using a dilute acid solution.

4. All waste and surplus masonry materials shall be removed from the job and all stains or dirt from this operation affecting adjacent surfaces shall be removed by an approved cleaning method.

I. Masonry Flashings:

1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls, and turn down on outside face to form drip.
2. Turn flashing up minimum eight [8] inches and bed into mortar joint of masonry seal to concrete or seal to sheathing over wood framed back-up.
3. Lap end joints and seal watertight.
4. Turn flashing, fold, and seal at corners, bends, and interruptions.

J. Lintels:

1. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
2. Maintain minimum six [6] inches bearing on each side of opening.

K. Grouted Components:

1. Reinforce bond beam and pilasters as detailed.
2. Support and secure reinforcing bars from displacement.
3. Place and consolidate grout fill without displacing reinforcing.
4. At bearing locations, fill masonry cores with grout for minimum twelve [12] inches both sides of opening.

L. Control and Expansion Joints:

1. Do not continue horizontal joint reinforcement through control and expansion joints.
2. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

M. Built-In Work:

1. As work progresses, install built-in metal door and frames, window frames, anchor bolts, plates, and other items to be built in the work furnished by other sections.
2. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum twelve [12] inches from framed openings.

N. Cutting and Fitting:

1. Cut and fit for chases, pipes, conduit, sleeves, grounds, etc. Coordinate with other sections of work to provide correct size, shape, and location.

O. Cleaning

1. Remove excess mortar and mortar smears as work progresses.
2. Clean soiled surfaces with cleaning solution.

P. Tolerances

1. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
2. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wall, and roof framing; built-up structural members; shop fabricated trusses; wall and roof sheathing; preservative and fire retardant treatment, sill gaskets, flashings; and roof curbs and cants; blocking in wall and roof openings; wood furring and grounds; electrical panel back boards, concealed wood blocking.

1.2 SUBMITTALS

A. Shop Drawings: Indicate framing system, loads and cambers, bearing details, and framed openings.

B. Manufacturer's catalogs showing rough hardware conforming to or equivalent to hardware shown.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:

1. Lumber Grading Agency: Certified by NIST PS 20.

2. Plywood Grading Agency: Certified by APA/The Engineered Wood Association.

B. Conform to IBC for loads, seismic zoning and other governing load criteria unless more stringent requirements are contained in these specifications or shown in the Drawings.

C. Prefabricated wood trusses shall be designed by or under the direct supervision of a Professional Engineer registered in the State of New Mexico and experienced in the structural design of wood trusses of the type used in this project.

D. Standard framing and spacing shall be used per applicable code requirements.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

A. Lumber Grading Rules: Lumber shall be graded in accordance with the "Standard Grading and Dressing Rules No. 16", of the West Coast Lumber Inspection Bureau (WCLIB) or in accordance with "Grading Rules for Western Lumber", published by Western Wood Products Association, as specified herein.

B. Grade Marking: Each piece of lumber shall bear the official grade mark of recognized grading agencies, using one of the above-mentioned grading rules.

C. Size Dressing: All lumber, except as otherwise shown or specified herein, shall be dressed to size in accordance with the standards of the association under which the lumber is graded. All lumber shall be S4S unless otherwise shown.

D. Drying: All lumber incorporated in the work, except where otherwise specified, shall be air or kiln dried to a moisture content of not more than 19% and not less than 1%.

E. All wood nailing blocks, sills and plates resting on or embedded in concrete or masonry within 18-inches of grade shall be pressure-treated in accordance with American Wood Preservers' Association Manual of Recommended Practice, Standard for Preservative Treatment by Pressure Process-All Timber Products, Cl. Preservative shall conform to American Wood Preservers Assn. and American Wood Preserves Bureau Standard Specifications referenced in Paragraph entitled, "References Specifications, Codes and Standards". Creosote shall not be used.

F. Wherever necessary to cut, notch, dap, drill or frame treated lumber, newly cut or bored surfaces shall be treated with two heavy coats of the same preservative used in the original treatment. The minimum penetration depth shall be 1/4-inch.

2.2 SHEATHING MATERIALS

A. Plywood Roof and Wall Sheathing: Plywood shall conform to the requirements of U. S. Product Standard PS 1, as specified herein. All plywood panels shall be marked with grade mark of the American Plywood Association. The mark shall identify the plywood as to species, glue type and grade in compliance with the applicable commercial standard. Except as otherwise specified below or shown, plywood shall be Douglas Fir, Exterior, C-D, SlS.

B. Telephone and Electrical Panel Boards: Plywood.

2.3 SHOP FABRICATED TRUSSES

A. Except where more restrictive requirements are shown on the Drawings, listed below or contained in the local building code, metal-plate-connected wood roof trusses are to be designed in accordance with the applicable provisions of the latest edition or revision of "Design Specification for Metal-Plate-Connected Wood Trusses", published by the Truss Plate Institute.

B. Manufacturers:

1. J.D. Adams Company
2. Alpine Engineered Products, Inc.
3. Gang-Nail Systems, Inc.
4. Hydro-Air Engineering, Inc.
5. Substitutions: Permitted if approved by Engineer.

C. Design Roof Live Load = 20psf; Roof Snow Load = 25psf and Dead Load: 10 psf with deflection limited to 1/240.

D. Truss Type: Plate connected.

E. Verify dimensions and site conditions prior to fabrication.

F. Fabricate steel connector plates to size, configuration and thickness required to properly transfer member loads.

G. Cut members accurately to length to achieve tight joint connections.

H. Jig trusses during fabrication to assure accurate configuration.

I. Press connectors into lumber, both sides of joint simultaneously.

2.4 ACCESSORIES

A. Fasteners: Galvanized steel for exterior, high humidity, and treated wood locations, plain finish elsewhere.

B. Die Stamped Connectors: Minimum 20 gauge (0.036 inches thick), galvanized steel.

C. Structural Framing Connectors: Galvanized steel, sized to suit framing conditions.

D. Rough Hardware: The term "rough hardware" shall include nails, screws, lag screws, bolts, nuts, washers, plates, metal fasteners and framing anchors; anchor bolts which are to be embedded into concrete, concrete masonry or brick masonry; and similar items employed in erection and construction of the rough carpentry work. Rough hardware shall be of standard manufacture, approved by a recognized agency for the intended applications and shall be provided with laboratory test results on capabilities when requested by the Engineer. All hardware items shall be steel unless specified or shown otherwise.

E. Building Paper: ASTM D226 No. 15 asphalt felt.

PART 3 EXECUTION

3.1 FRAMING

A. Erect wood framing members in accordance with applicable code. Place members level and plumb. Place horizontal members crown side up.

B. Rough carpentry shall be as shown, specified and as necessary to complete work. The Contractor shall verify drawing dimensions with actual field conditions and shall inspect related work and adjacent surfaces and shall report to the Engineer all conditions that could prevent proper execution of this work.

C. Timber connectors and installation thereof shall conform to applicable requirements of AITC 104 and AITC 105 of the Timber Construction Manual of the American Institute of Timber Construction.

D. Strength Considerations: Structural wood framing member shall not be spliced between bearing points or supports. Place framing so that structural and other important members do not require cutting for openings, pipes, vents, conduits or ducts. Bearing surfaces on which wood structural members are to rest shall be finished to give full, true and even support. Wedges or shims shall not be used to correct faulty work. Wood members, which have been split or otherwise damaged to such an extent as to impair their strength, shall be removed and replaced. Members shall not be cut, notched nor bored more than 1/4 of their depth without adequate and approved reinforcing.

E. Blocking and Backing: All blocking and backing in walls and ceilings shall be nominal 2-inch thick material of a depth as needed and shall be accurately located around light fixtures, ceiling register, grilles and other required mechanical and electrical items. The

blocking shall fit snugly and shall be spiked into the supporting framing members. Wood blocking (backing) to receive sheathing, siding, metal lath and gypsum board shall be provided wherever necessary for securing the facing materials.

F. Place full width continuous termite shield and sill flashing on foundations.

G. Place sill gasket directly on sill flashing.

H. Frame double joist headers at ceiling openings. Frame rigidly into joists. Frame double joists under wall studding.

I. Bridge framing in excess of 8 feet span at mid-span members. Fit solid blocking at ends of members.

J. Curb roof openings except where curbs are provided. Construct curb members of single pieces for each side.

3.2 SHEATHING

A. Secure wall sheathing with ends staggered, over firm bearing.

B. Place building paper over wall sheathing, weather lap joints and end laps, staple in place.

C. Install electrical panel backboards with plywood sheathing material where required. Size backboard by 12 inches beyond size of electrical panel.

3.3 SHOP FABRICATED TRUSSES

A. Verify that supports and openings are ready to receive trusses.

B. Verify that sufficient end bearing area exists.

C. Install trusses in accordance with the applicable provisions of "Commentary and Recommendations for Handling and Erecting Wood Trusses" of the Truss Plate Institute.

D. After trusses have been placed leveled, aligned and plumbed and temporary bracing is in place, reset, in accordance with manufacturer's directions, any connection plates that may have been loosened.

E. Bracing:

1. Before applying any superimposed loads, place permanent bridging, bracing and anchors.

2. Unless other bracing is shown on the Drawings, provide bracing in accordance with the applicable provisions of "Bracing Wood Trusses: Commentary and Recommendations" of the Truss Plate Institute.

F. Do not field-cut trusses or remove any truss members.

G. Place headers and supports to frame openings required.

H. If, in the opinion of the Engineer, any damaged trusses cannot be satisfactorily repaired, the damaged trusses shall be removed from the project and replaced with trusses acceptable to the Engineer.

3.4 SITE APPLIED WOOD TREATMENT

A. Treat site-sawn cuts. Brush apply two coats of preservative treatment on untreated wood in contact with cementitous materials and roofing and related metal flashings.

B. Allow preservative to cure prior to erecting members.

END OF SECTION

SECTION 08 11 13

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes steel doors, panels, hinges, closers, thresholds and frames.

B. Related Sections:

1. Section 08 71 00 Door Hardware

1.2 REFERENCES

A. ANSI A156.1 – Butts and Hinges

B. ANSI A156.18 – Materials and Finishes

C. ANSI 250.8 - Recommended Specifications for Standard Steel Doors and Frames.

D. ANSI A250.10 – Test procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

E. ASTM A653/A653 M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot Dip Process

F. ASTM C1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

1.3 SUBMITTALS

A. Product Data: Submit door and frame configurations, location of cut-outs for hardware reinforcement.

B. Samples: Submit two samples of metal, door frame and door face illustrating shop finish colors and surface texture.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:

1. ANSI 250.8 - Recommended Specifications for Standard Steel Doors and Frames.

2. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

3. Fire Rated Doors, Panels and Frames:

a. Product Construction: NFPA 252 – Standard Methods of Fire Tests of Door Assemblies.

b. Product Installation: NFPA 80 – Standard for Fire Doors and Other Opening Protectives.

PART 2 PRODUCTS

2.1 STEEL DOORS AND FRAMES

A. Manufacturers:

1. Amweld Building Products, Inc.
2. Ceco Door Products.
3. SW Fleming Limited.
4. Habersham Metal Products.
5. Kewanee Corp.
6. Steelcraft.
7. Substitutions: Permitted.

B. Product Description: Standard shop fabricated steel doors, and frames; fire rated and non-rated types; flush face or stile and rail design.

2.2 COMPONENTS

A. Exterior Doors (Insulated): ANSI A250.8, 1-3/4 inch thick.

1. Level 1 - Standard Duty, Model 2, seamless design.

B. Exterior Frames:

1. Level 1 for Door Models, nominal 18 gage/0.042 inch thick material, base metal thickness.

C. Door Core: Polystyrene foam.

D. End Closure: Channel, 0.04 inch thick, flush.

E. Thermal Insulated Door: Total insulation R-Value of 7, measured in accordance with ASTM C1363.

2.3 ACCESSORIES

A. Removable Stops: Rolled steel channel shape. Primer: ANSI A250.10 rust inhibitive type.

B. Heavy Duty Hinges: ANSI A156.1, full mortise type, complying with following general requirements unless otherwise scheduled.

1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
2. Number: Furnish minimum three hinges to 90 inches high, four hinges to 120 inches high for each door leaf.
    a. Fire Rated Doors to 86 inches High: Minimum three hinges.
    b. Residential Hollow Core Wood Doors: Furnish minimum two hinges.
3. Size and Weight: 4-1/2 inch heavy weight typical for 1-3/4 inch doors.
    a. Doors over 40 inches Wide: Extra heavy weight ball or oilite bearing hinges.

b. Doors 1-3/8 inch Thick: 3-1/2 inch size.

c. Doors 2 inch Thick: 5 inch extra heavy weight ball or oilite bearing.

d. Doors over 48 inches Wide: 5 inch extra heavy weight ball or oilite bearing.

4. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked outswinging doors, non-rising pins at interior doors.

C. Weatherstripping: Resilient vinyl set in aluminum retainer.

D. Heavy duty cane bolt and gate stop assembly to hold open doors:

1. 5/8” diameter, 36” long, black steel cane bolt.

a. Bolt must be able to be kept in the ‘up/unengaged’ position, such that operator need not hold the bolt up as door is opened or closed.

2. Minimum 6” throw, or more to allow full engagement with the gate stop set into concrete porch or driveway.

3. Gate stop shall be a field type gate center stop (set in concrete porch or driveway), part number HS 015 913-34 (custom) as by Hardware Specialties of Albuquerque, OAE

a. 3”x5” rectangular cold-plate steel formed with 7/8” wide by 1” deep at center concave channel.

b. 5/8” diameter, 5” long cold rolled steel bar affixed to bottom center of plate.

E. Closers: ANSI A156.4 modern type with cover closers; full rack and pinion type with steel spring and non-freezing hydraulic fluid; closers required for fire rated doors unless otherwise indicated.

1. Adjustability: Furnish controls for regulating closing, latching, speeds, and back checking.

2. Arms: Type to suit individual condition; parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees.

3. Location: Mount closers on inside of exterior doors, room side of interior doors typical; mount on pull side of other doors.

4. Operating Pressure: Maximum operating pressure as follows.

a. Interior Doors: Maximum 5 pounds.

b. Exterior Doors: Maximum 8.5 pound.

c. Fire Rated Doors: As required for fire rating, maximum 15 pounds.

F. Door Controls and Overhead Holders: Furnish with accessories as required for complete operational installation.

1. Manual Door Holders and Overhead Stops: ANSI A156.8, Grade 1 types as specified.

2.4 FABRICATION

A. Fabricate doors and frames with hardware reinforcement welded in place.

B. Attach astragal to fire rated doors.

C. Configure exterior frames and doors with profile to receive recessed weatherstripping.

D. Fabricate frames as face welded units.

E. Fabricate frames to suit masonry wall coursing with 4 inch head member.

F. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

G. Prepare interior frames for silencers and install.

H. Frame Mullions for Double Doors: Removable type, with profile matching jambs.

I. Frame Transom Bars: Fixed type, with profile matching jamb and head.

J. Attach fire rating label to each fire rated door and frame.

2.5 FINISHES

A. Provide shop-applied primer after fabrication:

1. Prior to shop painting, surfaces shall be cleaned with solvents to remove any grease or oil, and with power wire-brushing or sandblasting to remove loose rust, loose mill scale and other foreign substances.

2. Primer: Rust inhibitive paint suitable as a base for finish coating.

B. Door manufacturer shall provide finish powder coating of the surfaces of the door prior to shipment, per coating manufacturer's instructions, color to be selected by Owner.

C. Steel Sheet: Shop finished galvanized to ASTM A653/A653M A40.

D. Finishes: ANSI A156.18; furnish following finishes unless otherwise noted.

1. Hinges:

a. BHMA 630 and 626, satin finish.

2. Typical Exterior Exposed and High Use Interior Door Hardware:

a. BHMA 630, satin finished stainless steel.

3. Typical Interior Door Hardware:

a. BHMA 626, satin chromium plated brass or bronze.

4. Closers: Finish appearance to match door hardware on same face of door.

a. BHMA 628, satin aluminum, clear anodized.

5. Thresholds: Finish appearance to match door hardware on exterior face of door.

a. BHMA 628, satin aluminum, clear anodized.

6. Other Items: Furnish manufacturer's standard finishes to match similar hardware types on same door, and maintain acceptable finish considering anticipated use and BHMA category of finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install doors and frames in accordance with ANSI A250.8.

B. Mounting Heights from Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes where not otherwise indicated. Coordinate with Section 08 71 00.

1. Top Hinge: Jamb manufacturer's standard, but not greater than 10 inches from head of frame to center line of hinge.

2. Bottom Hinge: Jamb manufacturer's standard, but not greater than 12-1/2 inches from floor to center line of hinge.

3. Intermediate Hinges: Equally spaced between top and bottom hinges and from each other.

4. Hinge Mortise on Door Leaf: 1/4 inch to 5/16 inch from stop side of door.

C. Coordinate door frames with masonry wall construction for frame anchor placement.

D. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

E. Install door louvers plumb and level.

F. Finish/Coating:

1. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

2. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3. Door manufacturer shall provide finish powder coating of the surfaces of the door prior to shipment, per coating manufacturer's instructions, color to be selected by Owner.

G. Adjust door and hardware for smooth and balanced door movement.

H. Cane bolt and gate stop assembly to hold open doors:

1. Cane bolts must be factory welded to doors for pre-fabricated buildings.

2. If cane bolt assembly welded to door in field, touch-up paint and door finish as needed after welding.

3. Weld cane bolt assembly to steel door so as to allow 6" of throw, or more if needed to ensure bolt fully engages the field type gate center stop when bolt is in 'down' position. Bottom of bolt shall be held flush or slightly above bottom of door when disengaged.

4. After building is in place with doors and cane bolts installed, set gate stop in wet concrete so that plate is flush with finished surface and channel is perpendicular to door's swinging path when fully open. Before the concrete sets verify that angle and position of gate stop will allow bolt to fully engage the gate stop at the center of the gate stop.

I. Tolerances:

1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit adjacent work to damage hardware or hardware finish.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Overhead coiling insulated doors.

B. Related Sections:

1. Section 06 10 00 - Rough Carpentry.
2. Section 08 71 00 - Door Hardware.

1.2 REFERENCES

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

1. ASTM A123 Zinc [hot-dipped galvanized] coatings on iron and steel products.
2. ASTM A229 Steel wire, oil-tempered for mechanical springs.
3. ASTM A-653-94 Steel sheet, zinc-coated [galvanized] by the hot-dipped process, commercial quality.
4. ASTM E330 Structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.
5. ASTM E413-87 Sound transmission class acoustical performance value = 22.
6. ANSI/DASMA 203 American National Standards Institute Specifications for non-rated fire rolling doors published by Door & Access Systems Manufacturers Association International.

1.3 DESIGN / PERFORMANCE REQUIREMENTS

A. Overhead coiling insulated doors:

1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf without damage to door or assembly components while closed and while in operation.
2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

B. Single-Source Responsibility: Provide doors, tracks, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 00 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color charts representing manufacturer's full range of available colors and patterns. Color to be determined by owner.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weather tight location.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. Overhead Door Corp.

a. Stormtite 625 Series

2. Wayne Dalton Corp.

a. 800C Series

3. Requests for substitutions will be considered in accordance with provisions of Section 01 00 00.

2.2 INSULATED OVERHEAD COILING SERVICE DOORS

A. Overhead Coiling Insulated Service Doors:

1. Curtain: Interlocking roll-formed slats

a. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

b. Flat profile type F-265I or #14 flat slats.

c. Front slat fabricated of:

1) Minimum 20 gauge galvanized steel.

d. Back slat fabricated of:

1) Minimum 20 gauge galvanized steel.

e. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation, with minimum R-value of 7.7 (U = 0.15).

2. Finish:

a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A653 and receive rust-inhibitive, roll coating process, including minimum thickness of 0.2 mils thick baked-on prime paint, and minimum thickness of 0.6 mils thick baked-on polyester top coat.

1) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

2) Top Coat Color:

a) Powder coating finish in color as selected by Owner from manufacturer’s standard colors.

3. Weatherseals:

a. Vinyl bottom seal, exterior guide and internal hood seals.

4. Bottom Bar:
    a. Two prime painted steel angles minimum thickness 0.121 inch bolted back to back to reinforce curtain in the guides.
5. Guides:
    a. Three prime painted structural steel angles with minimum thickness of 3/16 inch.
    b. Guides weatherstripped with a vinyl weather seal at each jamb, on the exterior curtain side.
6. Brackets:
    a. Hot rolled prime painted steel with minimum thickness of 3/16 inch to support counterbalance, curtain and hood.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to maximum of 0.033 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8. Hood: Provide with internal hood baffle weatherseal.
    a. Minimum 24 gauge galvanized steel with intermediate supports as required.
9. Manual Operation:
    a. Chain hoist.
10. Locking:
    a. Chain keeper locks for chain hoist operation.
    b. Door shall have interior slide bolt lock suitable for padlocks (padlocks to be provided by others).
11. Wall Mounting Condition:
    a. Face-of-wall mounting to masonry

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Owner of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, utilizing authorized manufacturer's representative if required by manufacturer.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Install perimeter trim and closures.

F. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hardware for steel doors.

1. Provide door gaskets, including weather-stripping and seals, and locksets.

B. Related Sections:

1. Section 08 11 13 Steel Doors and Frames

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI A156.2 - Bored and Preassembled Locks and Latches.
2. ANSI A156.3 - Exit Devices.
3. ANSI A156.4 - Door Controls - Closures.
4. ANSI A156.5 - Auxiliary Locks and Associated Products.
5. ANSI A156.6 - Architectural Door Trim.
6. ANSI A156.7 - Template Hinge Dimensions.
7. ANSI A156.8 - Door Controls - Overhead Holders.
8. ANSI A156.12 - Interconnected Locks and Latches.
9. ANSI A156.13 - Mortise Locks and Latches.
10. ANSI A156.14 - Sliding and Folding Door Hardware.
11. ANSI A156.15 - Closer Holder Release Devices.
12. ANSI A156.16 - Auxiliary Hardware.
13. ANSI A156.18 - Materials and Finishes
14. ANSI A156.19 - Power Assist and Low Energy Power Operated Doors.
15. ANSI A156.23 - Electromagnetic Locks.
16. ANSI A156.24 - Delayed Egress Locks.
17. ANSI A156 - Complete Set of 24 BHMA Standards (A156 Series) with Binder.

B. Builders Hardware Manufacturers Association:

1. BHMA Directory of Certified Products.

C. National Fire Protection Association:

1. NFPA 80 - Standard for Fire Doors, Fire Windows.

2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

D. Underwriters Laboratories Inc.:

1. UL 10B - Fire Tests of Door Assemblies.
2. UL 305 - Panic Hardware.
3. UL - Building Materials Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 PERFORMANCE REQUIREMENTS

A. Fire Rated Openings: Provide door hardware listed by UL or Intertek Testing Services (Warnock Hersey Listed), or other testing laboratory approved by applicable authorities.

1. Hardware: Tested in accordance with NFPA 252.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:

1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts.
2. Submit manufacturer's parts lists.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of installed cylinders and their master key code.

C. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

D. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 00 00 - Product Requirements: Product storage and handling requirements.

B. Package hardware items individually with necessary fasteners, instructions, and installation templates, when necessary; label and identify each package with door opening code to match hardware schedule.

1.7 COORDINATION

A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.

1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

B. Sequence installation to accommodate required utility connections.

C. Coordinate Owner's keying requirements during course of Work.

1.8 WARRANTY

A. Furnish five year manufacturer warranty for locksets and door closers.

PART 2 PRODUCTS

2.1 DOOR HARDWARE

A. Manufacturers:

1. Bommer Industries, Inc.
2. Hager Companies.
3. Substitutions: Permitted.

B. Lockset Manufacturers:

1. Yale.
2. Substitutions: Permitted.

C. Closers Manufacturers:

1. Yale.
2. Norton.
3. Substitutions: Permitted.

2.2 COMPONENTS

A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.

1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.
2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware.
    a. Finish: Match hardware item being fastened.
4. Fire Ratings: Provide hardware with UL or Intertek Testing Services (Warnock Hersey Listed) listings for type of application involved.

5. Electrical Devices: Make provisions and coordinate requirements for electrical devices and connections for hardware.

B. Locksets: Furnish locksets compatible with specified cylinders. Typical 2-3/4 inch backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt.

1. Mortise Locksets: ANSI A156.13, Series 1000, Grade 1 unless otherwise indicated.

2. Bored (Cylindrical) Locksets: ANSI A156.2, Series 4000, Grade 1 unless otherwise indicated.

3. Preassembled (Unit) Locksets: ANSI A156.12, Series 2000, Grade 1 unless otherwise indicated.

4. Interconnected Locksets: ANSI A156.12, Series 5000, Grade 1 unless otherwise indicated.

C. Latch Sets: Typical 2-3/4 inch backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt.

1. Mortise Latch Sets: ANSI A156.13, Series 1000, Grade 1 unless otherwise indicated.

2. Bored (Cylindrical) Latch Sets: ANSI A156.2, Series 4000, Grade 1 unless otherwise indicated.

D. Exit Devices: ANSI A156.3, Grade 1 concealed vertical rod type, with cross bar, unless otherwise indicated. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt, with dust-proof floor strikes.

1. Types: Suitable for doors requiring exit devices.

2. Coordinators: Furnish overhead concealed in frame type at pairs of doors.

E. Cylinders: ANSI A156.5, Grade 1, pin type removable cylinders.

1. Keying: Key to existing keying system.

2. Provide eight (8) original keys to Owner.

2.3 ACCESSORIES

A. Through Bolts: Do not permit through bolts and grommet nuts on door faces in occupied areas unless no alternative is possible.

1. Do not use through bolts on solid wood core doors.

2.4 FINISHING

A. Finishes: ANSI A156.18; furnish following finishes except where otherwise indicated in Schedule at end of section.

1. Typical Exterior Exposed and High Use Interior Door Hardware:

a. BHMA 630, satin finished stainless steel.

2. Typical Interior Door Hardware:

   a. BHMA 626, satin chromium plated brass or bronze.

3. Other Items: Furnish manufacturer's standard finishes to match similar hardware types on same door, and maintain acceptable finish considering anticipated use and BHMA category of finish.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify doors and frames are ready to receive door hardware and dimensions are as instructed by manufacturer.

3.2 INSTALLATION

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.

B. Mounting Heights from Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes where not otherwise indicated.

1. Locksets: 38 inch.
2. Push/Pulls: 42 inch.
3. Dead Locks: 48 inch.
4. Push Pad Type Exit Devices: 42 inch.
5. Cross Bar Type Exit Devices: 38 inch.

3.3 ADJUSTING

A. Adjust hardware for smooth operation.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit adjacent work to damage hardware or hardware finish.

3.5 SCHEDULES

A. Hardware Set 1: Fire rated.

1.	Lock:	Mortise lock, Classroom Function.
2.	Closer:	Surface mounted as specified.
3.	Kickplate:	16 inch high, push side only.
4.	Gaskets:	Fire and smoke rated gaskets as specified.
5.	Floor Stop:	Dome type as specified.

END OF SECTION

SECTION 09 92 00

PROTECTIVE ANTI-GRAFFITI COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Materials and methods specifications for the following:

1. GRAFFITI PROOFER® GPA-300 (Anti-graffiti top coat)
2. Sealer Prime SCS-002SP (Concrete primer)

1.2 RELATED DOCUMENTS

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

B. Section 04 20 00 - Unit Masonry

C. Section 08 11 13 - Steel Doors and Frames

D. Section 08 33 23 - Overhead Coiling Doors

1.3 SUBMITTAL REQUIREMENTS

A. General: Submit in accordance with Division 01 00 00.

B. Before any materials are delivered to the job site, the Contractor shall submit a complete list of all materials proposed to be furnished and applied under this section.

C. For each product, the Contractor shall provide the manufacturer's specific application instructions.

1.4 QUALITY ASSURANCE

A. Schedule of References: To the extent specified elsewhere in this Division, comply with the requirements of the following standards and associations.

1. Steel Structure Painting Council Specifications (SSPC).
2. National Association of Corrosion Engineers Standards (NACE).
3. Applicable Standards of American National Standards Institute, Inc. (ANSI).
4. Occupational Safety and Health Act regulations (OSHA).

B. Painter's Qualifications. The Contractor shall cause the work specified under this section to be performed by or under the supervision of a qualified painter. The Contractor shall be prepared to document the painter's experience, competence and ability to comply with the requirements of these specifications and to complete the work in a timely manner.

C. Standard Products. All materials, supplies and articles provided shall be the standards products of recognized, reputable manufacturers. All coatings shall be the products of a single manufacturer. The Contractor shall also minimize the number of suppliers.

D. The standard products of manufacturers other than those specified will be accepted when it is demonstrated to the satisfaction of the Engineer they are equal in composition, durability, usefulness and convenience for the purpose intended.

1.5 DELIVERY AND STORAGE

A. All materials shall be delivered to the job site in their original, unopened containers bearing the manufacturer's name, brand, batch number, date of manufacture, and any special directions. Only the approved material shall be stored at the job site and stored only in designated areas restricted to the storage of paint materials and related equipment. All coatings shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold. Flammable materials shall be stored to conform with state and local safety codes. Materials shall be protected from freezing. Materials exceeding storage life recommended by the manufacturer will be subject to rejection and, if so rejected, removed from the site.

1.6 MANUFACTURER REPRESENTATION

A. Require the manufacturer to make available a qualified technical representative to visit the job site for technical support if necessary, in order to resolve field problems attributable to or associated with the manufacturer's products furnished under this contract.

1.7 PROTECTION OF SURFACES NOT TO BE COATED

A. Protect surfaces and equipment which are not to receive coatings during surface preparation, cleaning and painting operations.

B. Conduct spraying of coatings under controlled conditions. Promptly repair any damage to adjacent work or adjoining property occurring from spray operations.

PART 2 PRODUCTS

2.1 ANTI-GRAFFITI COATING AND PRIMER

A. Products:

1. Anti-graffiti coating: GRAFFITI PROOFER® GPA-300

a. PERFORMANCE CRITERIA:

1) ASTM D6578 - Graffiti Resistance Test (Level 10)

2) ASTM D4587 - Accelerated Weathering

b. TECHNICAL DATA:

1) STORAGE & HANDLING: Store between 40°F (4°C) to 90°F (32°C) in a cool, dry, well-ventilated area, out of direct sunlight and moisture.

2) Keep unused material tightly closed at all times. KEEP FROM FREEZING

2. Primer: Sealer Prime SCS-002SP
    a. PERFORMANCE CRITERIA:
        1) Water Absorption
            a) ASTM C 67 and 642-90: 4% max. after 24hr./75F
        2) Water Vapor Transmission Rate
            a) ASTM E 96-56:11.82 Perms
        3) Water Vapor Transmission
            a) ASTM D1653-93: 4.97 grains/hr/ft2
        4) Household Chemicals
            a) ASTM D1308-97: Pass
    b. TECHNICAL DATA:
        1) STORAGE & HANDLING: Store between 40°F (4°C) to 90°F (32°C) in a cool, dry, well-ventilated area, out of direct sunlight and moisture.
        2) Keep unused material tightly closed at all times. KEEP FROM FREEZING

B. Manufacturer:
    1. SEI Industrial Chemicals
    2. Substitutions: None

PART 3 EXECUTION

3.1 SYSTEM 1 - COATING OF EXTERIOR METAL

A. Area of Application: All exterior metal doors/metal components on the sides of the pump station buildings (areas susceptible to graffiti).

B. Protective coating required:
    1. Two coats of GRAFFITI PROOFER® GPA-300

3.2 SYSTEM 2 - COATING OF SPLIT FACE CONCRETE BLOCK

A. Area of Application: All exterior exposed split face concrete block surfaces.

B. Protective coatings required:
    1. Two coats of Sealer Prime SCS-002SP
    2. Two coats of GRAFFITI PROOFER® GPA-300

3.3 SURFACE PREPARATION

A. ALL SURFACES:

1. The surface is to be dry, clean and free of any foreign matter including corrosion, hydrocarbons, moisture, ice, efflorescence, silicones, fluoro-products, etc.
2. Always test the coatings adhesion and performance before a full application.
3. To help achieve greater coverage rates when applying to a porous substrate, first apply SEI Industrial's SCS-002SP in accordance with manufacturers' suggested application guidelines.
4. Allow porous substrates to dry for a minimum of 72 hours after pressure washing.
5. After rain, allow 48 hours to dry.
6. New concrete should be allowed to cure for 28 days.
7. All caulking and finishing should be done before Graffiti Proofer application.
8. Prior to application, protect all glass, vehicles and surrounding surfaces from overspray.
9. Always apply to a test area before proceeding with entire application.

B. SURFACE TEMPERATURE:

1. 40°F (4°C) to 100°F (38°C).
2. Surface should be dry (at least 5°F (3°C) above the dew point) with no damp or frozen moisture within the substrate.
3. This product will cure slower in lower temperatures.

3.4 COATING APPLICATION

A. TYPICAL COVERAGE RATES:

1. Anti-graffiti coating: GRAFFITI PROOFER® GPA-300

Surface	Square Feet per Gallon	Surface	Square Feet per Gallon
Concrete	125 - 200	Wood	150 - 200
Brick	125 - 175	Rough Painted	175 - 225
C.M.U.	125 - 175	Smooth Painted	225 - 300
Split-Faced Block	125 - 150	Metal(s)	225 - 300
Stucco	150 - 225		

2. Primer: Sealer Prime SCS-002SP

Surface	Square Feet per Gallon	Surface	Square Feet per Gallon
CMU - Fluted	35 - 65	Rough Wood	50 - 80
CMU - Split face	30 - 60	Smooth Wood	80 - 125
CMU - Smooth	80 - 100	Wood Shingles	70 - 90
Rough/cracked	30 - 60	Smooth Stone	100 - 125
Exterior Brick	60 - 80	Metal(s)	150 - 300
Concrete	80 - 100	Smooth Painted	150 - 170
Concrete Block	80 - 100	Rough Painted	100 - 150
Stucco	60 - 80		

B. CURING TIMES:

1. Anti-graffiti coating: GRAFFITI PROOFER® GPA-300

a. CURING TIMES @ 75°F (24°C):

1) To Touch: 2 - 3 hours

2) Full Cure: 4 - 5 hours (Full moisture and graffiti protection)

3) To Recoat: 30 min. - 2 hours

2. Primer: Sealer Prime SCS-002SP

1) CURING TIME: 75F (24C):

a) Dry Time: 45min. - 1 hour

b) To Recoat: 30 minutes

C. APPLICATION LIMITATIONS:

1. LIMITATIONS:

a. Product application must not be initiated during inclement weather or when precipitation appears to be imminent.

b. Product must not be applied to wet, frozen or dirty surfaces.

c. Product must not be applied when conditions are windy as over spray is a hazard and environmental contaminants dispersed from windy conditions can land in the coating during curing.

d. Always apply test area before proceeding with entire application.

D. GRAFFITI PROOFER GPA-300

1. GENERAL INFORMATION:

a. For optimum performance, allow individual coats to fully cure before applying the next application.

2. MIXING:

   a. Mix well by shaking the product container. After mixing, ensure the product is clear in appearance, consistent in thickness and that there is no settled/cured material within the container. Any cured or foreign material must be removed, by pouring the product through a paint strainer, prior to application.

3. POT LIFE & THINNING:

   a. Do not thin. Pot life can vary dependent upon temperature and humidity. Application time should not exceed 8 hours after the product has been opened.

4. EQUIPMENT:

   a. Apply via HVLP, airless sprayer, pump sprayer, aerosol can, roller or brush. Use a flood coat and apply liberally.

5. ROLLER:

   a. Use a ½" synthetic nap roller. Apply to porous substrates from the bottom up. To help ensure the product penetrates porous substrates, saturate the roller and apply slowly, allowing excess product to build on top of the roller.

6. SPRAY:

   a. Use a clean, independent line when spraying and use a .011 -.021" spray tip. Apply from top to bottom, chasing runs, and back-roll if needed. This will typically provide a 6 MIL WFT and 2 MIL DFT. Product can be applied wet-on-wet or wet-on-dry. For optimum performance allow the first coat to fully dry and cure before applying the second coat.

7. CLEANUP:

   a. Flush and clean all equipment immediately after use. MEK (Methyl Ethyl Ketone) is the preferred cleaning solvent, but mineral spirits may also be used. If flushing with mineral spirits, extreme care must be taken to ensure that ALL product is removed from spray lines.

8. APPLICATION TIPS:

   a. Ensure primer is fully cured before applying Graffiti Proofer.

   b. Ensure coverage is uniform by standing 2"- 3" away from the substrate while standing parallel to the surface (looking across the substrate at a 180° angle). The applied film should appear shiny across the entire surface. Reapply the Graffiti Proofer to any areas that are visually dull in appearance.

   c. Once cured, use a dry cloth to rub back and forth across the Proofer's surface. If this causes the Proofer to ball up and release from the surface, a second coat should be applied, allowed to cure and retest again. If rubbing the dry film with a dry cloth does not remove the Proofer from the substrate, proceed with the next step to test graffiti removal performance.

The Dry Film Thickness (DFT) must be 2 mils or greater (6 mil WFT) to ensure proper graffiti removal performance.

9. Upon completion of all coating activities, the Contractor shall remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other coating-related damage.

E. SEALER PRIME SCS-002SP

1. GENERAL INFORMATION:

   a. SCS-002SP is designed for above grade use only.

   b. Take special care to saturate joints, cracks and large pores.

   c. When first applied, the emulsified resins appear milky white. The micro emulsions will then coalesce drying clear and colorless. The milky appearance should last no longer than approximately 30 minutes.

   d. When applying the SCS-002SP for use a prime coat, always test an inconspicuous area to determine how fast the sealer is absorbed into the substrate. After the test application, let dry for 30-60 minutes and then feel the dry film on the substrate. Press your thumb firmly against the dry film and pull back slowly; one should feel a sticky sensation. If this is not experienced the SCS-002SP has not provided a sufficient film and an additional coat should be applied.

2. WATER BEAD TEST:

   a. Spray water onto the dry film with a trigger spray bottle. Water will either bead on the surface or darken/wet out the underlying substrate, which indicates absorption and an additional coat should be applied. If the water beads and does not absorb or darken the substrate the film is providing some moisture protection. For further and more in depth technical testing use a Rilem Tube to test the film’s moisture resistance. If the SCS-002SP has passed the Water Bead and/or Rilem Tube test(s), the coating is intact and ready for an application of a topcoat.

3. MIXING:

   a. Mix well by shaking the product. Ensure there is no settled/cured material on the film or within the container. Cured or foreign matter must be removed prior to application.

4. POT LIFE & THINNING:

   a. Do not thin. Pot life can vary depending temperature and humidity but typically open product can be used for up to 1 month if sealed and stored according to specification.

5. APPLICATION EQUIPMENT:

   a. Mix or shake well before application. Ensure product is consistent in thickness after stirring. Apply via HVLP, airless sprayer, pump sprayer, roller or brush. Use a flood coat and apply liberally.

b. Roller:

1) Use ½" synthetic nap roller. To a porous substrate apply from the bottom up. Excess buildup of product can accumulate on roller. Allow the product to saturate and flood the top of the roller and apply slowly as this will allow product to penetrate the substrate.

c. Spray:

1) Apply with low pressure using a tip size ranging from .011-.021". Back roll if needed. Apply from top to bottom chasing runs. Product can be applied wet on wet or wet on dry. For optimum performance allow the first coat to fully dry and cure before applying the second coat.

2) Hold spray tips 4-12 inches from the surface depending on application and substrate, start at the top and work down the substrate chasing the run with an overlapping horizontal spray pattern.

6. CLEAN UP:

a. Flush and clean all equipment immediately after using warm soapy water.

7. STORAGE & HANDLING:

a. Must be stored and handled in compliance with all current local regulations for flammable liquids. Store in cool, dry, well-ventilated areas, out of direct sunlight and moisture.

8. GENERAL APPLICATION NOTES:

a. Allow a minimum of 2 hours to cure before proceeding with water-bead testing as described below.

b. Spray water via a hand-pump or trigger sprayer onto the application area to determine if any substrate darkening occurs. If a sufficient amount of SP has been used, the substrate should not darken and the water will bead up on the surface. Water may also be sprayed onto an uncoated area to determine the highest level of darkening to compare against. If an unacceptable amount of darkening occurs on the SP applied area, and water does not simply bead up and run off the surface, an additional coat of SP should be applied, allowed to cure and the surface should be retested for darkening via the same water test method. If a second coat of SP prevents the substrate from darkening when using the water test method, it may be possible to decrease the coverage rates for the first coat of SP to alleviate the need for applying a second coat.

c. Substrate areas that have received concrete patching material may have increased absorbency and may require more SP to be applied while carrying out the initial product application.

9. Upon completion of all coating activities, the Contractor shall remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other coating-related damage.

3.5 TESTING

A. GRAFFITI PROOFER GPA-300

1. A minimum of 24 hours curing time is ideal before testing graffiti removal performance.
2. When testing the Proofer's cured film for graffiti removal performance, apply spray paint to a small inconspicuous area and allow the spray paint to fully cure before proceeding with its removal.
    a. Not allowing the spray paint to fully cure before removing it, may damage the Proofer's film.
3. A dry cloth is an acceptable means of testing for removing graffiti from the cured film; however, dampening the cloth with water will allow it to slide across the protective coating much easier. If the coating film is of proper thickness, spray paint should be easily removed.

3.6 REMOVAL OF GRAFFITI

A. Remove graffiti as soon as possible after surface has been vandalized.

B. If the coating has been damaged or removed, make sure the surface is clean and dry and reapply as described in the Application section.

C. Always test chemical cleaners before moving into a full application.

D. Options for removing graffiti:

1. Dry rag or cloth
    a. To remove markers always use a dry cloth first.
2. Pressure washer with pressure setting of less than 1000 psi.
3. Water and no more than 10% detergent with a rag or cloth.
4. SEI's TWL-200 Graffiti Remover Towels
5. SEI's Graffiti Remover GR-SYS-P

E. Flush the coating with water after chemical cleaning to ensure the integrity of the coating.

F. For removing graffiti over large areas, or for removing graffiti from rough surfaces:

1. Use a cold-water pressure washer with a 25 - 40° nozzle and a pressure setting of 1,000 psi or less.
2. Start the flow of water away from the removal area and then reposition the nozzle at a slight angular distance of 4"- 6" from the Graffiti Proofer coated surface.
3. Move the pressure washing wand in a continuous back and forth motion, so as not to focus the nozzle in one location during the graffiti removal.
    a. Focusing the nozzle in one location may damage the Proofer's film.

END OF SECTION

SECTION 26 01 00

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

1.2 ELECTRICAL DIVISION INDEX

26 01 00	General Electrical Provisions
26 05 23	Control Voltage Electrical Wire & Cables
26 11 00	Raceways
26 12 00	Wires and Cables
26 12 16	Transformers
26 13 00	Outlet Boxes
26 13 30	Cabinets
26 14 00	Wiring Devices
26 15 00	Motors
26 15 50	Motor Starters
26 16 00	Panelboards
26 17 00	Motor and Circuit Disconnects
26 18 10	Fuses
26 19 00	Relays and Contactors
26 27 33	Instrumentation and Controls Requirements
26 45 00	Grounding
26 56 00	Exterior Lighting
26 60 10	Lightning Protection
27 43 30	SCADA Radio Telemetry System

1.3 REQUIREMENTS

A. Furnish all labor, materials, service, equipment and appliances required to complete the installation of the complete Electrical System in accordance with the Specifications and Contract Drawings.

1.4 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC) and the terms and conditions of the Electrical Utility and other

authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations and authorities shall be made by the Contractor without additional charge.

B. Underwriters Laboratories (UL) or Factory Mutual (FM): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriters Laboratories, Inc. or Factory Mutual, Inc. The label of, or listing by, UL or FM is required.

C. Standards: Where referenced in these Specifications or on the Drawings, the publications and standards of the following organizations shall apply: Joint Commission on Accreditation of Healthcare Organizations (JCAHO), American Society of Testing and Materials (ASTM), Insulated Power Cable Engineers Association (IPCEA), National Fire Protection Association (NFPA), American National Standards Institute (ANSI), and National Electrical Manufacturers Association (NEMA).

D. Conflicting code requirements shall be brought to the attention of the Engineer. Where two or more codes apply, the most stringent of the codes shall govern.

1.5 SUBMITTALS AND SUBSTITUTIONS

A. Material List: Within 30 days of Contract Award or Notice to Proceed and before material is ordered, the Contractor shall submit for approval a list of all proposed material and equipment, indicating manufacturer's name and general description.

B. Shop Drawings: Submit for approval to the Engineer a minimum of six copies of all shop drawings no later than 30 days after the material list has been approved and prior to ordering any material. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation. Indicate in the transmittal that submittal has been reviewed and accepted and all Contract deviations identified. In addition to specific references or requests; submit shop drawings for the following applicable items: panelboards, lighting fixtures, transformers, primary cable and gear, alarm systems and all special equipment.

C. Substitutions may be requested in accordance with the specification.

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS: The Electrical requirements for equipment specified or indicated on the Drawings are based on information available at the time of design. If equipment furnished for installation has Electrical requirements other than indicated on the Electrical Drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection, grounding, and installation as required to accommodate the equipment supplied, without additional charge to the Owner. All adjustments to the Drawings reflecting the Electrical System shall be delineated in a submittal to the Engineer immediately upon knowledge of the required adjustments. The complete responsibility and costs for such adjustments shall be assigned to the respective section of these Specifications in which the equipment is furnished.

2.2 MATERIALS

A. All similar materials and equipment shall be the product of the same manufacturer.

B. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the Contract requirements and meets the approval of the Engineer.

C. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

2.3 ALTITUDE: Equipment affected by altitude shall perform satisfactorily the function intended at the altitude of the project site.

2.4 WET AREA EQUIPMENT: All equipment within the buildings shall be installed in a NEMA 3R, NEMA 12 or weatherproof enclosure for non-corrosive environments and NEMA 4X for corrosive environments (i.e. chemical rooms of chlorine buildings), unless otherwise noted on the drawings.

PART 3 EXECUTION

3.1 GENERAL: Fabrication, erection and installation of the complete Electrical System shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surface where Electrical equipment or material is to be installed, removed or relocated and report any unsatisfactory conditions to the Engineer before starting work. Commencement of work signifies this Contractor's acceptance of the prevailing conditions.

3.2 TEMPORARY POWER AND LIGHTING: Furnish and install all temporary Electrical facilities required for construction and safety operation. No part of the permanent Electrical Systems or the existing Electrical System may be used for temporary service unless approved by the Engineer.

3.3 UTILITIES

A. GENERAL: The Drawings reflect requirements of the serving utilities based on information derived from representatives of the utilities. During the project design phase, the fact that the Engineer may undertake to show the utility(s) requirements, does not necessarily indicate that the Engineer represents the utilities or their requirements; therefore, within 10 working days after Contract Award and/or Notice to Proceed has been issued, the Contractor shall be responsible for coordinating the requirements of the utilities for the Power System. The Contractor shall be responsible for coordinating the requirements for the Telephone, and Fiber Optic, if applicable.

B. Any deviations from the documents shall be brought to the attention of the Engineer no later than 10 working days after Award of Contract and/or Notice to Proceed. Failure to notify the Engineer within the 10-day time frame signifies the acceptance of documents and utility requirements by the Contractor and all associated costs therein.

3.4 EXCAVATION: Comply with Division 31 “Earthwork”.

3.5 PERFORMANCE TESTS

A. Thoroughly test all fixtures, services and all circuits for proper operating conditions and freedom from grounds, surges, and short circuits before acceptance is requested. All equipment appliances and devices shall be operated under load conditions.

B. After the interior-wiring system installation is complete and at such time as the Engineer may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices and equipment after installation to assure that all material continues to possess all the original characteristics as required by the governing codes and standards as listed in these Specifications.

C. After occupancy of the building has taken place and nominal building power loads have been established, make voltage readings at all panelboards. Based on these readings make final adjustments of taps on all transformers in the building, as directed by the Engineer. Submit to Engineer correspondence and/or drawing delineating readings.

D. Perform such other tests as required by other sections of these Specifications or as requested by the Engineer to prove acceptability.

E. Furnish all instruments and labor for testing.

F. The contractor will provide personnel to configure and startup all VFD's, Radio Transmitter Units (RTU'S) (including video signal or microwave transmission, if required), PLC control panels, starters and any other control or monitoring equipment not listed that was provided and installed by the Electrical Contractor at no additional cost to the owner.

3.6 OPERATING INSTRUCTIONS AND MANUALS

A. Instructions: Without additional charge to the Owner, the Contractor shall provide an experienced and competent representative to instruct the Owner or his representative fully in the concept, theory, operations, adjustment and maintenance of all equipment furnished for the Electrical System. Contractor shall provide at least two (2) weeks notice to the Engineer in advance of this period. Contractor shall provide DVD of instructions to Owner not less than two (2) weeks prior to scheduled final acceptance of the Project.

B. Manuals: Upon completion of the work, prepare and deliver to the Owner three (3) sets of complete operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data. Operating and maintenance manuals as required herein shall be submitted to the Engineer for review and distribution to the Owner not less than two (2) weeks prior to the scheduled final acceptance of the Project.

C. Other: The above requirements are in addition to specific instruction and manuals specified for individual systems or equipment.

3.7 DRAWINGS

A. General: The Electrical Drawings show the general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The Architectural and Structural Drawings shall be considered as a part of the work insofar as these Drawings furnish the Contractor with information relating to the design and construction of the building. Architectural Drawings shall take precedence over Electrical Drawings. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbows, pullboxes and accessories as may be required to meet such conditions.

B. Field Measurements: The Contractor shall verify the dimensions governing the Electrical work at the building. No extra compensation shall be claimed or allowed on account of differences between actual dimensions and those indicated on the Drawings.

3.8 LOCATION OF EQUIPMENT AND OUTLETS

A. The approximate locations of cabinets, panelboards, wiring gutters, switches, lights, light outlets, power outlets, etc., are indicated on the Drawings; however, the exact location shall be determined after thoroughly examining the general building plans and by actual measurements during construction to avoid conflicts with any Structural, Architectural, or other trades, with all locations subject to the approval of the Engineer.

B. Verify with the Engineer all locations of conduit, boxes, etc., stubbed in the floor prior to installation.

3.9 IDENTIFICATION AND SIGNS

A. Mark each individual motor controller, disconnect switch, transformer and remote control device to identify each item with its respective service using engraved nameplates.

B. Provide nameplates with engraved lettering not less than 3/8" high where specified or noted. In general, use white core laminated plastic, attached with screws. Embossed plastic adhesive tape is not acceptable. Flush mounted devices may have identification engraved in the device plate.

C. Identify panelboards, transformers and cabinets by engraved nameplates with descriptions indicated on the Drawings together with indication of the location of the feeder overcurrent protection. Install on inside of hinged doors or panelboards and cabinets.

Example: Panel 2P

120/208V, 3-phase, 4-wire

Fed from Panel MDP/cct. #4

D. Provide warning signs on all equipment or devices operating at 300 volts or more, reading "DANGER-480 VOLTS", etc. with white letters on red background of standard code size. Signs shall be decals.

E. All underground utilities indicated on the Drawings shall have a 6" wide plastic marker installed continuously in the trench at 12" below grade. The marker shall have continuous markings embossed in the tape identifying the system installed, i.e., communications, fiber optic, telephone, power.

F. Identify all exposed conduits, junction and pullboxes at maximum intervals of twenty feet and as indicated below. Identify exposed conduits according to the system carried by means of appropriate UL-recognized Brady wire marking sleeves, conduit and voltage markers, or approved equal by the Owner. Identify junction and pullboxes by painted on stencils or approved labels. Identification shall be placed at necessary intervals on straight conduit runs, close to all terminations, adjacent to all changes in directions and where conduits pass through walls or floors. Permanent identification markings on the sleeve or marker shall be to specification. Primary labels shall include voltage and shall have black lettering on an orange background. Secondary labels shall include information regarding power distribution such as “Fire Alarm” or “Grounding” and shall have a color scheme as indicated below. If the conduit is less than ¾” in diameter, color banding plus tags may be used. Color banding shall be ½” wide and resist UV rays, abrasion, corrosion, alkali, and acids.

1. Electrical Conduit Color Code (Common Ground Alliance Best Practices and APWA Uniform Color Code)

Secondary Label and Banding Color	Conduit Contents
Red	Fire Alarm Systems
White	Access/Security Systems
Dark Blue/White	Data Systems
Gray	Telecommunications
Black	120/208 Volt Power
Orange	277/480 Volt Power
Green	Grounding
Black/White	Computer/Data
Red (White on Red)	Electric Power Lines, Cables, Conduit, and Lighting
Orange (Black on Orange)	Communication, Alarm
White on Red	Fire Alarm System
White on Brown	Can be used for clarity on a Conduit not mentioned

F. Identify all receptacles and switch devices with the circuit and overcurrent protection device. Identification may be by waterproof, permanent marker on the rear of the device cover plate or as approved by the Engineer and Owner.

3.10 WARRANTY: Deliver originals of all guarantees and warranties on this portion of the work to the Engineer. Warrant all equipment, materials and workmanship for one year in accordance with the terms of the Contract.

3.11 PRODUCT HANDLING: Use all means necessary to protect Electrical materials and equipment before, during and after installation and to protect the installed work of other trades.

3.12 RECORD DRAWINGS: As part of this Contract, the Contractor shall provide a complete marked-up set of Contract Documents indicating all changes to the documents during the project construction phase to the Engineer. Changes to the Electrical System shall be documented on a set of "Record Drawings" on a daily basis.

END OF SECTION

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL WIRE AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. RS-232 cabling.
2. RS-485 cabling.
3. Low-voltage control cabling.
4. Control-circuit conductors.
5. Identification products.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Source quality-control reports.

C. Field quality-control reports.

D. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.

4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with UL 1581.

2.2 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

2.3 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Shielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

2.4 CONTROL-CIRCUIT CONDUCTORS

A. Control Circuits: Stranded copper, Type THHN-THWN, in raceway.

2.5 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

A. Cable will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Cables may not be spliced. Secure and support cables at intervals not exceeding 6 inches from terminals.

2. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.

3. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination points. Remove and discard cable if damaged during installation and replace it with new cable.

4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

5. Pulling Cable: Monitor cable pull tensions.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

D. Separation from EMI Sources:

1. Separation between cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

2. Separation between cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

3. Separation between cables in grounded metallic raceways and power lines and electrical

equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

4 Separation between Cables and Electrical Motors and Transformers, 5 kVA or 3HP and Larger: A minimum of 48 inches.

5 Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.2 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

- Class 1 remote-control and signal circuits, No 14 AWG.
- Class 2 low-energy, remote-control, and signal circuits, No. 18 AWG.

3.3 GROUNDING

A. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding."

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Division 26 Section "General Electrical Provisions"

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance.
2. Visually inspect cable placement, cable termination, grounding and bonding, and labeling of all components.
3. Test cabling for resistance, shorts, opens, intermittent faults, and polarity between conductors.

C. Document data for each measurement and submit.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 11 00

RACEWAYS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 26 01 00.

C. Grounding: Section 26 45 00.

PART 2 PRODUCTS

2.1 CONDUITS

A. Rigid Steel Conduit: Rigid, threaded, thick-wall with zinc-coated on the inside and either zinc-coated or coated with an approved corrosion-resistant coating on the outside. Conduit installed in the Chlorination Building Chemical room shall be PVC coated on the inside and outside. PVC coating must be UL6 listed and ETL-PVC-001 Verified and Labeled. PVC coating shall be a minimum of 40 mil exterior coating and 2 mil interior coating. Refer to drawings for additional PVC coating requirements.

B. Rigid Aluminum Conduit: Rigid, threaded, thick-wall type, approved for the application.

C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated or coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside.

D. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4 degrees Fahrenheit, 11,000 psi flexural strength, 8,600 psi compression strength, approved 90 degree conductors. Carlon, Triangle or approved equal.

E. Electrical Metallic Tubing (EMT): Mild steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside.

F. Flexible Conduit: Commercial Greenfield, galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.

G. Liquid-Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid-tight PVC outer jacket and a separate grounding conductor installed in the conduit.

H. Conduit Size: Minimum conduit size 1/2" except where specifically approved for equipment connections. Sizes not noted on the Drawings shall be as required by the NEC.

2.2 CONDUIT FITTINGS

A. Rigid Steel Conduit, IMC and EMT Fittings: Iron, steel, die-cast only. Conduit fitting and bodies installed in the Chlorination Building Chemical room shall be PVC coated on the inside and outside. PVC coating must be UL6 listed and ETL-PVC-001 Verified and Labeled. PVC coating shall be a minimum of 40 mil exterior coating and 2 mil interior coating. Refer to drawings for additional PVC coating requirements.

B. Rigid Aluminum Conduit Fittings: Malleable iron, steel or aluminum alloy. Ferrous fittings zinc-coated or cadmium plated. Aluminum alloy fittings shall conform to the characteristics defined by UL for rigid aluminum metallic conduit and shall not contain more than 0.04 percent copper.

C. Rigid Non-metallic Conduit Fittings: Approved for the purpose and as recommended by the manufacturer.

D. Flexible Conduit Fittings (Commercial Greenfield): Either die-cast, steel, or malleable iron only with insulated throats and shall be of one of the following types:

1. Squeeze or clamp type with bearing surface contoured to wrap around the conduit and clamped by one or more screws.

2. Steel, multiple point type, for threading into internal wall of the conduit convolutions.

3. Wedge and screw type with angular in-edge fitting between the convolutions of the conduit.

E. Liquid-tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon, or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seal.

F. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. Set-screw type fittings for rigid aluminum conduit not permitted. EMT couplings and connectors either die-cast, steel, or malleable iron only, "Concrete-tight" or "Raintight", and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set-screws or indentations as a means of attachment are not permitted.

G. Bushings: Insulated type, designed to prevent abrasion of the wires without impairing the continuity of the conduit grounding system, for rigid steel conduit, IMC, and rigid aluminum conduit.

H. Expansion Fittings: Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each run of 100 feet of exposed conduit shall be provided with an expansion fitting. Expansion fittings shall be hot dipped galvanized malleable iron with factory-installed packing and a grounding ring.

I. Sealing Fittings: Threaded, zinc or cadmium coated, cast or malleable iron type for steel conduits and threaded cast aluminum type for aluminum conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

2.3 WIREWAYS: Square D Company square duct lay in type without knockouts with lengths and fittings hinged to provide an unobstructed wireway to "lay-in" conductors, use standard lengths. Field cuts permitted where absolutely necessary. Rust-inhibiting phosphatizing coating on sheet metal parts. Blue-gray baked enamel finish. Hardware plated to prevent cross fittings, transposition section, gussett brackets, nipples, pull boxes, reducer fittings, wall flanges, panels or cabinet flanges, elbows, ceiling and wall support brackets and supporting hardware, etc.

PART 3 EXECUTION

3.1 CONDUIT INSTALLATION

A. Conduit Systems: Rigid steel conduit, IMC, rigid non-metallic conduit or EMT unless otherwise specified. Rigid Steel conduit shall be installed in the Chlorination building control

room and Rigid Steel conduit that's PVC coated on the inside and outside shall be installed in the Chlorination building Chemical room. Refer to drawings for additional requirements.

B. Aluminum Conduit: Aluminum conduit may be used only in dry locations above ground in sizes two inch or larger for Power and Communications Systems.

C. Rigid Non-metallic Conduit: Install in accordance with manufacturer's recommendations. Joints shall be solvent welded. Field bends shall utilize approved bending equipment. Provide rigid steel elbows and rigid steel conduit risers on underground runs or runs in concrete. Provide a suitable bond wire in each run except low voltage communications runs. Underground runs under concrete slabs may be direct buried without concrete encasement if of approved type. Rigid non-metallic conduit may be used for the secondary service conduit between the transformer and main distribution panel outside the perimeter of the building only when encased in concrete. Concrete total encasement shall be a minimum of four inches around outside of conduit. Rigid non-metallic conduit is not permitted to be surface mounted in ducts, plenums or other air handling spaces. All 90 degree bends installed in underground runs shall be rigid steel conduit. For encased conduits carrying 600 volts or more, the concrete shall be colored red using a permanent dye

D. EMT: Not permitted underground or embedded in concrete.

E. Flexible Conduits: Use flexible conduit only for motor or equipment connections and then only to the extent of minimum lengths required for connections. Length shall not exceed 5 feet without approval from the Engineer and Owner. Install flexible conduit connections at all resilient-mounted equipment. Provide liquid-tight flexible conduit in exterior, wet or damp locations and for connections to wet pipe mechanical systems.

F. Conduit in Concrete: Rigid steel conduit or rigid non-metallic conduit may not be embedded in concrete that is in direct contact with the earth. When embedded, the outside diameter shall not exceed one-third the thickness of the concrete slab, wall or beam, shall be located entirely within the center third of the member, and the lateral spacing of conduits shall not be less than three diameter unless otherwise prohibited by Engineer.

G. Steel Conduit in Ground: Rigid steel conduit that is not completely encased in concrete but is in contact with ground or on a vapor barrier shall be wrapped with Scotchwrap 51 half-lapped, or shall have an additional outside factory coating of polyvinyl chloride with a minimum coat thickness of 20 mils. Other PVC or Phenolic-resin epoxy coating material which is equally flexible and chemically resistant may be used providing approval by the Engineer is obtained prior to the installation.

H. Exposed Conduits: Install exposed conduit systems parallel to or at right angles to the lines of the building. Right angle bends in exposed runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radii not less than those of standard elbows.

I. Concealed Conduits: Install conduit systems concealed unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities, and where specifically approved by the Engineer. Install concealed conduit systems in as direct lines as possible.

J. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.

K. Sealing Fittings: Install where required by the NEC, where conduits pass from warm to cold locations and where otherwise indicated.

L. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls. Sleeves that are used shall be sealed tight with rated fire and smokeproofing compounds.

M. Duct seal all conduit ends.

3.2 CONDUIT SUPPORTS

A. Supports: Provide supports for horizontal steel conduits and EMT not more than eight feet apart with one support near each elbow or bend and one support within one foot of each coupling, including runs above suspended ceilings.

B. Straps: Install one-hole pipe straps on conduits 1-1/2" or smaller. Install individual pipe hangers for conduits larger than 1-1/2". Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.

C. Trapezes: Install multiple (trapeze) pipe hangers, Uni-Strut or approved equal, where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by specifically designed and approved fasteners for the system used.

D. Hanger Rods: Install 1/4" diameter or larger steel rods for trapezes, spring steel fasteners, clips and clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.

E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts. Wooden plugs and shields shall not be used. Power-driven fasteners may be used to attach pipe straps and hanger rods to concrete where approved by the Engineer. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy Fasteners of ERICO Products, Inc., or approved equal. Wire wrapped around conduits and supporting members will not be accepted. Conduit fastened to the wall above the ceiling is not acceptable.

3.3 IDENTIFICATION: Identify per Section 26 01 00, Paragraph 3.09F

3.4 CLOSING OF OPENINGS: Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, including bus ducts, such openings, if unused, or the spaces left in such openings, shall be closed in a manner approved by the Engineer. All closure material along with installation methods shall retain the fire rating integrity of the surface being penetrated. All openings in walls or floors remaining after removal of existing conduits, raceways, or bus ducts shall be closed in a like, approved manner.

END OF SECTION

SECTION 26 13 00

OUTLET BOXES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 26 01 00.

C. Grounding: Section 26 45 00.

PART 2 PRODUCTS

2.1 OUTLET BOXES

A. Construction: Zinc-coated or cadmium plated sheet steel boxes of a class to satisfy the conditions at each outlet except where unilet or condulet bodies are required. Knockout type with knockouts removed are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4" octagon concrete rings and 4" octagon hung ceiling boxes with bars may be folded type; one-piece deep-drawn for all other boxes. All exposed outlet boxes shall be Type FD casted boxes. Outlet boxes in the Chlorination Building Chemical room shall be PVC coated on the inside and outside. PVC coating must be UL6 listed and ETL-PVC-001 Verified and Labeled. PVC coating shall be a minimum of 40 mil exterior coating and 2 mil interior coating. Refer to drawings for additional PVC coating requirements.

B. Size: To accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed six inches deep except where necessary to permit entrance of conduits into sides of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.

C. Fixture Studs: 3/8" malleable iron fixture stud in outlet boxes for ceiling lighting fixtures and interior bracket lighting fixtures, other than lamp receptacles and drop cords.

D. Exposed: Screw-joint type with gasketed weatherproof covers in locations exposed to the weather.

E. Wall-Mounted Switch, Receptacle and Signal Boxes: Unless otherwise noted or specified not less 4" square by 1-1/2" deep for 2 devices and multi-gang boxes for more than 2 devices. Boxes for switches and receptacles on unfinished walls may be screw-joint type with covers to fit the devices. Boxes installed in the Chlorination Building Chemical room shall be PVC coated on the inside and outside. PVC coating must be UL6 listed and ETL-PVC-001 Verified and Labeled. PVC coating shall be a minimum of 40 mil exterior coating and 2 mil interior coating. Refer to drawings for additional PVC coating requirements.

F. Light Fixture Boxes: 4" diameter by 1-1/2" deep minimum for ceiling and interior bracket fixtures with concealed conduits. Plaster covers for bracket fixtures to have 3" diameter openings. Screw-joint boxes with canopy seat for ceiling and interior bracket fixtures with exposed conduits. Boxes installed in the Chlorination Building Chemical room shall be PVC coated on the inside and outside. PVC coating must be UL6 listed and ETL-PVC-001

Verified and Labeled. PVC coating shall be a minimum of 40 mil exterior coating and 2 mil interior coating. Refer to drawings for additional PVC coating requirements.

G. All Boxes installed in the Chlorination Building Chemical room shall be PVC coated on the inside and outside. PVC coating must be UL6 listed and ETL-PVC-001 Verified and Labeled. PVC coating shall be a minimum of 40 mil exterior coating and 2 mil interior coating. Refer to drawings for additional PVC coating requirements.

H. Grounding Terminal: Provide a grounding terminal in each box containing a green equipment ground conductor, or serving motors, lighting fixtures or receptacles. Grounding terminal shall be green colored washer-in-head machine screw or grounding bushing.

2.2 PULLBOXES: Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets or pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion-resistant screw or bolt attachment. Pullboxes installed in the chlorination chemical side of the building shall be rated for use in a corrosive and wet environment and shall be UL listed for that use.

2.3 WET AREA EQUIPMENT: All equipment within the buildings shall be installed in a NEMA 3R, NEMA 12 or weatherproof enclosure for non-corrosive environments and NEMA 4X for corrosive environments (i.e. chemical rooms of chlorine buildings), unless otherwise noted on the drawings.

PART 3 EXECUTION

3.1 OUTLET BOXES

A. Installation: Unless otherwise specified or shown on the Drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceiling of incombustible construction, not more than 1/4" back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plaster covers. Box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hanger, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work. Boxes shall be secured to metal studs with sheet metal screws. Metal stud clips, such as Caddy “MSF”, are not acceptable. All boxes shall have far side box supports installed similar to Caddy #766.

B. Mounting Heights: The mounting height of a wall-mounted outlet box shall be construed to mean the height from the finished floor to the horizontal centerline of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. The height of all outlets shall be at the same height when there is a secondary type wall construction along with the masonry construction. The height in the masonry construction shall be the governing factor. Verify exact height of all boxes with Engineer.

C. Wall mounted switch, receptacle and signal outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to the trim. Install outlet boxes near the doors or the lock sides as shown on Architectural Drawings unless other locations are approved by the Engineer.

3.2 PULLBOXES: Provide additional pullboxes wherever necessary to meet requirements for maximum lengths of conduit runs and maximum numbers of bends per the NEC.

3.3 FIXTURE CONNECTIONS: Surface light fixtures in accessible ceilings shall be connected with minimum 1/2" flexible metallic conduits, 4 to 6 feet long with grounding provisions.

3.4 IDENTIFICATION: Identify all exposed junction and pullboxes according to the system carried by means in accordance with DIVISION – 26 01 00-3.9

END OF SECTION

SECTION 26 13 30

CABINETS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 26 01 00.

C. Grounding: Section 26 45 00.

PART 2 PRODUCTS

2.1 GENERAL: Sheet steel except those exposed to wet or rain conditions that shall be raintight unless otherwise noted. Cabinets without through feeder wiring shall be arranged to provide a wiring gutter not less than 4" wide for branch circuit panelboards served by feeders up to 4/0. Panelboards served by feeders in excess of 4/0, up to and including 750 MCM, shall be provided with top, bottom and side gutters 8" wide. Panelboard cabinets in all cases shall meet or exceed the minimum requirements of Article 312 of the National Electrical Code. Cabinets shall be of standard make and shall be equal in all respects to those bearing the Underwriters Laboratories label. Cabinets, including boxes shall be made of galvanized steel. All outside surfaces of trim and doors shall be given a factory finish coat of No. 61 ANSI gray paint, or approved manufacturer's standard. Cabinet for telephone and communications systems shall have 5/8" exterior grade, one-face B-grade or equal plywood backboard inside with maximum height and width. All Cabinets within the building shall be NEMA 3R or NEMA 12 enclosure for non-corrosive environments and NEMA 4X for corrosive environments (i.e. chemical rooms of chlorine buildings), and outdoor or as noted on the drawings.

2.2 FEED THROUGH GUTTERS: Where feeders go through panelboard cabinets to serve panelboards above or beyond, the wiring gutters in panelboard cabinets shall be a minimum of 8" on sides, top and bottom.

2.3 FRONTS: One piece sheet steel frame and a hinged door with catch and lock for flush cabinets. Telephone and signal cabinets for surface mounting shall be equipped with a door hinged directly to cabinet. One piece sheet steel with 3/4" flange with all edges shaped to cover edge of box. Fronts may be secured to box by means of flathead screws with captive nuts or clamps.

2.4 DOORS: Doors shall close against a rabbet placed all around the inside edge of the frame with a close fitting joint between door and frame. The doors shall be fitted with substantial flush hinges placed not over 24" apart, nor more than 6" from ends of doors, and fastened permanently to the door and frame with flat-headed rivets or spot welds, or with concealed flush piano hinges. Fastening screws of fronts shall be set not over 24" apart. Doors over 48" in height shall be equipped with a vault hinge and a three point catch.

2.5 DOOR-IN-DOOR: Both surface and flush cabinets shall be door-in-door. The door over the interior of the cabinet shall be provided with hinges and combined lock and latch. The outside door over the cabinet gutters shall have a hinge on one side, and machine screws into threaded holes in the cabinet on the other three sides. In order to insure the rigidity of the outside door, surface type

cabinets shall have a 1/2" deep lip bent over all around, with the corners welded and grounded; or in the case of flush cabinets, a steel angle frame, equivalent in strength to the bent over lip, shall be welded to the inside of the door. The outside door shall be of such size as to allow a minimum of 2-3/4" opening to all four sides of the wiring gutter. All locks shall be keyed alike.

2.6 LOCKS: Furnish each cabinet with a combination catch and flat key lock. The telephone, electrical and signal cabinet locks shall be fitted to separate keying for each system. Furnish two keys for each cabinet.

2.7 GROUND BAR: Each cabinet for a panelboard shall be provided with a copper interior ground bar suitably braced or bolted to the cabinet wall. The equipment ground bar shall be equivalent in current carrying pressure connector terminations for the associated feeders, branch circuits, etc.

PART 3 EXECUTION

3.1 CABINETS: Cables installed in the wiring gutters of cabinets shall be neatly bundled, routed and supported. Minimum bending radii as recommended by the cable manufacturer shall not be reduced. Lighting and power cabinets shall be installed with tops 6'-6" above floor or less and bottoms not less than 12" above floor. The height above floor of the highest over current device handle shall not exceed 6'-6".

3.2 SPACE: If cabinet is not shown on the plans, placement shall be appropriate for an ergonomic work area. Cabinets shall have front working clear space in accordance with OSHA regulations.

END OF SECTION

SECTION 26 14 00

WIRING DEVICES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Electrical Provisions: Section 26 01 00.

C. Grounding: Section 26 45 00.

PART 2 PRODUCTS

2.1 SNAP SWITCHES: Unless otherwise specified each snap switch (flush tumbler-toggle) shall be of the AC general use type for mounting in a single-gang spacing, fully rated 20 amperes, 120-277 volts, conforming to minimum requirements of the latest revision of the Underwriters Laboratories, Inc., UL 20, Fifth Edition, Standard Snap Switches and further requirements herein specified. Industrial Specification grade, heavy duty, single pole, three way or four way, of the maintained momentary or lock type as indicated on the Drawings. Ivory color handles unless otherwise indicated on the drawings. Silver or silver alloy contacts, AC 120/277 volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publication WDI-1965, and shall be as follows unless otherwise noted:

20A120-277V AC	Hubbell	Bryant	P & S
1P	1221-I-IV	4901-I-IV	20-AC-1-I-IV
2P	1222-I-IV	4902-I-IV	20-AC-2-I-IV
3 way	1223-I-IV	4903-I-IV	20-AC-2-I-IV
4 way	1224-I-IV	4904-I-IV	20-AC-3-I-IV

2.2 RECEPTACLE

A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publication WDI-1965, Part 3 and Part 10. Single or duplex as shown or noted on Drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.

B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250-95 of the NEC with minimum size No. 14 AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.

C. Unless otherwise noted, receptacles shall be as follows:

Type	Hubbell	Bryant	P&S
Spec. Grade Duplex - 20 amp	5362-I	5362-I	5362-I
GFCI, Spec. Grade Duplex - 20 amp	GF-5362-I	GFR53FT-I	2091-FI
Isolated Gnd., Orange, Spec. Grade Duplex - 20 amp	IG-5361	5361-IG	IG5366-SS
Safety Receptacle, Duplex	SG-62HI	SG-62	SG-62

D. Special: Receptacles for special applications shall be as indicated on the Drawings.

2.3 PLUG CAPS: Except for duplex receptacles and cleaning combination receptacles one matching plug cap shall be provided for each receptacle. No plug caps are required for duplex receptacles.

2.4 DEVICE PLATES

A. General: Provide device plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Do not use sectional gang plates. Provide multi-gang outlet plates for multi-gang boxes. Plates shall be Stainless Steel unless otherwise noted. Chlorine Room plates shall be stainless steel grade 316L or better unless otherwise noted.

B. Exposed: Plates for exposed joint fittings shall match the fittings with edges of plates flush with edges of fittings. Heavy cadmium steel plates with gasket. Plates for cast type boxes at locations subject to wet or rain conditions shall be of cast, vapor tight type. Provide hinged lift covers for devices.

C. Communication: Plates for telephone and signal outlets shall each have a 3/8" bushed opening in the center. Wall plates for push-button and buzzer outlets shall have openings to suit the push buttons and buzzers.

D. Plates for special purpose outlets shall be of a design suitable for the particular applications.

E. All plates installed in the Chlorination Building Chemical room shall be PVC coated on the inside and outside. PVC coating must be UL6 listed and ETL-PVC-001 Verified and Labeled. PVC coating shall be a minimum of 40 mil exterior coating and 2 mil interior coating. Refer to drawings for additional PVC coating requirements.

2.5 REMOTELY CONTROLLED SWITCHES OR RELAYS: Electro-magnetically operated, mechanically held unless otherwise required. Rugged construction, substantially made, conforming to NEMA and IEEE test standards for industrial type power relays and the requirements of UL 508, Standards for Safety Lighting Control Equipment. Ratings as indicated on the drawings, suitable for the application. Contacts shall be double break, renewable, solid wiping type, silver to silver or silver Tungsten alloy, self aligning, quick make, quick break, with a minimum inductive load rating of 20 amps. Relays shall be as manufactured by Allen-Bradley, ASCO, Cutler-Hammer, General Electric, Square D, or Cutler-Hammer, equal to ASCO mounting and enclosure. Device shall be mounted in a NEMA 12 or NEMA 3R enclosure as indicated on the drawings.

2.6 MOMENTARY CONTACT SWITCHES: Tumbler type single pole double throw momentary contact for 3 wire connection, with OFF position when tumbler handle is in the center, similar in appearance to the conventional snap switch. Handle or key complete as indicated on the Drawings. 20 ampere at 120-277 volts for control of 30, 60, or 100 ampere remotely controlled switches or relays rated 101 amperes and above. Provide cover plates to match the finish of other conventional snap switch plates in the area. Provide nameplate to identify the circuit or equipment controlled. Device shall be mounted in a NEMA 12 or NEMA 3R enclosure as indicated on the drawings.

2.7 ENCLOSURE: All equipment enclosures within the buildings shall be rated for wet locations (NEMA 12 or NEMA 3R as indicated on the drawings). All equipment enclosure installed in the chlorination chemical rooms shall be rated for use in a corrosive and wet environment and shall be UL listed for that use and shall be NEMA 4X.

PART 3 EXECUTION

3.1 DEVICE PLATES: Install with alignment tolerance of 1/16" and all edges in continuous contact with wall surfaces.

END OF SECTION

SECTION 26 16 00

PANELBOARDS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Electrical Provisions: Section 26 01 00.

C. Cabinets: Section 26 13 30.

D. Motor and Circuit Disconnects: Section 26 17 00.

E. Fuses: Section 26 18 10.

F. Grounding: Section 26 45 00.

1.2 SUBMITTALS: Submit complete shop drawings with outline dimensions, descriptive literature and complete description of the frame size, trip setting, class and interrupting rating of all overcurrent devices. Identify available space.

PART 2 PRODUCTS

2.1 GENERAL: Dead front, safety type with voltage ratings as scheduled. Panelboards shall be of the type required for the short circuit and duty ratings indicated on the drawings. Panelboards shall be as manufactured by General Electric, ITE, Square D, or Cutler-Hammer and shall be circuit breaker or fusible type as scheduled.

2.2 CABINETS: Each panelboard shall be enclosed in a single sheet metal cabinet with front doors, catches, locks, etc., as specified in Section 26 13 30, Cabinets.

2.3 DOOR-IN-DOOR: Both surface and flush panels shall be door-in-door NEMA 3R or NEMA 12, indicated on the drawings, enclosure for non-corrosive environments and NEMA 4X for corrosive environments (i.e. chemical rooms of chlorine buildings). The door over the interior of the panel shall be provided with hinge and combined lock and latch. The outside door over the panel gutters shall have a hinge on one side and machine screws into threaded holes in the panelboard cabinet on the other three sides. In order to insure the rigidity of the outside door, surface type panels shall have a 1/2" deep lip bent over all around with the corners welded and ground; or, in the case of flush panels a steel angle frame, equivalent in strength to the bent over lip shall be welded to the inside of the door. The outside door shall be of such size as to allow a minimum of 2-3/4" opening to all four sides of the wiring gutter or as required by NEC All locks shall be keyed alike.

2.4 BREAKERS: Molded-case or combination molded-case and current limited fuses as scheduled or required. Provide quick make and quick break toggle mechanism, inverse time trip characteristics and trip free operation on overload or short circuit. Automatic tripping shall be indicated by a handle position between the manual OFF and ON position. Provide a trip element for each pole, a common trip bar for all poles and a single molded insulating material handle. Handle ties will not

be accepted. Adjustable magnetic trip devices shall be set at the factory to the low trip setting. Provide breaker frame sizes as required for the continuous rating or the interrupting capacity, whichever is larger.

2.5 BOLTED TYPE: Circuit breaker current-carrying connections to the bus shall be of the bolted type, factory assembled. Stab in type not permitted. Provide bus bars for three phase panelboards of the sequence phased type connection and arranged for three-phase, four wire mains, unless otherwise indicated on the Drawings.

2.6 FUSIBLE SWITCH UNITS: Quick make, quick break type with external operation handle suitable for padlocking in OFF position. Provide interlock to prevent opening cover when switch is in ON position unless interlock release is operated. Provide switch frame sizes as required for the continuous rating or the interrupting capacity, whichever is larger. Fusible panelboards shall be UL rated and listed for service entrance where applicable.

2.7 SPACE ONLY: Where "Space Only" is noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device.

2.8 DIRECTORIES: Provide circuit directories on the inside face of the door of each panel.

2.9 LABELS: Labels for identifying the breakers shall be engraved laminated plastic strips attached by screws or phenolic buttons or small window frame type. Adhesive stick on labels alone will not be acceptable unless specifically approved.

2.10 SKIRTS: Where noted on the Drawings panelboards shall be skirted with complete metal enclosures and barriers separating the panel interior.

PART 3 EXECUTION

3.1 DIRECTORIES: Provide typewritten circuit descriptions referencing permanent room numbering assigned in lieu of the room numbering shown on the Drawings inserted in plastic holder. Text shall be able to be read entirely without moving the card.

3.2 CIRCUIT NUMBERING: Circuit numbering shown on the Drawings is based on pole position in the panelboard and not consecutive numbering.

3.3 PHASE ROTATION: Phase A, left bus; phase B, center bus; phase C, right bus (front viewing).

END OF SECTION

SECTION 26 17 00
MOTOR AND CIRCUIT DISCONNECTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 26 01 00.

C. Grounding: Section 26 45 00.

PART 2 - PRODUCTS

2.1 DISCONNECTING MEANS

A. Safety Switches: Fusible or non-fusible Type HD quick break safety switches of the sizes and capacities indicated or required. Raintight enclosures at locations exposed to the weather.

B. Separately Enclosed Motor Snap Switches: Motor snap switches may be used for motor disconnect means, controller and motor overcurrent protection when applicable. These devices shall be horsepower rated and may contain motor running overcurrent protection.

C. Safety Type Disconnecting Switches: Heavy duty, quick make, quick break type, 250 or 600 volt rating as required for the application. Number of poles and ampacity as noted or required by code. Fusible where noted with fuse clips suitable for Buss Fusetron Class R Fuses. Short circuit rating of 200,000 RMS Amperes with CV Class R rejection feature installed in fuseholders. NEMA 1 enclosures for dry locations. NEMA 3 R enclosures for wet locations or at exposed weather locations unless otherwise noted.

2.2 MANUFACTURERS

A. General Electric, ITE, Square D, or Cutler-Hammer.

PART 3 - EXECUTION

3.1 DISCONNECT MEANS: Install in each location indicated on the Drawings and elsewhere as required by NEC.

END OF SECTION 26 17 00

SECTION 26 18 10

FUSES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Electrical Provisions: Section 26 01 00.

C. Motor and Circuit Disconnect: Section 26 17 00.

D. Grounding: Section 26 45 00.

PART 2 PRODUCTS:

2.1 FUSES

A. General: Dual element, time delay type, based on heavy service, Buss Fusetron, or equal, unless otherwise noted or required for installation.

B. Current Limiting Fuses: Provide where indicated on the Drawings. For individual motor circuit protection, provide fuse sized approximately 175 percent of full load current with 100,000 amperes interrupting capacity. For non-motor feeder protection in conjunction with fused switches, install NEMA Class L fuses sized 175 percent of load current or as required for coordination with air and molded case circuit breakers, shall be furnished by the circuit breaker manufacturer.

C. Above 600 amps; Class L, "Hi-Cap" as manufactured by Bussman or approved equivalent by Chase-Shawmut or Federal Pacific.

D. Below 600 amps, as required by short circuit duty, Class K-1, "Limitron" or class K-5, "Low Peak" or Class K-5, "Fusetron" as manufactured by Bussman or approved equivalent by Chase-Shawmut or Federal Pacific.

E. All switches having current limiting fuses installed shall have a Lamicoid nameplate with white lettering on red background reading:
WARNING, REPLACE ONLY WITH CURRENT
LIMITING FUSES AS ORIGINALLY INSTALLED

2.2 COORDINATION: Coordinate the low voltage fuses required for the project to provide basic selective protection and properly coordinate with the other associated protective equipment.

PART 3 EXECUTION

3.1 COORDINATION: Coordinate the low voltage fuses required for the project to provide basic selection protection and properly coordinate with the other associated protective equipment.

3.2 SPARE FUSES: Furnish one complete spare set of each size of fuses. Deliver to the Owner in the original boxes. It shall consist of 100% fuse replacement for all fuses required for panelboards and safety switches.

END OF SECTION

SECTION 26 19 00

RELAYS AND CONTACTORS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Electrical Provisions: Section 26 01 00.

C. Grounding: Section 26 45 00.

PART 2 PRODUCTS

2.1 GENERAL: Electromagnetically operated, electrically held unless otherwise required. Rugged construction substantially made conforming to NEMA and IEEE test standards for industrial type power relays and the requirements of UL 508, Standards for Safety Industrial Control Equipment. Relays and contactors shall be as manufactured by General Electric, ITE, Square D, or Cutler-Hammer.

2.2 RATINGS: As indicated on the Drawings or required, suitable for the application.

2.3 CONTACTS: Double break, renewable, solid wiping type, silver to silver or silver tungsten alloy, self aligning, quick make, quick break, with a minimum inductive load rating adequate for the load controlled, but not less than 25 amps.

2.4 ENCLOSURES: NEMA 3R or NEMA 12, as indicated on the drawings, for surface mounting in non-corrosive environments and NEMA 4X for corrosive environments (i.e. chemical rooms of chlorine buildings), Flush mounted with hinged door and flush latch where indicated. Sound-absorbing enclosures where located in or adjacent to occupied areas. Enclosures installed in the chlorination chemical side of the building shall be rated for use in a corrosive and wet environment and be UL listed for that use.

PART 3 EXECUTION

3.1 INSTALLATION: Install and connect in accordance with related work specified in other sections of these Specifications.

END OF SECTION

SECTION 26 45 00

GROUNDING

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Electrical Provisions: Section 26 01 00.

C. Raceways: Section 26 11 00.

D. Outlet Boxes: Section 26 13 00.

E. Wires and Cables: Section 26 12 00.

F. Wiring Devices: Section 26 14 00.

G. Cabinets: Section 26 13 30.

H. Motor and Circuit Disconnects: Section 26 17 00.

I. Panelboards: Section 26 16 00.

PART 2 PRODUCTS

2.1 Materials, equipment and devices related to the grounding system are specified under other sections of these Specifications.

PART 3 EXECUTION

3.1 GENERAL: Install two separate grounding systems, a service grounding system and an equipment grounding system. The service equipment, conduit systems, supports, cabinets, equipment, and neutral conductor shall be grounded in accordance with the minimum code requirements and as further indicated on the Drawings or as specified. Connect the two grounding systems together only at the main service equipment and at the secondary terminals of transformers creating separately derived distribution systems such as dry-type transformers.

3.2 SERVICE GROUNDING SYSTEM

A. General: The service grounding system is provided for the AC service neutral ground. Current return conductors, such as neutrals of the service entrance, feeder circuits and branch circuits, shall not be used for equipment grounding. Care must be exercised to ensure that neutral bars are not bonded to the enclosures of panelboards, etc., which are not part of the main service equipment. Except for separately derived systems, the neutral conductors shall be grounded only in the main service equipment.

B. Common Ground Point: Establish one common ground point in the main service equipment by interconnecting the insulated neutral bus (or bar), the uninsulated equipment ground bus (or bar), and service grounding electrode conductor.

C. Neutral Disconnecting Means: Install a neutral disconnecting means in the main service equipment for disconnecting and isolating the neutral bus from the common ground. The disconnecting means may be disconnecting links in the interconnection between the insulated neutral and uninsulated equipment ground.

D. Neutral Bars: Provide an insulated neutral bar, separate from the uninsulated equipment ground bar, in all panelboards, transformers, starters, disconnect switches, cabinets, etc., which have neutral connections.

3.3 EQUIPMENT GROUNDING SYSTEM

A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the Drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground of non-current-carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current-carrying parts of the system and to provide a low impedance path to ground for possible ground fault currents.

B. Common Ground Point: Establish one common ground point as specified elsewhere in this section of the specifications for interconnection of the equipment grounding system and the service grounding electrode conductor.

C. Service Equipment Enclosure: Bond the enclosure of the main service equipment to the uninsulated equipment ground box (or bar) with a conductor or bar sized for 50% of the largest service overcurrent device.

D. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all panelboards, starters, disconnect switches, cabinets, etc. for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in panelboards or a separately mounted bar adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.

E. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring only shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each nonmetallic conduit or duct except those used for telephone, sound, or low voltage signals and in all flexible conduit that does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.

F. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three phase feeder and each branch circuit with a three phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits where indicated on the Drawings. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders

installed in more than one raceway each raceway shall have a green insulated equipment ground conductor installed.

G. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings and other fixed equipment.

H. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center or separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

3.4 SEPARATELY DERIVED SYSTEMS: Transformers creating separately derived distribution systems, such as dry type transformers, shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground with separate grounding conductor extended to an approved ground electrode.

3.5 GROUNDING ELECTRODES: Two service ground electrodes shall be utilized. One shall be the main cold water metallic water piping system and the other shall be a made electrode consisting of not less than twenty feet of bare copper conductor encased along the bottom of a concrete foundation footing which is in direct contact with the earth (NEC 250-50). Make the connections to the cold water pipe inside the building at the point of entrance. The grounding electrode for separately derived systems shall be approved for the application.

3.6 GROUNDING CONDUCTORS: The grounding conductors for both service ground electrodes shall be insulated or bare copper, sized in accordance with NEC 250-66, including the conductor for the made electrode. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Install the conductor to permit the shortest and the most direct path and terminate in the main service equipment on the common ground point. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor, but not less than Type TW. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards of transformers the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal sheathed holes. All connections shall be available for inspection and maintenance.

3.7 GROUND CONNECTIONS: Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal it shall be painted or touched up with "Galvanoz", or equal.

3.8 TESTS

A. Remove all jumpers between the equipment ground busses and the service (neutral) ground busses in the main service panel and all separately derived systems. See Section 3.02.C.

B. For each grounding system, using an ohm-meter, measure the resistance between the two ground busses at the panel where the jumper was installed. The resistance shall be greater than 10 megohms.

C. Re-connect the equipment and service bus jumpers on all systems. See Section 3.02.C.

D. For each grounding system, using an ohm-meter, measure the resistance between the two ground busses at the panel farthest away (electrically) from the panel where the jumper was installed. The resistance shall be less than 5 ohms.

E. Submit a written report to the Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Engineer.

F. Test resistance from grounding electrode system to ground using ohm-meter.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.

1.3 DEFINITIONS

A. HID: High-intensity discharge.

B. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
5. Photoelectric relays.
6. Ballasts, including energy-efficiency data.
7. Lamps, including life, output, and energy-efficiency data.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

D. Warranty.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One complete replacement set.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: Furnish at least one of each type.
3. Ballasts: Furnish at least two of each type.

PART 2 PRODUCTS

2.1 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Exterior fixtures shall comply with the New Mexico Night Sky Ordinance.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather-and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel, SS 316 or better.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat-and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and tested luminaire before shipping.

2.2 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Adjustable window slide for adjusting on-off set points.

2.3 FLUORESCENT BALLASTS AND LAMPS

A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures 0 deg F (minus 18 deg C) and higher.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: A.
3. Electronic.
4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) and higher.

D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.4 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:

- Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
- Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
- Normal Ambient Operating Temperature: 104 deg F (40 deg C).
- Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

- Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
- 5 HID LAMPS

C. High-Pressure Sodium Lamps: ANSI C78.42, average rated life of 24,000 hours, minimum.

1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

PART 3 -EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to structural supports.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards

END OF SECTION

SECTION 26 60 10

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

1.2 REQUIREMENTS: Comply with Underwriters Laboratories. Inc. UL 96A, and NFPA Standard #78.

PART 2 PRODUCTS

2.1 GENERAL: All materials for the lightning protection system shall be suitable for a copper-bronze system.

2.2 AIR TERMINAL RODS: Air terminal rods shall be 24 inches in height and shall have a tapered point. The rod shall be 1/2 inch minimum diameter below the point and shall be solid copper.

2.3 CONNECTORS: All clamps used in connecting conductors to each other and to air terminals shall be made of high conductivity copper or bronze alloy suitable for copper-copper or copper-bronze joints as the cast may be, and drawn tight with bolts or capscrews of similar metal clamps. Bolts or capscrews shall be of sufficient cross section that there shall be no distortion or breaking under any stress to which they might be subjected under ordinary usage.

2.4 CONDUCTORS: Counterpoise conductor below grade shall be bare stranded copper lightning protection and grounding conductor weighing not less than 420 pounds per thousand feet. The size of any wire in the cable shall be not less than .0689". Roof conductors shall be bare stranded copper lightning protection conductor weighing not less than 320 pounds per thousand feet, 24 strand, 14 gauge. Down lead conductors shall be bare stranded copper lightning protection conductor weighing not less than 320 pounds per thousand feet, 24 strand, 14 gauge.

2.5 GROUND RODS: Shall be one inch round and ten feet long, copper weld with top of the rod three feet minimum below grade. If copper can be seen from offsite it must be masked, capped, or disguised.

PART 3 EXECUTION

3.1 INSTALLATION: The installation shall be accomplished by the manufacturers installing contractor of the LPI, working under the direct supervision of the manufacturer. All equipment shall be installed in a neat workmanlike manner in the most inconspicuous manner possible. The system shall consist of a complete cable network on the roof including all air terminals, splicers, and bonds with cable downleads routed concealed either directly in the building construction or in 1" PVC conduit to ground. Downlead cables shall not be brought directly through the roof. Through-roof connectors with solid rods or conduit through approved flashings shall be utilized for this purpose. Copper equipment shall not be connected to aluminum surfaces except by means of an approved bimetal transition fittings.

3.2 DRAWINGS: Shop drawings and plans for the system installation shall be approved by the Engineer before the cutting, fabricating, assembling, finishing, delivering or installation of any materials specified herein.

3.3 COORDINATION: The installer will work with other trades to insure a correct, neat, and unobtrusive installation. The lightning protection installer shall assure a sound bond to the main water service and interconnection with other building ground systems, including both telephone and electrical. All final flashing and sealing of lightning protection system roof penetrations shall be furnished and installed by the roofing contractor in compliance with the roofing system in use. A copy of the lightning protection system shop drawings shall be forwarded by the architect to the roof contractor for coordination purposes.

3.4 WORKMANSHIP: The installation shall comply with the applicable codes. All materials shall be new. Defective equipment and equipment damaged in the course of installation or tests shall be replaced or repaired in a manner meeting the approval of the Architect.

3.5 UNDERWRITERS LABORATORIES, INC. CERTIFICATION: The lightning protection system extension shall receive the Underwriters Laboratories Master Label. The master label shall be evidence that the installation of the lightning protection system has been made by an installer accredited by a manufacturer of listed lightning protection materials, that materials used are subject to factory inspection and are labeled and that the installation will require a field inspection program by UL with a report of inspection to the Owner, covering proper installation of the labeled materials according to UL requirements. Coordinate all facets of the extension to maintain master label for existing system and to provide a complete master labeled system for the entire complex. The contractor shall also submit copies of as-built shop drawings with LPI Form LPI-1-R91 to finalize the LPI Certified System Application with a copy of the test results.

3.6 AIR TERMINAL RODS: Shall be securely connected to and made electrically continuous with the roof conductors. Air terminals shall extend above the roof to which they are attached. Where practicable all air terminals shall be provided with at least two paths to ground.

3.7 ROOF CONDUCTORS: Shall be connected to all metal parts of the roof. Sharp turns in conductors shall be avoided. Bends shall have a radius of eight inches or more and shall not turn more than 90 degrees. Roof conductors shall be connected to form a closed loop and connect all air terminals together. Connections to air terminals shall be made with screwed or bolted clamps.

3.8 DOWN CONDUCTORS: Shall be electrically continuous from all terminals or roof conductors to the grounding system. Down conductors shall be concealed and shall be as widely separated as possible. All connections to down conductors shall be made with screwed or bolted clamps.

3.9 TESTS: After the installation of the lightning protection and static grounding system is completed and at such time as the Architect may direct, the Contractor shall provide a UL field inspector to conduct an operating test, as specified by the manufacturer, for approval. The Contractor shall furnish all instruments and personnel required for the test and it shall be performed in the presence of the Architect and Owner. Loose connections, inadequate ground or improper workmanship found by such tests shall be replaced or corrected at the Contractor's expense and the system retested until conditions are satisfactory. A report on the test shall be provided to the Owner.

3.10 Connections shall be made in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors hardware, conductors and connections methods so metal in direct contact will be galvanic ally compatible.

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 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.

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.

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 13 - Surveying

2. Section 31 23 17 - Trenching

3. Section 31 23 18 - Rock Removal

4. Section 31 23 23 - Backfill

5. Section 33 11 13 - Public Water Transmission Systems

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. Report prepared by Geo-Test, entitled: “Geotechnical Engineering Services Report Job No. 1-91203 Smith Lake Water System Improvement Project”, dated October 12, 2020.

2. 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.

3. Note that in the event of any discrepancy or difference in requirements between the geotechnical reports and the Technical Specifications, the more stringent requirement shall apply.

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.
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. Compacted fill from top of utility bedding to finished grade.
3. Backfilling and compaction.

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.

1.2 REFERENCES

A. Subsurface data:

1. Report prepared by Geo-Test, entitled: “Geotechnical Engineering Services Report Job No. 1-91203 Smith Lake Water System Improvement Project”, dated October 12, 2020.
2. 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.
3. Note that in the event of any discrepancy or difference in requirements between the geotechnical reports and the Technical Specifications, the more stringent requirement shall apply.

B. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
1. NMSSPWC Sections 701, 801 & 802 “Trenching, Excavation and Backfill”.

C. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

D. American Society for Testing and Materials International (ASTM):
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).
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 D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3).
8. ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.
9. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
10. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
11. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
12. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
13. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
14. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
15. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
16. ASTM D4254 - Minimum Index Density and Unit Weight of Sols and Calculation of Relative Density.
17. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
18. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
19. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
20. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
21. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
22. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
23. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
24. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
25. ASTM D5080 - Rapid Determination of Percent Compaction.
26. 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 state standards and specifications of the utility provider.

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.

B. Pipe Backfill: As specified in Section 31 23 23.

C. Structural Fill: As specified in Section 31 23 23.

D. Granular Fill: As specified in Section 31 23 23.

E. Concrete: As specified in Section 03 30 00.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes 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 for Project conditions.

3.2 PREPARATION

A. Call New Mexico “One Call” at 811, NTUA Call Before You Dig Program at 1-928-729-5721, 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. Notify Engineer at least five (5) working days prior to commencing work within 100 feet of any designated 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 for site-specific requirements.

C. Identify required lines, levels, contours, and datum locations.

D. Protect plant life, lawns and other features remaining as portion of final landscaping.

E. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Maintain and protect above and below grade utilities indicated to remain.

G. 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.

3.3 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 per Section 33 11 13.
3. When bottom of trench is rocky, over-excavate and fill as specified in Section 31 23 23.

B. Excavate trench to minimum width as indicated on Drawings.
1. Cut trenches to width indicated on Drawings, providing at least 6 inches of clear space between the trench face and the outside diameter of the pipe. The maximum permissible width of the trench shall be the outside diameter of the pipe (or distance between pipes plus pipe diameters in the event that two pipes are buried in the same trench) plus 24 inches, unless otherwise indicated on the Drawings, permission in writing to use a greater width is obtained from the Engineer.
2. 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. Increased trench width, if needed to meet these requirements, shall be provided at no additional cost to the Owner.

3.4 TRENCHING

A. Excavate subsoil required for utilities.

B. Remove lumped subsoil, boulders, and rock up to the size that would require special equipment beyond conventional machinery used for trenching, in which case the Engineer should be notified immediately.

C. Allowable Open Trench: Trenches may be opened in advance of pipe placement and backfill operations under the following conditions:
1. No more than 100 feet of trench shall be opened in advance of pipe laying operations. This distance may be reduced due to traffic control considerations. Backfilling shall begin as soon as pipe is laid and inspected and shall keep pace with the pipe laying. Whenever local, county, state or federal regulations impose stricter limitations, such regulations will take precedence.
2. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by traffic weight steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day.

3. Do not block vehicular traffic or impede access to homes or businesses.
4. Protect open trench to protect the public, livestock, wildlife and the environment.

    a. The Owner or land-controlling agencies, at their sole discretion, may require temporary fencing to protect livestock, wildlife and local residents and land users from open trenches. Such fences shall be required in all trenches left open in active livestock grazing areas. Contractor shall provide such fencing, if required, at no additional cost to the Owner.
5. Contractor is solely responsible for safety of all open trenches and bears sole liability for any incidents or accidents arising from open trenches.
6. The Owner may further restrict the amount of open trench as needed due to safety, land use or environmental considerations.

D. Intercept and divert surface drainage and precipitation away from excavation through use of dikes, curb walls, ditches, pipes, or other means.

E. Dewater and maintain substantially dry subgrade during pipe installation.
1. Remove groundwater by pumping to keep excavations dry.
2. Comply with New Mexico state standards and requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.
3. If a separate bid item is not included on the Bid Form for dewatering, the cost thereof will be considered incidental to the cost of trenching and utility installation.

F. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

G. 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.

H. 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.

I. 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.

J. 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.

K. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

L. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

M. Remove excess subsoil not intended for reuse, from site.

N. Protect open trench at all times to prevent danger to the public and to wildlife. Any safety requirements imposed by agencies or entities with jurisdiction must be met.

3.5 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.

3.6 BACKFILLING OF TRENCHES

A. See Section 31 23 23 - Backfill, Articles 3.3 and 3.4 for general backfill requirements, as well as trench backfill and bedding requirements around pipelines.

3.7 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.
   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.

3.8 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.

3.9 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. Perform laboratory material tests in accordance with ASTM D1557.

E. Refer to compaction testing requirements in Section 31 22 13 - Rough Grading and/or Section 31 23 23 - Backfill, Field Quality Control, as applicable.

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 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.
2. Section 31 23 23 - Backfill.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Trench Rock Removal:

1. Basis of Measurement:

a. Along stationed waterlines: 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.

b. Within Treatment Site: Incidental to work.

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.

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 building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.
6. Pipe bedding material.

B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 17 - Trenching.
4. Section 33 11 13 – Public Water Transmission Systems.

1.2 REFERENCES

A. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
1. NMSSPWC Sections 701, 801 & 802 “Trenching, Excavation and Backfill”.

B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T99 - Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 3050mm (12-in.) Drop.
2. 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 for Testing and Materials International (ASTM):
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 D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3, 2,700 kN-m/m3).
8. ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.
9. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

10. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
11. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
12. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
13. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
14. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
15. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
16. ASTM D4254 - Minimum Index Density and Unit Weight of Sols and Calculation of Relative Density.
17. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
18. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
19. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
20. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
21. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
22. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
23. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
24. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
25. ASTM D5080 - Rapid Determination of Percent Compaction.
26. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Percentage Compaction: Ratio, expressed as percentage, of actual density of material compared with maximum dry density based on Modified Proctor (ASTM D1557).

B. Optimum Moisture Content: Based on Modified Proctor (ASTM D1557).

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 and pipe bedding material.

F. Submit construction drawings with compaction test locations marked and labeled with station, date, test number, depth of test below ground surface, and test result.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Suitable materials may be processed on-site, or may be imported. If imported materials are required to meet the quantity requirements of the project, it will be provided at no additional expense to the Owner, unless a unit price item is included for imported materials on the Bid Form. The following types of materials are defined as suitable where scheduled:

1. Type A (three-quarter inch minus aggregate backfill): Crushed rock or gravel, and sand with the gradation requirements below.

Sieve Size	Percentage Passing
3/4-inch	100
No. 4	30 – 50
No.200	0 – 12

2. Type B (Class I crushed stone): Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements. The material shall have a minimum sand equivalent value of 75.

Sieve Size	Percentage Passing
3/4-inch	100
No. 4	30 – 50
No. 200	0 - 5

3. Type C (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a No. 4 sieve, and a sand equivalent value not less than 30.
   a. This material to be used only when approved by Engineer.

4. Type D: (pipe bedding material): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 5 percent passing a No. 10 sieve and 1 to 2 percent passing a No. 200 sieve.

5. Type E (pea gravel backfill): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 10 percent passing a No. 4 sieve.

6. Type F (coarse drain rock): Crushed rock or gravel meeting the following gradation requirements:

Sieve Size	Percentage Passing
2-inch	100
1-1/2-inch	90- 100
1-inch	20 – 55
3/4-inch	0 – 15
No. 200	0 – 3

7. Type G (aggregate base, base course) as follows:

Sieve Size	Percentage Passing
1-inch	100
3/4 inch	80-100
No.4	30-60
No.10	20-45
No. 200	3-10

8. Type H (graded drain rock): Drain rock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements:

Sieve Size	Percentage Passing
1-inch	100
3/4-inch	90 - 100
3/8-inch	40 - 100
No. 4	25 – 40
No. 8	18 – 33
No. 30	5 – 15
No. 50	0 – 7
No. 200	0 – 3

9. Type I Not Used

10. Type J (cement-treated backfill): Material which consists of Type H material, or any mixture of Types B, C, G, and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.

11. Type K (topsoil): Stockpiled topsoil material which has been obtained at the site by removing soil to a depth not exceeding 2 feet. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris.

12. Type L (controlled low strength material): Controlled low strength material, also referred to as ‘soil cement slurry’ or ‘flowable fill’ shall meet the following requirements:
    a. Slurry shall have a 7-day compressive strength of not less than 50 psi and not more than 150 psi. The compressive strength shall be determined in accordance with ASTM D4832.
    b. Typical cement content: 3 to 10 percent by dry weight of soil to obtain specified compressive strength.
    c. The water-cement ratio of the mix shall not exceed 3.5:1. The water content shall not exceed that required to provide a mix that will flow and can be pumped.

d. The consistency of the slurry shall be such that the slurry flows easily into all openings between the pipe and the lower portion of the trench.

13. Type M (aggregate sub-base, structural fill). Well-graded crushed rock or natural gravel meeting the following gradation requirements:

Sieve Size	Percentage Passing
4-inch	100
3-inch	95 100
No. 200	3 - 15

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, the Engineer shall be immediately notified. In case of conflict between types of pipe embedment backfills, the Contractor is to use the agency-specified backfill material if that material provides a greater degree of structural support to the pipe, as determined by the Engineer. In case of conflict between types of trench or final backfill types, the Contractor shall use the agency-specified backfill material if that material provides the greater in-place density after compaction.

C. Fill and backfill types, including use of native soil, shall be used in accordance with the following provisions. Native soil used for fill and backfill must meet the requirements of the type of material specified below and as shown for the corresponding type of material shown in 2.1.A above.

1. Embankment fills shall be constructed of Type M material, as defined herein, or other material approved by the Project Engineer. Drainage structures embankments shall be backfilled with materials used in original construction.
2. Pipe zone backfill shall consist of the following materials for each pipe material listed below. All pipe bedding material shall receive prior approval by the Engineer before use.
    a. Concrete pipe, shall be provided Type A or B pipe bedding and embedment backfill material, or native material that meets the criteria described below, and is acceptable to the Engineer.
    b. Plastic pipe shall be provided Type D bedding and embedment zone material, or native material that meets the criteria described below, and is acceptable to the Engineer.
        1) In trenches where dewatering is required, the pipe bedding material and embankment backfill shall be Type A or B as directed by the Engineer.
    c. Excavated native material will be allowed, provided that it is free draining and contains no organic materials, no rocks larger than 1/2-inch, clods or frozen lumps. A proctor of this material shall be submitted to the Engineer for review and approval before use. If native backfill material is approved, on-site screening may be required by Engineer to remove any rock material larger than 1/2-inch at no additional expense to the Owner. The location of such sites must be coordinated with the Owner.
3. Trench zone backfill for pipelines shall be any of Types A through H backfill materials or any mixture thereof.

4. Final backfill material for pipelines under paved areas shall be Type G backfill material.
5. Final backfill under areas not paved shall be the same material as that used for trench backfill, unless otherwise indicated.
6. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.
7. Aggregate base materials under pavements, curb and gutter, and sidewalk shall be Type G material constructed to the thickness indicated.
8. Aggregate sub-base shall be Type M material.
9. Backfill around structures shall be Types A through Type H materials, or any mixture thereof.
10. Under structures where groundwater must be removed to allow placement of concrete, Type F material shall be used. Before the Type F material is placed, filter fabric shall be placed over the exposed foundation. Filter fabric shall be Mirafi 140 N, Mirafi 700X, or equal.
11. Under all other structures, Type G or H material shall be used.
12. Backfill used to replace pipeline trench over-excavation shall be a layer of Type F material with a 6-inch top filter layer of Type E material or filter fabric to prevent migration of fines for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet.

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 BACKFILLING FOR STRUCTURES, SITE WORK AND APPURTENANCES

A. Backfill areas to contours and elevations with unfrozen materials as indicated on the Drawings or as directed by the Engineer.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.

D. Place material in continuous layers 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.

E. Employ placement method that does not disturb or damage other work.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Slope grade away from building minimum 6 inches in 10 ft, unless noted otherwise.

H. Make gradual grade changes. Blend slope into level areas.

I. 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.

J. 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.

K. Under surfaced or paved roads, driveways or parking areas, apply base course at uppermost layer of backfill 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.

L. Remove surplus backfill materials from site.

M. Leave fill material stockpile areas free of excess fill materials.

N. Repair or replace remaining items damaged by excavation or filling.

3.4 BACKFILLING OF TRENCHES

A. Place a minimum of 4 inches of bedding material in pipe trenches to lines and grades indicated on Drawings or as directed by Engineer and compact before pipe is laid. Grade bedding material parallel to bottom of pipe.

B. Do not place material when either the material or the surface upon which it is to be placed is frozen.

C. Pipe zone backfill materials shall be manually spread around the pipe so that, when compacted, the pipe zone backfill will provide uniform bearing and side support.
   1. Exercise care not to damage pipe or appurtenances when placing embedment material.
   2. Maintain optimum moisture content of fill materials to attain required compaction density.
   3. 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.
   4. Place material in uniform layers.
   5. Work material into pipe haunches to prevent voids and achieve specified compaction under the haunches.
   6. No backfilling by machine methods permitted until a minimum of one foot of material has been placed by hand over the top of the pipe.
   7. Place material to a compacted depth of 12 inches over the top of the pipe, 15 inches of compacted depth over the top of the pipe in paved or traffic areas, and compacted by hand held compacting tools before other backfilling is done.

D. If pipe laying operations are interrupted for more than 24 hours, cover pipe laid in the trench with backfill.

E. When the bottom of the trench is unstable, an additional 4 inches shall be over-excavated and filled with bedding material before pipe is laid.

F. Where rock is present and where there is concern that settling rocks in the surrounding material may rupture the pipeline, the amount of bedding material below and above the pipe shall be increased. In these cases there will be 8 inches of bedding material below the pipe and 15 inches above, as directed by the Engineer.

G. When using free-draining crushed rock or gravel for embedment on stretches longer than 300 feet, install trench plugs composed of silty, non-plastic material at 300 foot intervals to impede flow of trench water through the embedment.

H. Under surfaced or paved roads, driveways or parking areas, apply base course at uppermost layer of backfill 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.

3.5 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 Modified Proctor method, ASTM D1557.
   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 over-excavation 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 over-excavation backfill may be compacted to 95%.
2. Pipe Bedding Material: Place and compact pipe bedding material as indicated on Drawings for given soil classification, pipe wall thickness, and depth of cover. If native material meets grading requirements and is used, compact to 95%.
3. Initial and Final Backfill: For trenches outside of roads, driveways, parking areas or wash crossings, compact to 85%, or to a density equal to that of the adjacent undisturbed soil, as directed by the Engineer. For trenches within the driving surfaces of roads, driveways or parking areas (both paved and unpaved) or within wash crossings, compact to 95%.
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. Note that all Percent Compaction values in these Technical Specifications and Drawings are based on Modified Proctor, ASTM D1557, unless otherwise noted.

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.

3.6 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. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

E. Percent Compaction: Shall meet minimum required compaction as set forth in these specifications

F. Moisture Content: As set forth in these specifications.

3.7 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Testing, Adjusting, and Balancing.

B. Perform laboratory material tests in accordance with ASTM D1557.

C. Perform in place compaction tests in accordance with the following:
1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D6938.
2. Moisture Tests: ASTM D6938.

D. When tests indicate Work does not meet specified requirements, remove material, replace, compact, and retest.

E. Provide test trenches and excavations including excavation, trench support, and groundwater removal for the soils testing operations, at the locations and depths required. The cost of all work associated with accessing, preparing, or time delays for testing to be included in the unit price of the applicable pay item being tested.

F. Compaction testing shall be done to the extent such that the Owner and Engineer can be reasonably assured that the backfill has been placed in accordance with the requirements of the Contract Documents, or as required by the utility for which the trenching is being provided, whichever is the more stringent. When a testing allowance is established on the Bid Form, the Owner and Engineer will determine the testing frequency to be used throughout the project. If no allowance is included, the frequency of testing shall be at least once every 400 linear feet of trenching, or at least once every 200 square feet below structural slabs.

G. Correction of Substandard Work: 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. Contractor shall correct elevations, lines and grades as needed, at no additional expense to the Owner.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 00 00 - Execution Requirements: Protecting Installed Construction.

B. Reshape and re-compact fills subjected to vehicular traffic.

3.9 SCHEDULE

A. Interior Slab-On-Grade:
1. Per Geotech Report.

B. Exterior Side of Foundation Walls, Retaining Walls and Over Granular Filter Material and Foundation Perimeter Drainage:

1. Fill Type A – H or any mixture thereof, to subgrade elevation. 6 inches thick, each lift, compact uniformly to 90 percent of maximum density.

C. Fill Under Asphalt and Concrete Paving:
   1. Compact subsoil to 95 percent of its maximum dry density.
   2. Fill Type G, to 2 inches below finish paving elevation, or to match existing conditions, whichever is greater, compact uniformly to 95 percent of maximum density.

D. Fill Over Drainage Piping Gravel Cover:
   1. Fill Type H, to 6 inches below finish grade, compact uniformly to 90 percent of maximum density.

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.
      1) Measurement is based on actual coverage area. Where the Drawings require wire mesh both above and below the riprap blanket, both layers are included the pay item, but the coverage area is not doubled for purposes of measurement.
   b. Basis of Payment: Includes 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) 6” 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:
   a. Fencing: By linear foot to fence height specified, based on specified post spacing.
   b. Gates doors: By Each, as described on bid form.
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: 12 or 16 ft double-swing, consisting of two (2) 6 or 8 ft swinging sections, or as shown on Drawings.

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 selvage 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. Do not attach hinged side of gate from building wall.

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.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Grassed Areas:

1. Basis of Measurement: By linear foot of waterline right of way.
2. Basis of Payment: Includes preparation of subsoil, topsoil, placing topsoil, seeding, watering and maintenance to specified time limit. Reseeding of any additional site areas disturbed by Contractor is incidental.

1.3 REFERENCES

A. Federal Specifications:

1. OF-241 - Fertilizers, Mixed, Commercial.

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. NNAD: Navajo Nation Department of Agriculture

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 Navajo Nation Department of Agriculture 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. Contractor is advised that there are three seed mixtures included in the appendices. Selection of specific mixture will depend on existing vegetation and soil type at each location. Contractor shall coordinate with Engineer prior to purchasing seed to determine exactly where to use each seed mixture.

C. Contractor shall coordinate seeding dates to coincide with the dates stipulated in the NNAD re-vegetation requirements and stipulations.

1. Contractor shall indicate exact proposed re-seeding dates in project schedule, and shall notify the Engineer as early as possible of any deviations from this proposed seeding schedule.

1.9 MAINTENANCE SERVICE

A. Section 01 00 00 - Execution Requirements: Requirements for maintenance service.

B. 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.

C. 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 Navajo Nation Department of Agriculture standards. Refer to seed mixtures provided in Appendix C.

B. Engineer, in consultation with NNAD, shall determine which seed mixture applies at each location within the project. Contractor is responsible to coordinate with Engineer to determine proper seed mix prior to purchasing seed.

C. 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.

PART 3 EXECUTION

3.1 GENERAL

A. Prepare and restore site per applicable NNAD, included in Appendix C to the Contract Documents.

B. Seed and reclaim all disturbed areas, including temporary construction easements and any areas disturbed by construction traffic.

C. Temporary fence gates along the pipeline and access alignments must be kept closed to manage the livestock in the project 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 by Engineer, based on land ownership and native vegetation.

B. Apply seed at rates specified by NNAD. Use seed drill followed by drag packer over area to incorporate seed approximately ½ inch deep.

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.

3.8 MULCHING

A. Do not apply mulch on Tribal lands.

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 11 13

PUBLIC WATER TRANSMISSION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water Piping and Fittings.
2. Tapping Saddles, Tees and Valves.
3. Dismantling Joints.
4. Expansion Joints.
5. Underground Pipe Markers.
6. Aboveground Pipe Markers
7. Pipe Supports and Anchoring
8. Casing Spacers
9. Bedding and Backfill Materials.
10. Accessories
11. Source Quality Control.
12. Source Quality Assurance

B. Related Sections:

1. Section 02 21 13 - Surveying.
2. Section 03 30 00 - Cast-in-Place Concrete: Thrust restraints.
3. Section 31 23 17 - Trenching: Execution requirements for trenching.
4. Section 31 23 18 – Rock Removal
5. Section 31 23 23 - Backfill: Requirements for backfill to be placed.
6. Section 32 92 19 - Seeding.
7. Section 46 63 15 – Packaged Treatment System for Iron and Manganese Removal
8. Section 33 12 16 - Water Utility Valves.
9. 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.

3. The actual laboratory cost of concrete and compaction 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 and concrete 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 and horizontal directional drills shall be paid via a separate bid item. The cost of work associated with hydrostatic pressure testing for all other facilities (including site piping, pump stations, chlorination buildings, 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 and 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, pump stations, chlorination buildings, 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 A283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
6. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
7. ASTM F594 – Standard Specification for Stainless Steel Nuts.
8. 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
9. 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
10. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
11. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
12. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
13. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
14. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping
15. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test
16. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
17. 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
18. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

19. ASTM E165 – Standard Practice for Liquid Penetrant Examination for General Industry
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
21. 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 C206 - Field Welding of Steel Water Pipe.
10. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In. (100 mm through 3,600 mm).
11. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
12. AWWA C209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
13. AWWA C210 – Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
14. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances.
15. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
16. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
17. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/2 In. through 3 In. (13 mm through 76 mm), for Water Service.
18. AWWA M11 – Steel Pipe: A Guide for Design and Installation

19. AWWA M23 – PVC Pipe – Design and Installation

F. NACE International (NACE)

1. SP0274 – High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.

G. Society for Protective Coatings:

1. SSPC-SP5 White Metal Blast Cleaning

H. National Fire Protection Agency

1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

I. NSF International Standard / American National Standard (ANSI)

1. ANSF/ANSI 61 – Drinking Water System Components – Health Effects.

J. 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.

K. American Welding Society

1. AWS D1.1 – Structural Welding Code

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 will be used to comply with the Drawings and Specifications. The plan shall be in tabular form indicating the 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 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. Design calculations, drawings and material data sheets for cathodic protection and monitoring systems. Include assumptions and basis for design. Include approximate locations of anodes, test stations and isolation kits. Include copy of cathodic protection specialist’s NACE certification.

5. As-built drawings and any Contractor-provided survey data. Refer to Sections 01 00 00 – Basic Requirements and 02 21 13 - Surveying.

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. Record actual locations of piping mains, connections, thrust restraints, and invert elevations.

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 AWWAM23 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 shall conform to AWWA C900 and AWWA C905, 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.

6. Gasketed Joints:

   a. Joints per ASTM D3139.

   b. Use rubber gaskets manufactured and tested in accordance with ASTM F477.

   c. For all PVC casings at petroleum line crossings or where otherwise indicated on Drawings, use petroleum-resistant gaskets in accordance with ASTM F477.

7. 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.

8. Mechanical Joint Restraints:

a. Refer to specifications for ductile iron joint restraints in this section, below.

B. Ductile Iron Pipe, Joints, and Fittings:

1. Manufacturers:

a. US Pipe

b. American Pipe

c. Substitutions: Approved Equal

2. Ductile iron pipe:

a. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover.

b. 350 psi working pressure.

c. Coatings:
1) Bituminous Coating: AWWA C151.
2) Cement Mortar Lining: AWWA C104, standard thickness.

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 joints, fittings and gaskets shall be at least 350 psi, unless otherwise noted on the Drawings.

d. Pressure rating of flanged fittings and gaskets shall at least match that of the attached pipe, unless otherwise noted on the Drawings.

e. Marked with pressure rating, nominal diameter of opening, manufacturers' identification, country where cast, and degree of bend.

f. Coatings:
1) Bituminous Coating: AWWA C110.
2) Cement Mortar Lining: AWWA C104, standard thickness.

4. Joints:

a. Mechanical and Push-On Joints: AWWA C111.
1) No ductile iron pipe joints shall be allowed on pressure bearing pipes. Use only solid pipe pieces.

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 Star, "EBAA Iron, Megalug®" Series 2000PV, 2200, 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. Provide sacrificial anode cathodic protection where indicated in this Section.

e. 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. Mechanical Bell Restraint Harnesses:

a. Mechanical bell restraint harnesses shall be used to obtain required restraint lengths noted on Drawings.

b. Mechanical joint restraints shall be Star, "EBAA Iron, Megalug®" Series 1700 for Ductile Iron or 1900 or 2800 for PVC, 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.

7. Flanges:

a. Ductile or Cast Iron: ANSI/AWWA C110/A21.10 / ANSI B16.1, Class 125 , unless otherwise 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 rubber annular ring flange gasket in accordance with AWWA C115. Installation according to manufacturer's recommendations.

f. 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 bolts.

g. Bolt shall be long enough to protrude through the assembled nut at least two threads but not more than ½-inch.

h. 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 overdrlling is within manufacturer's recommended tolerances.

i. Contractor shall be responsible to verify compatibility of all flange bolt patterns prior to purchasing materials and shall notify the Engineer in the event that alternate bolt patterns are required to mate flanges.

8. Jackets:

a. AWWA C105 polyethylene jacket, Installation Method "A".

b. Double-wrap all ductile iron components, unless they are cathodically protected.

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.

f. Do not use polyethylene encasement on ductile iron pipe or fittings with cathodic protection.

C. Steel Pipe and Fittings:

1. Pipe fabrication:

a. Steel plate: ASTM A283, Grade C or D, or ASTM A36.

b. Steel sheet: ASTM A1011, Designation SS, Grade 40, 45 or 50; or ASTM A1018, Designation SS, Grade 40.

c. 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. Galvanized

b. All coatings shall be NSF 61-approved.

c. All surfaces shall be ground smooth. All weld splatter and other defects shall be removed prior to blasting.

d. Surface preparation shall conform to SSPC-SP5 White Blast Clean with surface profile of 2.0 to 3.0 mils.

e. Coating thickness for both interior and exterior per manufacturer's recommended maximum thickness.

f. All wetted surfaces of pipe interior shall be coated. All exposed surfaces of pipe exterior shall be coated.

g. Do not apply coating to mating surfaces of flanges.

h. 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 fusion-bonded epoxy coatings specified above.

5. Flanges:

a. Steel: ANSI Class 150 / AWWA C207 Class E / ASME B16.5 Class 150, unless otherwise 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 overdrlling 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 in the event that 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 350 psi Cold Working Pressure

2.2 TAPPING SADDLES, TEES AND VALVES

A. Tapping Saddles:

1. Manufacturers:

a. Mueller Co.

b. Kennedy Valve Co.

c. Romac Industries, Inc

d. JCM Industries

e. Ford Meter Box Company, Inc

f. Smith-Blair, Inc

g. Substitutions: Approved equal.

2. For taps 2-inches or smaller, use nylon coated ductile iron tapping saddles with stainless steel dual compression straps.
3. For taps larger than 2-inches, use fusion-bonded epoxy-coated steel.
4. All saddles shall be specifically designed for use on the type of piping 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. Saddle Working pressure rating: 350 psi.
7. Tapping saddles shall be used on unrestrained bell-and-spigot PVC, and DI pipe only. All taps on 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”.

2.3 DISMANTLING JOINTS

1. Manufacturer:
   a. ROMAC, Model DJ400
   b. Substitutions: Approved Equal
2. Flanges: AWWA C207 Class E Flange, ANSI Class 150
3. NSF 61 Certified fusion bonded epoxy coating
4. Color: Blue
5. Integral Tie Rods
6. 304 stainless steel fasteners (nuts, bolts, tie-rods)
7. Working pressure: 275 psi

2.4 EXPANSION JOINTS

1. Manufacturer:
   a. Proco Fitting, Model RC-231
   b. Substitutions: Approved Equal
2. Working pressure: 200 psi
3. NSF-61 approved elastomer material
4. Flange pattern: 125/150# dimensions
5. 304 stainless steel fasteners (retaining rings, nuts, bolts, tie-rods)
6. Neutral length to be field verified by Contractor during submittals process prior to ordering.
7. Provide with limit rods and accessories as recommended by manufacturer fur installation during 2-hour field pressure test at up to 235psi.

2.5 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.

2.6 ABOVE-GROUND PIPE MARKERS

A. Carsonite marker posts, blue, with Navajo Tribal Utility Authority (NTUA) decals. Decals to be specified by NTUA and provided by the Contractor. Place markers as specified on the Drawings.

2.7 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.

2.8 CASING SPACERS

A. Polyethylene Casing Spacer

B. Two part or multi segmented

C. Stainless steel 304 bolts, nuts and washers. All bolts shall be provided by the fitting manufacturer especially for use with their respective components.

2.9 BEDDING AND BACKFILL MATERIALS

A. As specified in Section 31 23 23.

2.10 BOLTS AND NUTS

A. Zinc-plated or fluoropolymer coated bolts and nuts shall be used for the installation of pipelines up to 500 mm (20") diameter and shall be carbon steel conforming to ASTM A307, Grade A, unless otherwise indicated on the approved drawings. Bolts and nuts shall have standard ANSI B1.1, Class 2A coarse threads.

B. Stainless steel bolts and nuts shall be used for the installation of pipelines 600 mm (24") diameter and larger and for submerged flanges. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts, and Grade 8M for nuts.

C. All bolt heads and nuts shall be hexagonal, except where special shapes are required. Bolts shall be of such length that not less than 6.4 mm (¼") or more than 12.7 mm (½") shall project past the nut in tightened position.

2.11 ACCESSORIES

A. Concrete for Thrust Restraints (where applicable): Conform to Section 03 30 00, with minimum compressive strength of 3,000 psi.

B. 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.

C. Field-applied Roskote coal tar epoxy coating on all buried steel bolts on all fittings and valves.

2.12 SOURCE QUALITY CONTROL

A. Pipe:

1. Polyvinyl chloride (PVC): Factory test all PVC pipe in accordance with AWWA C900 or AWWA C905, as applicable.

2. Ductile iron: Factory test in accordance with AWWA C151 and AWWA C104.

3. Steel: Factory test in accordance with ASTM A53.

a. 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.

d. Remove all defects disclosed during testing, re-weld and re-test the fitting.

C. 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 and cold-applied tape coatings:

a. All fusion-bonded epoxy coatings and cold-applied tape coatings on all pipes and fittings shall be holiday tested prior to installation, at no additional cost to the Owner.

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.

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.

F. Engineer reserves right to require additional holiday testing of any and all coated components that are suspected of having holidays in the field prior to installation. Costs of failed tests shall be borne by the Contractor; costs of passed additional tests shall be reimbursable from the Testing Allowance.

2.13 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. If required in the Contract Documents, take photographs or video along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.

2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing site features that may potentially be impacted by the construction work.

3. Include project description, date taken and sequential number on back of each photograph.

B. Construction staking:

1. Refer to Section 02 21 13 – Surveying.

C. 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.

D. Remove scale and dirt on inside and outside before assembly.

E. Prepare pipe connections to equipment with flanges or unions.

F. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

3.3 TRENCHING

A. In accordance with Section 31 23 17.

3.4 BEDDING AND BACKFILL

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 ductile iron piping and fittings according to AWWA C600.

1. Encase all ductile iron pipe and fittings that are not cathodically protected 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, 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 the felt outside both layers of polyethylene. Trim the felt to 2" above the floor and seal with silicone.

d. When installing ductile iron floor drain lines, bring both layers of polyethylene into the slab, trim, and tape to pipe just below the inset floor drain.

e. Use only 10-mil UHMW polyethylene film to tape the PE jackets. Do not use duct tape.

2. For pressure bearing pipes, no bell and spigot joints shall be allowed.

3. For Non-pressure bearing pipes (i.e. drain lines), install joints in accordance with manufacturer's recommendations.

4. Any damaged shop-applied coatings shall be repaired in accordance with manufacturers specification or this section for FBE coated pipes. In the event that field repair is required due to damage of shop-applied coating, Contractor shall notify Engineer prior to making the repair.

C. 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.

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.

D. 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.

E. Maintain 10 ft horizontal separation of water main from sewer piping in accordance with local code.

F. Lay pipe in straight line and center pipe within trench. Re-lay pipe that is out of alignment.

G. 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, and/or pipe deflection (i.e. pipe bending for fused pipe or joint deflection for jointed pipe).

a. 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 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. If the Contractor chooses to use DI ells at any given location, the required length of restrained pipe must be used on both sides of the bend, whether the restraint length is shown on the plan and profile sheet, or not.

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. Jointed PVC pipe joint deflection shall not exceed 1 degree per joint.

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 to abide by manufacturer's recommended maximum allowable deflection

H. 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.

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. 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.

i. All deviations from the Drawings shall be documented by the Contractor and must be approved in advance by the Engineer.

j. All other specifications shall be met.

k. 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. 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.

a. 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.

b. Additional air valves 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 is located on a restrained section of main line, a reducing tee is required in lieu of tapping saddle.

I. 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.

J. Do not lay pipe in wet or frozen trench.

K. Direction of pipe bells may be reversed for ease of installation, provided that all pipe material and installation meets applicable AWWA, ASTM, NTUA and material manufacturer's standards. On grades greater than 10%, install jointed pipe uphill.

L. Pipe expansion and contraction

1. Install pipe to allow for expansion and contraction without stressing pipe or joints.

M. 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.

N. Install tracer wire continuous, taped to top of pipeline; coordinate with Sections 31 23 17 and 31 23 23.

O. 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.

P. Install thrust blocks at locations indicated on Drawings. Installation of thrust blocks shall not relieve the Contractor of responsibility to provide pipe restraints as indicated on Drawings and Specifications.

Q. Flanged Joints: Not to be used in underground installations except within accessible structures or as shown on Drawings.

R. All pipes, fittings and appurtenances must remain within designated permanent rights-of-way. All construction activities must remain within the right-of-way or temporary construction easement. Do not encroach on adjacent properties or culturally sensitive areas.

S. Embed pipe within 100 feet behind pipe-laying operations, unless otherwise permitted by the Engineer.

T. Do not backfill pipe prior to as-built surveying; refer to Section 02 21 13 - Surveying.

3.6 INSTALLATION - TAPPING SADDLES

A. Install tapping saddles and valves 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 saddles on restrained PVC pipe. All taps on restrained PVC main lines must use MJ reducing tees.

3.7 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.

3.8 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.

3.9 THRUST RESTRAINT

A. Install tie rods, clamps, setscrew retainer glands, or restrained joints. Protect metal restrained joint components against corrosion by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.

B. Install thrust blocks or restrained fittings in accordance with Drawings and in accordance with manufacturer's instruction.

C. All thrust blocks shall bear against undisturbed earth.

3.10 BACKFILLING

A. In accordance with Section 31 23 23.

3.11

3.11 PIPELINE RIGHT-OF-WAY GRADING

A. Establish finished grade to provide a minimum of four (4) foot of cover over the pipe. Measure depth of cover from final surface grade (not including dirt mound) 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.

B. Mound soil over top of pipe in accordance with Drawings, except at wash crossings, road crossings, or where prohibited by landowner.

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 culturally sensitive areas.

3.12 TAPPING EXISTING WATER DISTRIBUTION FACILITIES

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

B. Coordinate with NTUA's designated representative regarding schedule, means and methods, maximum allowable shut-off time, water usage rates (both gpm and gpd) and other parameters stipulated by NTUA.

C. Contractor is advised that a Water Use Permit from Navajo Nation Water Code Administration is required for use of the NTUA water. Contact Monte Chee at (928) 729 – 4132 or mchee_71@yahoo.com for more information.

D. 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.

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. Taps on existing NTUA pipelines shall be by cut-in tees, with NTUA's approval. Wet taps shall not be permitted.

G. Prevent contamination of existing facilities with trench water, mud, debris, chemicals or other substances.

H. All new materials shall be thoroughly cleaned and disinfected with a strong (200 ppm) chlorine solution prior to connecting to existing NTUA facilities.

3.13 INITIAL FILLING OF PIPELINE

A. "Initial filling" refers to first introduction of water and evacuation of air in the pipeline.

B. 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.

C. Unless otherwise directed by the Engineer, the maximum allowable instantaneous flow rate shall be 40 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.

3.14 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.15 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 as Appendix 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

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 NTUA personnel. Contractor is responsible for coordination of testing schedule with NTUA to allow NTUA's representative to be present.

C. 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.

D. Compaction Testing: Refer to Section 31 23 23 – Backfill.

E. Testing of cathodic protection systems in accordance with NACE SP-0169. Provide report on test methods utilized and results of tests conducted, as well as as-built drawings with list of anode locations.

F. Test electrical isolation kits for cathodic protection isolation using radio frequency isolation test device both prior to burial and after burial. Test in the presence of the Engineer.

G. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.

3.16 TOLERANCES

A. Line and grade surveying tolerances:

1. See Section 02 21 13 – Surveying.

2. 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. Gate Valves.
2. Check Valves.
3. Air Valves.
4. Inflow Preventor
5. Flush Valve Assemblies.
6. Valve boxes.
7. Meter cans & pits.
8. Pipe Supports
9. Valve vaults.
10. 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. Air Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, combination air valve assembly including inflow preventor, meter pit, cover and hatch, identification placards, warning tags, fittings, accessories and backfill.

B. Gate Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, gate valves, adaptors, fittings, valve boxes, lids, collars, accessories, and backfill.

C. Check Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, check valve, dismantling joint, adaptors, fittings, vault with lid, accessories, and backfill.

D. Flush Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment:
   a. 2-inch Flush valve with above grade discharge: Includes excavation, 2-inch piping, 2 inch gate valve, valve boxes, collars, above-grade discharge pipe, gravel pack at weep hole, accessories and backfill.

E. Valves used in Prepackaged Iron and Manganese Treatment System are incidental to the installation of the t6reatment system.

1.3 REFERENCES

A. ASTM International (ASTM)

1. ASTM A48 – Standard Specification for Gray Iron Castings
2. ASTM A536 – Standard Specification for Ductile Iron Castings
3. ASTM A564 – Standard Specification for Hot Rolled and Cold Finished Age Hardening Stainless Steel Bars and Shapes
4. ASTM C478 – Circular Precast Reinforced Concrete Manhole Sections
5. ASTM C857 – Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
6. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
7. ASTM F594 – Standard Specification for Stainless Steel Nuts.
8. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test
9. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate Zinc Rich Primers by Solvent Rub

B. American Water Works Association (AWWA):

1. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
2. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
3. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
4. AWWA M11 – Steel Pipe: A Guide for Design and Installation
5. AWWA M23 – PVC Pipe – Design and Installation

C. American National Standards Institute

1. ANSI B16.1 Gray Iron Pipe Flanges and Flanged Fittings

D. NACE International (NACE)

1. SP0274 – High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.

E. NSF International/ American National Standard (ANSI):

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

F. 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 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, NTUA Standards and the National Fire Protection Act (NFPA).

B. All piping, fittings, valves and any other potable water system appurtenances shall comply with the “Reduction of Lead in Drinking Water Act”, in effect as of 2014, or any subsequent revision thereof.

C. Valves: Mark valve body with manufacturer's name and pressure rating.

1.7 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years’ experience.

1.8 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.

1.9 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.

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 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 or threaded, 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.

2.3 CHECK VALVES

A. Inline 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. Working pressure rating: 250 psi.
5. Pressure testing: Seat test – 500 psi.
6. 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.
7. Provide with screw-type backflow actuator with stainless steel T-handle for operation.
8. Provide with mechanical indicator to indicate disc position.

B. Cast Iron Flap Check Valve
1. Manufacturer:
a. Clow Valve Flap Valve F3012-T
b. Substitutions: Approved Equal.
2. Flanges: NSI B16.1, Class 125.
3. ANSI/AWWA C508 certified.
4. Working pressure rating: 250 psi.
5. Pressure testing: Seat test – 500 psi.
6. Materials of construction:
a. Body and cover: ASTM A-126 Class B grade iron.

b. Seat ring: bronze.
c. Hinge pin: stainless steel.
d. Coating: Interior and exterior shall be coated with fusion bonded epoxy.
e. Insect screen

2.4 BALL VALVES

A. Stainless steel ball valves for air valve assemblies

1. Size: ¼-inch, ½-inch or 1-inch, as shown on Drawings
2. May be imported or domestic
3. Manufacturers:
4. Milwaukee Valve
5. Apollo
6. Approved equal
7. Working Pressure: Not less than 250 psi
8. Inlet/Outlet: FNPT, or as shown on Drawings
9. All stainless steel construction, including body, tailpiece, ball, ball retainer, stem, handle, handle nut, packing nut, and lock washer
10. 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 curb stop style operating nuts are required.

2.5 AIR VALVES

A. 1-inch combination air release valve:

1. Manufacturer:
    a. Val-Matic Valve and Manufacturing Corporation. Single-body Type.
    b. Combination air valve model 201C.2 SV.
    c. Substitutions: Not permitted
2. Working pressure: 300 psi
3. Inlet 1” NPT
4. Outlet: 1”, NPT
5. Cast iron or ductile iron body, cover and baffle; stainless steel trim, float, and fasteners.
6. Seat: Resilient Buna N.

7. Valve to perform functions of both air release and vacuum relief.
    a. Air release orifice: 5/64”
8. Stainless steel 304 piping, valve, and fittings between vacuum relief valve and air valve bodies.
9. Internal and external coatings shall be fusion bonded epoxy conforming to NSF-61 requirements.

2.6 INFLOW PREVENTOR

A. Inflow Preventor for a 1-inch Combination Air Valve (Single Body Type):
1. Manufacturer
    a. Valmatic Model 1300 Series
2. Female NPT thread
3. Materials
    a. The upper and lower chambers shall be constructed of ASTM A536, Grade 65-45-12 ductile iron.
    b. Float checks and trim shall be constructed of Type 316 stainless steel.
    c. Resilient seats shall be EPDM with fiberglass reinforcement.
4. Redundant float actuated closure members.
5. Heavy duty basket type screen.
6. FBE coated wall bracket shall be provided.
7. Stainless steel braided hose to attach to Air Valve.

2.7 FLUSH VALVE ASSEMBLIES

A. Components of flush valve assembly shall be as provided elsewhere in project specifications.

2.8 VALVE BOXES

A. 12-inch diameter Valves and Smaller: Cast iron, two-piece, slip type.
B. Valves larger than 12-inch diameter: Domestic cast iron, three-piece, slip type; round base.
C. Where waterline is buried at a depth greater than 4 feet, provide valve box extensions as required.
D. Cast iron lid marked “Water”.
E. Heavy duty, traffic rated.
F. Locking lids with standard pentagon nut.

2.9 METER CANS & PITS

A. Frame and cover for Air 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

B. Meter Pit for Air 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.

C. 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

D. Contractor responsible to ensure compatibility between meter pit / box, flange, ring, and cover.

2.10 PIPE SUPPORTS

A. Manufacturer:

1. Standon, S92 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

2.11 VALVE VAULTS

A. Concrete manhole sections conforming to ASTM C478 and ASTM C857.

1. Bell and spigot joints.
2. Symmetrical reinforcement only.

3. Soil-tight gasket conforming to ASTM C-990.
4. Embedded ladder rungs.

B. Concrete shall conform to Section 03 30 00 – Cast-in-Place Concrete.

C. Concrete shall be 4000 psi.

D. Manufactured or cut to lengths shown on Drawings.

E. "Mouse hole" or circular cut-outs to accommodate main line pipe inside vaults, if needed, shall be pre-cast.

F. Square access covers:

1. Manufacturers:
   a. Halliday Products, Series W2S
   b. MSU Mississauga Ltd series MD-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

G. 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.

2.12 VALVE IDENTIFICATION PLACARDS

A. Rectangular stainless steel 430 plate with 4 x ¼" pre-drilled holes.

B. Dimensions: 8"w x 6"h x 0.029"t or as shown on plans.

C. Laser-etched lettering using Cermak LMM6000 laser marking promoter with 150 watt CO2 laser.

D. Arial font with size as large as permitted by placard dimensions and pre-drilled holes, centered horizontally and vertically on placard; minimum 3/8" letter height.

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.

2.13 VALVE IDENTIFICATION PLACARDS (FOR AIR VALVES)

A. Rectangular stainless steel 430 plate with 4 x 3/16" pre-drilled holes.

B. Dimensions: 6"w x 6"h x 0.029"t or as shown on plans.

C. Laser-etched lettering using Cermak LMM6000 laser marking promoter with 150 watt CO2 laser.

D. Arial font with size as large as permitted by placard dimensions and pre-drilled holes, centered horizontally and vertically on placard; minimum 3/8" letter height.

E. Valve identification placards shall be affixed with four 3/16" dia. Stainless steel rivets.

F. Submit a proof to Engineer for approval before producing placards.

2.14 VALVE IDENTIFICATION TAGS (FOR AIR VALVES)

A. Identification tag:

1. Stainless steel 304 or 316
2. Natural metal color background with black lettering
3. Dimensions: 2" x 2.5" x 0.024" thick
4. Includes pre-cut hole for fastener. Contractor responsible for assuring pre-cut hole is properly sized for fastener.
5. Laser-etched lettering using Cermak LMM6000 laser marking promoter with 150 watt CO2 laser
6. Minimum letter/font height: 0.1", or larger depending on available printing space for each tag.
7. Wording as indicated on drawings.

B. Fastener:

1. Stainless Steel #6 Beaded Chain

C. Submit a proof to Engineer for approval before producing tags.

2.15 ACCESSORIES

A. Concrete for thrust restraints, blocks and collars: Concrete type specified in Section 03 30 00.

2.16 STEEL PIPES AND FITTINGS

A. All steel pipes and fittings shall be Stainless Steel 304, unless otherwise noted.

B. Pressure rating: At least 350 psi Cold Working Pressure, unless otherwise noted.

2.17 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.

2.18 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.

3.3 INSTALLATION

A. Valve scribing: All valve collars shall be scribed with the valve data.

1. Valve collars shall be etched using a 4-inch grinder, with Engineer's approval in field.

2. All valve collars 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)

e. Number of turns to operate.

3. All valve collars 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 vaults inside fenced areas ("site valves") shall be further labeled with a laser etched 8" x 6" aluminum identification 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. Isolation 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) Number of turns to operate.

   d. Vault identification placards shall contain the data shown on the drawings.

5. All valve collars inside fenced areas ("site valves") and outside fenced sites ("main line valves") shall be further labeled with a laser etched 8" x 6" (or as specified on drawings) aluminum collar warning 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 collar warning placards shall have wording per drawings.

6. 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 rivet head diameters are compatible with holes in aluminum plate.

   c. Valve identification etching shall contain the following valve data:

      1) Valve station

      2) Valve type (i.e. 1" Combo ARV, etc.)

      3) Tapped pipe size and type

7. 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 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.

C. 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.

D. 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.

E. 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 or meter boxes installed as shown on drawings above finished grade.

    a. Any valve box lids, meter can 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. Valves shall require the same joint restraint lengths as dead-ends of similar size and pipe material.

F. Flush Valves:
1. Components of flush valve assembly shall be as provided elsewhere in project specifications.
2. Steel piping underground shall be tape wrapped.
3. Steel piping above ground shall be painted blue.

G. Assemble steel flanged joints in accordance with AWWA M11 and AWWA C207.

H. No high points in the pipe of any magnitude shall be allowed without an appropriate vacuum/ air valve. 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.

    b. If a reducing tee is required within a corrosive soil zone, Contractor shall provide cathodic protection for the tee at no additional cost to the Owner.

I. 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 direct buried valves with valve box lids inside meter cans, bring tracer wire into the meter can outside of the valve box. Coil 18” tracer wire inside meter can.

3. For all valve vaults, coil min. 24” tracer wire against wall on each side of vault.

J. 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, 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 SPARE PARTS

A. Contractor shall supply the following spare parts to NTUA, at a location to be specified by NTUA within 75 miles of the project site:

1. One (1) 1-inch combination air valve
2. One (1) 1-inch inflow preventor
3. One (1) 4-inch 350 psi gate valve
4. One (1) tee handle valve wrench for 2-inch square operating nut

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 00 – Water Utility Distribution Piping: 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.

B. Basis of Payment: Payment for pipeline disinfection will be made based on linear footage, upon successfully passing bacteriological testing. Disinfection of other facilities shall be incidental to their respective bid items.

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. 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, 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 NTUA 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 and building plumbing.

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 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 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 NTUA and the Engineer.
    b. Contractor shall install testing saddles, if needed to comply with spacing requirements for bacteriological testing under AWWA C-651 and NTUA'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 NTUA. Note that NTUA will not accept project transfer until all punch list items have been completed and the project has been inspected by NTUA personnel. NTUA typically requires 21 days notice prior to final inspection and Transfer. Contractor is solely responsible for coordination with NTUA. If punch list inspection, Final Completion, and NTUA 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